DRAFT

Hawai‘i Climate Action Pathways August 2025

‘A‘ohe hana nui ke alu ‘ia

No task is too big when done together

Hawai‘i Climate Pathways

August, 2025

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Acronyms and Abbreviations

AFOLU	Agriculture, Forestry, and Other Land Use
ALICE	Asset Limited, Income Constrained, and Employed
CAB	Clean Air Branch
CARP	County of Maui Climate Action and Resiliency Plan
CARPAC	Climate Action and Resiliency Plan Advisory Committee
CCMAC	Hawai‘i Climate Change Mitigation and Adaptation Commission
CE	Circular Economy
CPRG	Climate Pollution Reduction Implementation Grants
DBEDT	Department of Business, Economic Development and Tourism
DLNR	Hawai‘i Department of Land and Natural Resources
DOH	Department of Health (Hawai‘i)
DOH-CAB	Hawai‘i Department of Health-Clean Air Branch
ENSO	El Niño- Southern Oscillation Years
GHG	Greenhouse Gas
HAR	Hawai‘i Administrative Rules
HCEI	Hawai‘i Clean Energy Initiative
HPUC	Hawai‘i Public Utilities Commission
HGIA	Hawai‘i Green Infrastructure Authority
DOH	Hawai‘i Department of Health
HEER	Hawai‘i Department of Health’s Hazard Evaluation and Emergency Response
HRS	Hawai‘i Revised Statute
HSEO	Hawai‘i State Energy Office
IPCC	Intergovernmental Panel on Climate Change
IPPU	Industrial Processes and Product Use
KCAAP	County of Kaua‘i Climate Adaptation and Action Plan
LIDAC	Low-Income and Disadvantaged Communities
LMI	Low to Moderate Income
MMT CO2e	Million metric tons of carbon dioxide equivalent
NCA5	Fifth National Climate Assessment
PCAP	Priority Climate Action Plan
RFI	Request for Information
RPS	Renewable Portfolio Standards
SLH	Session Laws of Hawai‘i
TKE	Traditional Ecological Knowledge
TWG	Technical Working Group
UNFCCC	United Nations Framework Convention on Climate Change
U.S. EPA	United States Environmental Protection Agency

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1. Introduction

This document was developed in partnership with community members, State agencies, counties, technical experts, the University of Hawai'i system, and non-governmental organizations across Hawai'i to produce comprehensive Climate Action Pathways (CAP) to guide investment in policies, practices, and technologies that reduce pollutant emissions, increase affordability, enhance resiliency and safety, protect public health, create high-quality jobs, spur economic growth, and enhance the quality of life for all residents in Hawai'i.

Hawai'i has established itself as an international leader in comprehensive climate action, developing an extensive legislative and policy framework that addresses both climate change mitigation and adaptation over nearly two decades. The state's unique geographic position as an isolated island chain in the Pacific Ocean has created both vulnerabilities that demand urgent climate action, as well as opportunities to serve as a model for sustainable development and climate resilience. This CAP builds upon Hawai'i's longstanding commitment to reducing greenhouse gas (GHG) emissions while simultaneously preparing communities and ecosystems for the unavoidable impacts of climate change.

1.1 Legislative Foundation for Climate Action

Hawai'i's climate policy framework began with groundbreaking legislation in 2007 when the state became one of the first in the nation to establish binding greenhouse gas emissions limits. Act 234, the Global Warming Solutions Act, declared that

> "Climate change poses a serious threat to the economic well-being, public health, natural resources, and the environment of Hawai'i," recognizing that major industries including tourism, agriculture, recreational and commercial fishing, and forestry were vulnerable to climate impacts.[1],[2], [3]

The legislative framework expanded significantly in 2012 with the passage of Act 286, which added climate change adaptation priority guidelines to the Hawai'i State Planning Act.[4] This landmark legislation established climate change adaptation as one of seven major areas of statewide concern, requiring all state and county land use, capital improvement, and program decisions to consider climate adaptation impacts. The Act specifically addresses climate change impacts across multiple sectors including agriculture, conservation lands, coastal and nearshore

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[1] Hawai'i Climate Change Adaptation Framework, Ocean Resources Management Plan Working Group, November 2009, pp. 4, 24. https://files.hawaii.gov/dbedt/op/czm/ormp/reports/climate_change_adaptation_framework_final.pdf

[2] Act 234, Session Laws of Hawai'i 2007: https://health.hawaii.gov/cab/files/2023/05/SLH2007_Act234.pdf

[3] Act 234, Session Laws of Hawai'i 2007. https://health.hawaii.gov/cab/files/2023/05/SLH2007_Act234.pdf

[4] Act 286, Session Laws of Hawai'i 2012, pp. 979-981. https://data.capitol.hawaii.gov/sessions/sessionlaws/Years/SLH2012/SLH2012_Act286.pdf

marine areas, natural and cultural resources, education, energy, health, water resources, transportation, and the economy.

1.2 Institutional Framework and Coordination Mechanisms

Recognizing the need for coordinated institutional response, the state established the Hawai‘i Climate Adaptation Initiative through Act 83 in 2014.[5] This legislation created the Interagency Climate Adaptation Committee (ICAC), administratively attached to the Department of Land and Natural Resources and co-chaired by the Chairperson of the Board of Land and Natural Resources and the Director of the Office of Planning (now the Office of Planning and Sustainable Development). The State's climate governance structure was further bolstered with the establishment of the Hawai‘i Climate Change Mitigation and Adaptation Commission (CCMAC) in 2017 through Act 32.[6] The Commission serves as the primary coordinating body for climate action and provides policy direction, facilitation, coordination, and planning among state and county agencies, federal agencies, and other partners as appropriate.

1.3 Recent Legislative Advances and Decarbonization Goals

Hawai‘i's climate ambitions reached new heights with the passage of Act 15 in 2018, which established the state as the first in the nation to commit to achieving carbon net-negative emissions by 2045.[7] Act 238 (2022) supported this comprehensive decarbonization by setting an interim target requiring greenhouse gas emissions to be at least 50 percent below 2005 levels by 2030.[8] The legislation also mandates annual greenhouse gas inventory reporting by the Department of Health to track emissions and monitor progress toward climate targets. According to the latest statewide inventory, total in-state greenhouse gas emissions were estimated at 20.32 million metric tons of carbon dioxide equivalent in 2022 (17.83 MMT CO2 Eq including carbon sinks) an increase in emissions over 2021.[9] Hawai‘i must increase its ambition if we are to achieve our 2030 and 2045 statewide emission targets.

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[5] Office of Planning, Adapting to Climate Change, State of Hawai‘i. https://planning.hawaii.gov/czm/initiatives/adapting-to-climate-change-2/

[6] Act 32, Session Laws of Hawai‘i 2017: https://www.capitol.hawaii.gov/sessions/session2017/bills/GM1132_.PDF

[7] Act 15, Session Laws of Hawai‘i 2018 https://www.capitol.hawaii.gov/sessions/session2018/bills/GM1115_.PDF

[8] Hawai‘i State Energy Office. (2023, December). *Hawai‘i Pathways to Decarbonization: Act 238, Session Laws of Hawai‘i 2022* (pp. 3-4). https://energy.hawaii.gov/wp-content/uploads/2024/01/Act238_HSEO_Decarbonization_Report.pdf

[9] Hawai‘i Department of Health. (2025, April). *Hawai‘i Greenhouse Gas Emissions Report for 2022*, (ES-3). https://health.hawaii.gov/cab/files/2025/04/Final-2022-GHG-Emissions-Report.pdf

1.4 State Agency Implementation and Coordination

Multiple state agencies have integrated climate considerations into their core functions and planning processes.

The State's Climate Change Mitigation and Adaptation Commission is the coordinating body on climate mitigation and adaptation. The Commission is comprised of 12 State offices and agencies, all four county planning offices, and four legislative representatives. They are responsible for the Sea Level Rise Vulnerability Assessment[10] and accompanying Sea Level Rise Viewer[11] as well as the "State's Priority Climate Action Plan".[12]

Hawai'i State Energy Office developed the "Hawai'i Pathways to Decarbonization"[13] outlining sector wide recommendations for decarbonization. The Department of Transportation has published the "Climate Adaptation Action Plan"[14] which is accompanied by the Hazard Viewer[15] and is in development of the "Draft Energy Security & Waste Reduction Plan"[16] which will outline actions that will contribute to decarbonization.

The Office of Planning and Sustainable Development's Costal Zone Management Program has a number of initiatives following coastal resiliency, including the "Assessing The Feasibility And Implications Of Managed Retreat Strategies For Vulnerable Coastal Areas In Hawai'i".[17]

The Department of Health's Clean Air Branch manages the state's greenhouse gas program and conducts annual emissions inventories and leads the state's Climate and Health Program.[18]

1.5 County-Level Climate Action

Recognizing that climate action requires coordinated efforts across all levels of government, Hawai'i's counties have developed comprehensive climate action plans tailored to their unique

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[10] Sea Level Rise Vulnerability And Adaptation Report (2022), https://climate.hawaii.gov/wp-content/uploads/2023/01/OCCL23-Sea-Level-Rise-Report-FY22-1.pdf
[11] Sea Level Viewer, https://www.pacioos.hawaii.edu/shoreline/slr-hawaii/
[12] Hawai'i Priority Climate Action Plan (2024) https://climate.hawaii.gov/wp-content/uploads/2024/03/Hawaii-PCAP-FINAL-March-1-2024-1-3.pdf
[13] Hawai'i State Energy Office. (2023, December). *Hawai'i Pathways to Decarbonization: Act 238, Session Laws of Hawai'i 2022*. https://energy.hawaii.gov/wp-content/uploads/2024/01/Act238_HSEO_Decarbonization_Report.pdf
[14] Climate Adaptation Action Plan (2021) https://hidot.hawaii.gov/wp-content/uploads/2021/07/HDOT-Climate-Resilience-Action-Plan-and-Appendices-May-2021.pdf
[15] Hazard Viewer, https://hidot.hawaii.gov/resilience/
[16] Hawai'i Energy Security and Waste Reduction Plan, https://highways.hidot.hawaii.gov/stories/s/h9gp-xxmt.
[17] Assessing The Feasibility And Implications Of Managed Retreat Strategies For Vulnerable Coastal Areas In Hawai'i (2019) Managed Retreat Report Final.
[18] DOH, *Hawai'i Greenhouse Gas Emissions Report for 2022*, April 2025, available from https://health.hawaii.gov/cab/files/2025/04/Final-2022-GHG-Emissions-Report.pdf

geographic and demographic characteristics. The City & County of Honolulu adopted its first Climate Action Plan for 2020-2025, establishing a roadmap for transitioning Oʻahu to 100% renewable energy (on the path to carbon neutrality) by 2045.[19] This plan provides "ambitious and achievable GHG emissions reduction strategies" that support the state's goal of achieving net-negative emissions.[20]

The County of Hawaiʻi has developed an Integrated Climate Action Plan (ICAP) with a vision to "ensure a just transition to a climate resilient island by addressing the causes and impacts of climate change through incorporating equitable climate mitigation and adaptation priorities into policies, programs, infrastructure, and decision-making".[21] The plan establishes three primary goals: increasing county capacity to implement climate action, reducing the county's contribution to global greenhouse gas emissions, and increasing the resilience of county infrastructure, assets, and services to climate change impacts.

Maui's Climate Action and Resiliency Plan (CARP) (2024) outlines 170 actions to achieve net-negative emissions and 100% renewable energy.

Kauaʻi's County Climate Adaptation and Action Plan (2025) targets an 83% reduction in operational carbon emissions by 2045 compared to 2005 levels through energy efficiency, renewable energy transitions, and waste reduction.[22] The county's Climate Adaptation Plan (2025) prioritizes community-led strategies to address sea level rise, flooding, and drought, emphasizing equity in coastal zone management and infrastructure resilience.

These county plans show the commitment to Climate Action across all counties in Hawaiʻi, and the measures presented in the State Climate Action Pathways are envisioned as a way to further support and cooperate with the counties.

1.6 Funding Landscape for Implementation

Hawaiʻi is uniquely vulnerable to the impacts of climate change and must take bold, urgent action to reduce greenhouse gas emissions and strengthen climate resilience. Meeting this challenge requires a diversified funding strategy that integrates state investments, federal support, and private capital. The Hawaiʻi Climate Change Mitigation and Adaptation Commission (CCMAC) has compiled a list of 248 projects needed across sectors (transportation, energy, agriculture, forestry, etc.), and estimates that a minimum investment of $2.23 billion is needed over the next three years to implement critical climate projects. While the state has made meaningful progress through general fund allocations, the Barrel Tax, bond financing, and clean energy loan programs, the

[19] Climate Action Plan 2020-2025, City & County of Honolulu, p.11. https://resilientoahu.org/s/Climate-Action-Plan.pdf
[20] Climate Ready Oʻahu (2024), https://www.resilientoahu.org/climatereadyoahu
[21] Integrated Climate Action Plan (ICAP) for the Island of Hawaiʻi, County of Hawaiʻi, May 13, 2025. https://cohplanning.konveio.com/integrated-climate-action-plan-icap-island-hawaii
[22] Kauaʻi Climate Adaptation and Action Plan (March 2025), p15. https://kauaiadaptation.com/wp-content/uploads/2025/04/KCAAP_PublicDraft_PartI_032425_Clean-1.pdf

estimated $2.23 billion necessary over the next three years far exceeds currently available resources.

New revenue streams—such as the recently enacted Climate Impact Fee, also know as the "Green Fee" on visitor accommodations, Act 96 (2025)[23] - will help close this gap, but are not sufficient on their own. Federal funding remains essential, with programs like the Inflation Reduction Act and Bipartisan Infrastructure Law enabling critical progress in energy, transportation, waste management, and environmental restoration. However, recent changes in federal agencies and spending pose a serious risk to long-term climate planning and project delivery. The Big Beautiful Bill, recently renamed The Act has resulted in funds being paused, rescinded, and canceled. In addition to funding changes, there have been major staffing layoffs resulting in agencies that are understaffed and overwhelmed. The Bureau of Energy Resources, Bureau of Oceans and International Environmental and Scientific Affairs, and Indian Health Service have been paused. The National Institute for Health has been frozen. All grants under the US Department of the Interior (DOI) are under review. Bureau's within the DOI having a mix of canceled, still active and under review including funds from the Bureau's of Indian Affairs, Land Management, Ocean Energy Management, Reclamation, Safety and Environmental Enforcement, Trust Funds Administration, Nation Park Service, Office of Surface Mining Reclamation and Enforcement, U.S. Fish and Wildlife Service and U.S. Geological Survey. The Federal Emergency Management Agency has had a mix of impacts from spending freezing, pauses and still active grants. The National Science Foundation has canceled nearly 1,400 grants and the agencies 37 divisions are being abolished, dramatically reducing the numbers of programs. The Environmental Protection Agency has some active grants posted from 2024, but has issues no new grants in 2025, and conservation programs and climate change related programs have been frozen or cut. While some Departments are still active such as the Department of Energy and U.S. Department of Agriculture there have been amendments to grants regarding language, and many grant opportunities are under review. While other agencies such as Housing an Urban Development grants have been closed without notice without any determination being made public. The number of grants being offered has significantly declined dropping from 10-30 new opportunities a day to 0-2 new opportunities a day. Climate change related funding has been cancelled and or rescinded, University support and research funding has been dramatically reduced, and the Department of Government Efficiency has taken over grants.gov.

To achieve its climate goals, Hawai'i must also expand private and philanthropic engagement. By building partnerships with foundations, corporate stakeholders, high-net-worth individuals, and the insurance sector, the state can tap into underutilized sources of investment. A coordinated, multi-sector approach is essential for Hawai'i to become a national leader in climate resilience, environmental stewardship, and sustainable development.

[23] Senate Bill 1396, Act 96 (2025), Regarding Economic Development, also known as "Green Fee" on visitor accommodations, https://data.capitol.hawaii.gov/sessions/session2025/bills/SB1396_.HTM

Local Discussions:

To better understand the impacts of shifts in the funding landscape, the State has been engaged in a series of conversations with local partners, including the Hawai‘i Alliance of Nonprofit Organizations (HANO), the Funder Hui, and Conservation International. A focus discussion was also convened with community partners and stakeholders to assess on-the-ground needs and explore potential solutions. These efforts have helped identify a range of possible strategies for addressing funding gaps such as legislative advocacy, capacity-building partnerships, and more sustainable funding mechanisms independent of federal sources.

State Investments:

The State of Hawai‘i is actively investing in climate change mitigation and adaptation through various funding mechanisms, including general fund allocations, tax revenues, bond financing, and competitive federal grants. Key sources include the Environmental Response, Energy, and Food Security Tax (commonly known as the Barrel Tax), Community Improvement Programs funds (a variety of funding programs including the Hawai‘i Community Development Authority, Community Enrichment Program, Community Health Improvement Plan, etc.), and targeted infrastructure investments.

Additional initiatives such as the Green Energy Money $aver (GEM$) and funding administered by the Hawai‘i Green Infrastructure Authority (HGIA) further incentivize private sector participation in renewable energy and energy efficiency. HGIA is Hawai`i's Green Bank, a state administered clean energy financing authority created to accelerate Hawai‘i’s transition to clean energy, mitigate climate change and ensure equity in renewable and energy efficiency projects. HGIA facilitates access and affordability to clean energy financing, including the Green Energy Money (GEM) programs, support for underserved communities, advances in Hawai`i's energy goals, and specific financing pathways for homeowners, renters, nonprofits and small business to reduce financial barriers. Through the Capital Improvement Program funds and General funds, the Department of Land and Natural Resources (DLNR) also contributes through programs like the 30x30 Watershed Initiative to protect priority watersheds (carbon sinks), and the Carbon Smart Land Managers Assistance Pilot Program, which supports reforestation, land management, and carbon sequestration initiatives on agricultural, ranch and natural lands. Other investment efforts include resilient infrastructure projects, renewable energy projects, and energy efficiency measures and fleet transitions for the State.

Despite these efforts, Hawai‘i faces an enormous funding gap based on the grant opportunity forecasts. In FY 2024, the state’s total tax revenue was approximately $11.08 billion. Given existing obligations to education, public welfare, healthcare, transportation, housing, and public safety, allocating 20% of the general budget to climate initiatives is not feasible without significantly impacting essential public services.

To generate dedicated climate funding, the state recently passed legislation establishing a Climate Impact Fee or “Green Fee”—a surcharge on hotel stays expected to raise up to $100 million annually. While this is a positive step, it falls dramatically short of what is needed. Additionally,

sustained funding sources must be secured to build long-term climate resilience and implement climate mitigation projects across the state. Creating opportunities for the state to leverage private investments in all sectors will accelerate the State's transition.

Federal Investments and Incentives:

Federal funding remains the backbone of Hawai'i's climate change efforts. Programs such as the Inflation Reduction Act (IRA), Bipartisan Infrastructure Law (BIL), and targeted grants from the Environmental Protection Agency, National Oceanic and Atmospheric Administration, Department Of Energy, and United States Department of Agriculture, including the Kapapahuliau Climate Resilience Program and the Climate Pollution Reduction Grant, have enabled the state to launch climate action planning, implement localized resilience initiatives, and prioritize high-impact projects. According to the US Climate alliance, Hawai'i has received over $1.06 billion dollars of investments from the federal government since the IRA passed, these funds support critical transportation, energy grid, food production, resiliency, and other climate related projects.[24] Without these investments, many of these initiatives would not have been possible. The chart below demonstrates how vital federal funding is, highlighting some of the projects made possible through federal resources. It is important to note that there have been and are on-going changes in these awards as the new administration has altered programmatic objectives, rescinded obligated funds, and cut the workforce and budgets of many federal departments and agencies.

The reconciliation bill (P.L.119-21) passed on July 3rd, 2025 rescinded unobligated balances from dozens of IRA grant programs. The administration has taken steps to indicate that its interpretation of this bill includes the rescinding of obligated funds as well. According to information posted July 15th, 2025, in the IRA State Allocations Spreadsheet issued by the Federal Funds Information for the States, $102.billion in grants was available to states through the IRA. Upon passage of the reconciliation bill 37 programs have had their unobligated balances rescinded by the bill. Totaling $67.9 billion no longer available for climate change related projects, $59.9 billion of which states were eligible for.

Funding Source	Amount	Purpose	Additional Information
Inflation Reduction Act (IRA)	$20,000,000	$20 million for the Kapapahuliau Climate Resilience Program, which aims to empower the Native Hawaiian community to address climate change impacts. This investment supports native-led climate solutions, such as forest restoration, protecting cultural resources, and raising climate awareness.	learn more here
	$1,000,000	Over $1 million for the County of Hawai'i to purchase zero-emission vehicles through the Clean Heavy-Duty Vehicles Grant Program.	learn more here

[24] US Climate Alliance. Inflation Reduction Act Spreadsheet, accessed on July 8th, 2025, https://docs.google.com/spreadsheets/d/1p0iQpHXmktysbjfxK9CjbgrFq8o5rVpZCcCf78Pvptw/edit?gid=0#gid=0

	$59,000,000	Over $59 million in Clean Ports Program grants for the Hawai‘i Department of Transportation (HDOT) to purchase hydrogen-fueled tractors and construct a hydrogen fueling facility at Honolulu Harbor.	learn more here
	$3,000,000	$3 million for the Climate Pollution Reduction Grant (CPRG) program to support planning for innovative climate projects across the state. This initial grant allows Hawai‘i to develop comprehensive strategies for reducing pollution and makes the state eligible for future implementation grants.	learn more here
Bipartisan Infrastructure Law (BIL)	$6,000,000	More than $6 million to implement Hawai‘i's Digital Equity Plan, improving broadband access and digital inclusion efforts across the state.	learn more here
	$9,200,000	Approximately $9.2 million over five years to support commercial motor vehicle safety efforts.	learn more here
	$50,000,000	More than $50,000,000 for Hawai`I drinking water, wastewater and stormwater infrastructure upgrades.	learn more here
	$316,000,000	Approximately $316 million over five years to improve public transportation options.	learn more here
	$18,000,000	Approximately $18 million over five years to expand the electric vehicle (EV) charging network	learn more here
National Oceanic and Atmospheric Administration (NOAA)	$68,500,000	$68.5 million for coastal resilience projects to address climate change and other coastal hazards.	learn more here
	$5,100,000	Over $5.1 million for marine debris projects, including efforts to remove and repurpose harmful ocean plastic pollution.	learn more here
	$7,000,000	Over $7 million in grants to partner agencies and organizations in the Pacific Islands region, including Hawai‘i, for various fisheries management and conservation efforts.	learn more here
Department of Energy (DOE)	$95,000,000	$95 million in federal funds to harden Hawai‘i's energy grids following the Maui wildfires.	learn more here
	$18,000,000	$18 million to support the development and adoption of a Building Performance Standard (BPS) to reduce energy use and carbon emissions from large commercial buildings.	learn more here
	$3,000,000	Approximately $3 million annually for five years under the Grid Resilience formula funds for building resilience in Hawai‘i's electric grid.	learn more here
Enivornmental Protection Agency (EPA)	$2,000,000	$2 million in grants to assess communities for potential revitalization efforts, ensuring future development aligns with public health and Native Hawaiian values.	learn more here
United States Department of Agriculture (USDA)	$1,700,000	More than $1.7 million to protect Hawaiian crops and natural resources, funding projects related to pest management, plant health, and workforce development.	learn more here
	$2,600,000	$2.6 million awarded for grants to support food system innovation, including assistance for agricultural businesses.	learn more here
	$525,000	$525,000 in federal Specialty Crop Grants to support food and horticultural production	learn more here

Table 1: Indicative list of federal funds for Climate Action Received by Hawai‘i

However, recent federal rollbacks, rescinded incentives, grant program delays, and agency staffing shortages have created significant uncertainty in the funding landscape. These disruptions hinder Hawai‘i’s ability to plan strategically, commit staff to long-term grant development, and maintain momentum on climate projects.

Despite these setbacks, federal funding remains irreplaceable. No other sector—public or private—can match the scale or scope of investment provided by federal agencies such as:

- Environmental Protection Agency (EPA)
- Department of the Interior (DOI)
- Department of Energy (DOE)
- National Oceanic and Atmospheric Administration (NOAA)
- United States Department of Agriculture (USDA)
- National Science Foundation (NSF)
- Department of Housing and Urban Development (HUD)

Continued and expanded federal support is essential—not optional—for Hawai‘i to build a resilient and equitable future.

Private Investments:

Private sector and philanthropic investment play a growing but still limited role in climate funding for Hawai‘i. While over 150 foundation grants have been identified as potential funding sources for Hawai‘i-based, climate related projects, most of these are small in scope, short in duration, and require significant administrative effort to secure and manage. As federal funds decrease, competition for these smaller grants will intensify, further straining already limited state and nonprofit staff capacity.

There is a growing opportunity—and need—for strategic engagement with the private sector, including:

- **Philanthropic Foundations**: Hawai‘i is home to few foundations compared to the continent, and those that operate here cannot meet the scale of need alone.
- **Corporate Contributions and Collaborations**: Partnerships with corporations is vital in achieving our climate goals. Working with airlines and the hotel industry is critical in reducing waste and emissions. Cooperation with Hawaiian Electric to build out utility scale renewable energy projects is integral in a clean energy transition. . Expanding the role of the private sector—through green bonds, public-private partnerships, and climate-aligned investment funds—can unlock new capital for renewable energy, resilient infrastructure, and carbon sequestration projects. However, contemporary policy and regulatory barriers, such as uncertainty around tariffs on clean energy technologies, can discourage private investment and stall progress. Overcoming these obstacles will be key in reaching clean economy targets.
- **High-Net-Worth Individuals**: Hawai‘i is home to and visited by some of the nation’s wealthiest individuals, including Jeff Bezos, Larry Ellison, Oprah Winfrey, and Mark

Zuckerberg. These individuals have made notable philanthropic contributions, such as the $100 million donation to Maui wildfire recovery. Sustained relationships with these donors remains a challenge without dedicated outreach and engagement infrastructure.

- **Insurance Sector Partnerships**: With insurance rates tripling for some residents and others being told their homes are uninsurable the need to explore climate resilience partnerships with insurance providers is high. Investing in resilience reduces the risk of costly disaster-related payouts, aligning the interests of both insurers and the state.

Hawai‘i’s path to a climate-resilient future is clear, but without significant and sustained investment, it remains out of reach. The state cannot shoulder this burden alone. Federal funding must be stabilized and expanded to support long-term planning and project implementation. Private and philanthropic sectors must be engaged more deeply and strategically. High-net-worth individuals with ties to Hawai‘i represent a powerful, underutilized opportunity for transformative investment.

With more than $2.2 billion in estimated climate-related needs in the next three years alone, Hawai‘i must be positioned not only to receive but also to maximize available funding. Increased funding, flexibility in grant criteria to accommodate small and remote communities, and stronger federal-state partnerships are essential. Only through collaborative investment can Hawai‘i become a national model of climate resilience, environmental stewardship, and sustainable community development.

1.7 Current Priorities and Implementation Framework

Hawai‘i is facing a cost-of-living crisis affordability is out of reach for many Kanaka and Kama’aina alike. Life threatening hurricanes, drought, extreme heat, flooding and wildfires are increasing in frequency taking lives, livelihood and reducing public health. This document identifies 23 key measures across multiple sectors designed to achieve significant greenhouse gas reductions to reduce Hawai‘i’s contribution in increasing the frequency of these disasters while also addressing affordability, support vulnerable communities, enhance resiliency and safety, protect public health create high-quality jobs, spur economic growth, and enhance wellbeing in Hawai’i. These measures were identified by experts in each focus area based on their greenhouse gas reduction potential, implementation readiness, and ability to provide co-benefits including job creation, equity, improved air quality, enhanced climate resilience, and economic development. from 2025 through 2050. The plan emphasizes that “the climate crisis has already cost Hawai‘i lives, a price much higher and more devastating than even the most pessimistic predicted”, underscoring the urgency for immediate and sustained action.[25] This comprehensive foundation of legislation, institutional coordination, and multi-level planning that the Climate Action Pathways document lays out positions Hawai‘i to advance ambitious climate action across the State, building upon nearly two decades of climate policy development and implementation experience.

[25] Hawai‘i Priority Climate Action Plan, Environmental Protection Agency, March 2024, pp. 1-2. https://www.epa.gov/system/files/documents/2024-03/hawaii-pcap-final-.pdf

2. Coordination and Outreach

The development of the Climate Action Pathways (CAP) has been a collaborative effort which has been co-designed with the participation of numerous individuals across one hundred different State agencies, county departments, and distinct non-profit organizations (a list of these can be found in the Acknowledgements section above).

2.1 Interagency and Intergovernmental Coordination

One key site of this collaborative effort has been the sectoral Technical Working Groups (TWG) which began meeting in 2023. The Working Groups were comprised of State and County employees, as well as University researchers and non-profit organizations, all with expertise in sector focus areas. TWGs identified additional research needs, barriers to implementation, policy needs and measure recommendations.

The 15 TWG sectors were:

- Decarbonization EV *(Transportation)*
- Decarbonization VMT and Land Use *(Transportation)*
- Alternative Fuels *(Transportation)*
- Decarbonization of Aviation *(Transportation)*
- Electricity and Combustion Decarbonization *(Transportation)*
- Farming, Ranching, Food System Decarbonization (*AFOLU* - Agriculture, Forestry, and Other Land Use*)*
- Forestry (*AFOLU)*
- Decarbonization of IPPU (Industrial Processes and Product Use)
- Marine Transportation *(Transportation)*
- Wetlands (*AFOLU)*
- Waste and Material Management
- Urban Forestry (*AFOLU)*
- Buy Green
- Wastewater
- Buildings Energy Efficiency

In tandem with the TWGs, a statewide hui (working group) has been working since April 2023 to review the TGW recommendations and identify priority measures across the state, counties, and in the nonprofit sector. Hui members represent the Departments of Education, Agriculture, Land and Natural Resources, Transportation, Health, Business, Tourism and Economic Development, Hawai‘i Emergency Management Agency, the County of Maui, the County of Hawai‘i, the County of Kaua‘i, and the City and County of Honolulu, and other state, county, university, and non-governmental agencies.

2.2 Outreach and Equity Groups

Outreach Plan:
The Outreach Plan for this work[26] was developed in collaboration with the counties and largely taken from existing and proven county outreach strategies. The Outreach Plan emphasizes a nuanced, inclusive, and culturally tailored approach to engage all residents, with emphasis on reaching Native Hawaiians, minorities, low-income, and historically marginalized communities, across every island. Recognizing the distinct environmental challenges and historical impacts of colonization, the strategy blends physical methods like pop-up events, local community and neighborhood events, Community Based Organization events, film events, focus groups, and direct engagement with kūpuna (elders) and youth, alongside digital tactics such as robust social media campaigns, e-newsletters, and accessible online platforms. By focusing on understanding unique community dynamics, fostering trust through transparent processes, and integrating traditional knowledge, the plan aims to empower residents to actively shape climate actions that are truly relevant and sustainable for Hawai‘i.

Outreach, Community Engagement and Stakeholder Input:
Recognizing that effective climate action requires broad participation and reflects the diverse needs and concerns of all residents, a multi-faceted outreach strategy was developed with various stakeholders and implemented across the Hawaiian Islands. This section details the methodologies employed to gather feedback, highlights the key concerns raised by the community, and underscores the importance of this input in shaping a robust and equitable climate action plan for the state.

Methodology for Community Engagement and Stakeholder Input:
A dedicated outreach team was established to ensure comprehensive coverage across all islands, actively engaging with communities, key stakeholders, and youth organizations. The outreach strategy was designed to be inclusive, accessible, and to provide multiple avenues for residents to learn about climate change and contribute their perspectives to the development of the Climate Action Plan. The following methodologies were employed:

Community Events and Public Engagement:
A significant component of the outreach effort involved active participation in over 50 diverse community events statewide. These events served as crucial opportunities for direct interaction with residents and included:

- *Film Screenings* (7): Utilizing visual media to raise awareness about climate change impacts and solutions relevant to Hawai‘i, interactive panel discussions followed each film screening.
- *Earth Day Events* (7): Leveraging established community gatherings focused on environmental stewardship to engage a broad audience.

[26] See Appendix B for the Outreach Plan.

- *Round Table Discussions* (5): Facilitating in-depth conversations with community leaders and residents on specific climate-related challenges and potential solutions, many of these were virtual to gain a wider audience across the islands.
- *School Visits* (6): Engaging with students and educators to foster climate literacy and solicit youth perspectives on the future impacts of climate change.
- *Community Climate Fairs* (2): Hosting dedicated events in various locations across the state, providing information, interactive activities, and opportunities for feedback.
- *Intensive Climate Week* (1): Organizing a concentrated period of events and activities to elevate public awareness and engagement on climate action.
- *Other Events* (30+): Attended and tabled at numerous organizational events, such as non-profits or other governmental agencies and events being held.

At each of these events, outreach staff actively engaged with attendees, providing information, answering questions, and facilitating feedback collection.

Educational Resources and Materials:
A detailed educational poster was developed and widely disseminated both physically at events and digitally online. This resource aimed to:

- Clearly outline the key impacts of climate change on the State of Hawai‘i, utilizing accessible language and visuals.
- Highlight the specific ways in which these impacts affect the daily lives of Hawai‘i residents.
- Showcase current climate change initiatives being undertaken by county and state governments.
- Provide actionable steps that individuals can take to reduce their carbon footprint and contribute to climate solutions.

The online availability of the poster ensured that this crucial information reached a wider audience beyond event attendees.

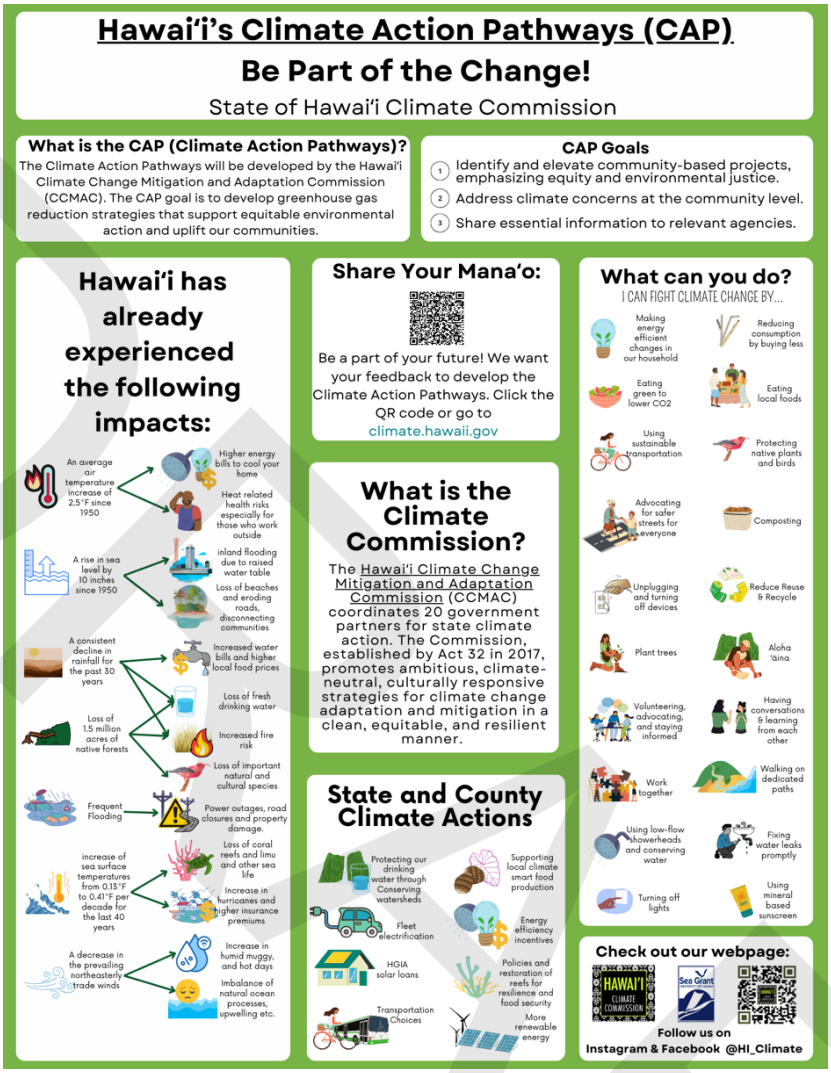

Figure 1: Hawai'i Climate Action Poster

Feedback Collection Mechanisms:
Multiple methods were employed to ensure that all residents had the opportunity to contribute their concerns and ideas to the Climate Action Plan:

- *Field Notes*: Outreach staff meticulously documented key themes and concerns raised during direct conversations at community events.
- *Provided Forms*: Physical forms were made available at all events, allowing residents to document their specific concerns in a structured manner.
- *Online Feedback Form*: A dedicated online platform was created to provide a continuous avenue for feedback submission, accessible to all residents at their convenience.

These diverse collection methods ensured that feedback was captured from a wide range of individuals and in various formats.

Online Communication and Engagement:

Recognizing the importance of digital platforms for information dissemination and community building, the following online tools were utilized:

- *Statewide Climate, Conservation, and Sustainability Events Calendar*: An online calendar was developed and maintained to centralize information about relevant events across the state. This has proven to be a valuable resource for residents seeking to engage in climate-related activities.
- *Monthly Newsletter*: A newsletter providing updates on climate action efforts, relevant news, green jobs that were available and opportunities for engagement was distributed to approximately 1,800 subscribers statewide, receiving positive feedback for its informative content.
- *Weekly Social Media Engagement*: Consistent weekly posts were used to share information, promote events, and engage in online conversations about climate action. This engagement on Instagram (approximately 1,800 followers) reached 6,624 accounts over a 30 day period, and Facebook (approximately 900 followers) had 1,025 views over the same period.
- *Direct Constituent Communication*: Weekly calls and emails were conducted with constituents on Kauai, Hawai‘i Island, Maui Nui, and Oahu to provide updates and solicit feedback.

Strategic Partnerships:
Collaborations were actively fostered with key community-based organizations and Native Hawaiian organizations. These partnerships were crucial in:

- Reaching marginalized and underserved communities to ensure their unique vulnerabilities and perspectives were integrated into the Climate Action Plan.
- Leveraging existing community networks and trusted relationships to build trust and encourage participation.

Youth Engagement:
Recognizing the critical role of future generations in climate action, specific efforts were made to engage young people:

- *School Presentations*: Outreach staff conducted presentations in schools to educate students about climate change and its impacts.
- *Youth Climate Summit*: A dedicated summit was organized at the state capitol to provide a platform for youth voices and perspectives on climate action.
- *Youth Engagement Webpage*: An online resource was created listing organizations that work with youth in the climate sector, providing Plans for ongoing engagement.

Climate Action Artists Residency:
An innovative Climate Action Artists Residency program was developed to integrate creative perspectives into the planning process. Selected artists participated in focus groups to deepen their understanding of climate change impacts in Hawai‘i and will subsequently develop artwork that reflects these issues, fostering broader public engagement through artistic expression.
Through these diverse and interconnected methodologies, a robust framework for community engagement and stakeholder input was established, ensuring that the development of the State of Hawai‘i Climate Action Plan is informed by the experiences, concerns, and aspirations of the people it serves.

2.3 Top Community Concerns for the Climate Action Plan

The extensive outreach efforts conducted during 2024 and 2025 included 2,700 active engagements with over 7,000 attendees at 82 events, yielded a wealth of valuable feedback, with over 650 individual concerns documented. The analysis of this feedback has identified the following top 10 concerns raised by the community, highlighting the key areas of focus for the State of Hawai‘i Climate Action Plan:

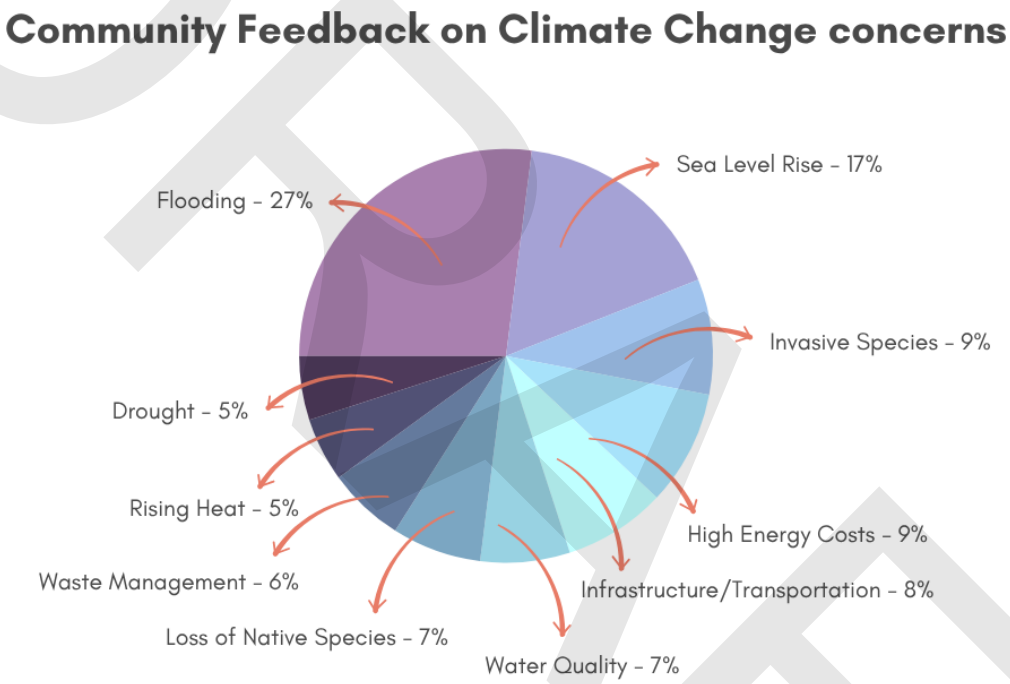

Figure 2: Community Feedback on Climate Change Concerns.

This list clearly indicates the most pressing climate-related concerns for the residents of Hawai‘i. Flooding emerged as the most frequently mentioned concern, highlighting the increasing vulnerability of communities to extreme weather events. Sea Level Rise and Coastal Erosion also ranked highly, reflecting the direct threat to coastal communities, infrastructure, and ecosystems. The significant concern regarding Invasive Species underscores the interconnectedness of climate change with other environmental challenges facing the islands. High Energy Costs are a persistent issue for residents and are directly linked to the state's reliance on fossil fuels, emphasizing the need for a transition to renewable energy sources.

The concerns regarding Lack of Transportation/Infrastructure and Water Quality/Runoff point to the need for resilient and sustainable infrastructure development. The Loss of Native

Species/Ecosystems/Forests highlights the importance of protecting Hawai‘i's unique biodiversity in the face of climate change.

Issues related to Waste Management/Pollution, Heat/Rising Temperatures, and Lack of Water/Drought further emphasize the multifaceted impacts of climate change on daily life and natural resources.

The other concerns that were shared, while mentioned less frequently, are nonetheless important and reflect specific vulnerabilities and challenges facing different communities and sectors across the state. These include Agricultural Issues, Cesspools/Wastewater Management, Lack of Emergency Preparedness, Military Impacts, Housing/Affordability, Healthcare Access, Plant/Bird Extinction, and the potential for increased Hurricanes. Concerns about Tourism Impacts and Lack of Government Action/Accountability signal the community's desire for responsible and effective climate governance.

This comprehensive list of concerns will serve as a critical foundation for the development of targeted strategies and actions within the State of Hawai‘i Climate Action Plan. Addressing these priorities, as articulated by the community, will be essential for creating a plan that is effective, equitable, and reflects the lived experiences of Hawai‘i residents.

Direct Stakeholder Engagement on Climate Equity:
In addition to these extensive public outreach efforts, a parallel effort was carried out to gather in-depth stakeholder input on issues of climate equity through a targeted engagement process. This effort was designed to elevate the voices of those working directly in or affected by climate equity challenges across Hawai‘i. The process involved one-on-one meetings with key stakeholders from across the climate change and resilience landscape, including researchers, nonprofits, community-based organizations (CBOs), and public agencies.

Over the course of these engagements, qualitative interviews and informal discussions were conducted with a wide array of participants. These conversations focused on understanding the equity concerns observed in their work, identifying needs and gaps, surfacing community-driven solutions, and collecting recommendations for what the State can do to support equitable climate resilience. The result was a robust set of feedback, totaling 101 unique stakeholder comments. These comments were analyzed and grouped by category to identify common themes and priorities.

A quantitative breakdown of these comments revealed key areas of concern, with the number of comments indicated in brackets ():

- **Equity and marginalized communities** (21 mentions): Emphasizing distributional equity, access for underrepresented populations such as Native Hawaiians, Micronesian and Pacific Islanders, and low-income households.
- **Funding and financial support** (19): Including suggestions on grant access, utility bill relief, and new funding mechanisms.
- **Workforce development** (12): Highlighting equitable access to job training, certification programs, and green economy pathways.

- **Community engagement and participation** (12): Calling for more inclusive planning, better outreach coordination, and compensated community involvement.
- **Infrastructure and transportation** (11): Including safe transit systems, climate-resilient design, and accessibility improvements.
- **Renewable energy, water management, education, land use, and disaster resilience** were also notable themes, each receiving between 6 and 9 mentions.

This analysis underscores the depth and diversity of climate equity concerns across Hawai‘i. Key takeaways include the urgent need for better funding systems, inclusive and coordinated planning processes, workforce pipelines for underrepresented communities, and enhanced community ownership in climate initiatives. These insights form a critical backbone to our state's Climate Action Pathways and should guide both policy and implementation.

Climate Equity Hui: A Collaborative Working Group

Complementing the direct interviews, we convened a recurring working group referred to as the Climate Equity Hui, bringing together diverse stakeholders from CBOs, researchers, Native Hawaiian organizations, and public agencies to collaboratively explore equity challenges in climate resilience. This Hui meets bimonthly to hold space for cross-sector dialogue, exchange best practices, and collectively develop actionable recommendations for the state.

A topic of interest that arose organically during discussions was for the Hui to explore mechanisms to strengthen community-led resilience planning, including improved coordination among agencies, equitable funding pathways, and strategies to support local leadership. Discussing various pathways to achieve this became a focus for meeting discussions.

Key recommendations that have emerged from the Climate Equity Hui to date include:

- "Resilience hubs" (community-serving facilities that provide daily services and become centralized support centers during disasters) could potentially serve as centers of empowerment for community planning and engagement. The state should help develop and support resilience hubs through funding, technical assistance (TA), and partnerships with local CBOs.
- More coordination around state outreach and community engagement efforts, and tracking mechanisms to support this effort. A potential solution is to create an entity or staff position to track and coordinate community plans and outreach efforts, ensuring efforts build on each other and prevent community fatigue.
- Improve equity in state funding by updating NOFA/RFP language and providing pre-application support for CBOs.
- Increase state-level TA opportunities for resilience planning and funding applications, as most current TA opportunities are federal and don't effectively navigate the state landscape
- Compensate community members and ensure their priorities are addressed in implementation.
- Center food security, place-based education, and Indigenous knowledge as pillars of climate resilience.

Through these sustained conversations and partnerships, the Climate Equity Hui has helped build a shared understanding of equity challenges and has co-developed early strategies for moving from

planning to action. These efforts are helping to build a more inclusive, resilient, and just climate future for Hawai‘i.

The findings and recommendations generated through both individual engagements and the Hui will be carried forward as a foundational component of this Climate Action Plan and should inform future phases of implementation and monitoring.

Engagement Metrics (2023-2025)	Results
Number of outreach meetings or events	*82*
Number of Engagements at Outreach Events	*2700+*
Number of advisory groups and number of members in these groups	
1. Energy	*11*
2. Commercial and Residential Buildings	*14*
3. Transport	*26*
4. Industry	*8*
5. Buy Green	*17*
6. Agriculture, Forestry and Other Land Uses	*31*
7. Waste	*17*
8. Circular and Wellbeing Economy	*18*
9. LIDAC and Workforce Development	*22*
Number of survey respondents	*400*
Number Feedback Comments received for CAP	*650+*
Number of newsletter subscribers	*1850+*
Number of Social Media Followers	*2600+*

Table 2: Engagement Metrics for Development of CAP 2023-2025

Integrating Community Voices into Climate Action:
The extensive outreach and engagement efforts undertaken have been instrumental in gathering valuable insights and concerns from communities, stakeholders, and youth across the State of Hawai‘i. The methodologies employed were designed to be inclusive and accessible, ensuring a broad representation of voices in the development of the Climate Action Plan. The identification of the top 20 community concerns provides a clear roadmap for prioritizing key areas of action. Issues such as flooding, sea level rise, invasive species, and high energy costs demand immediate and focused attention. The diverse range of other concerns, from water quality to healthcare access, underscores the interconnectedness of climate change with various aspects of life in Hawai‘i.

The feedback received through this outreach process is not merely a list of concerns; it represents the lived experiences, vulnerabilities, and priorities of the people of Hawai‘i. Integrating these voices into the State's Climate Action Plan is paramount to ensuring its relevance, effectiveness, and equitable implementation. This chapter highlights the commitment to a community-driven approach, recognizing that a successful climate action plan must be built in partnership with the people it aims to serve. The insights gained will directly inform the development of specific goals, strategies, and actions within the subsequent chapters of this plan, ensuring that the State of Hawai‘i takes meaningful and responsive steps towards a sustainable and resilient future for all.

2.3 County Plans and Outreach

Each of Hawai‘i’s four counties undertook comprehensive community engagement to inform their respective climate action and resilience plans. These efforts emphasized transparency, inclusion, and public participation in shaping local climate strategies.

County of Hawai‘i - Hawai‘i County’s planning process began with three climate workshops in 2021, supported by a Climate Action Working Group composed of community members. The County’s Climate Action Team (CAT) partnered with this group to create and distribute a climate sentiment survey, collecting 1,079 responses between September 2021 and March 2022. Survey distribution was extensive, leveraging government networks, media, and local organizations such as UH Hilo, Hawaiian Electric, and Zero Waste Hawai‘i. The survey helped shape the draft Climate Action Plan by identifying key community concerns and co-benefits for climate actions.[27]

City and County of Honolulu - Honolulu integrated over 2,000 community perspectives into its Climate Action Plan (CAP) through three phases: 11 public meetings (672 participants), a representative island-wide survey (760 respondents), and a virtual open house (614 participants). Early events featured interactive climate games, and a stakeholder working group refined strategies and technical inputs. The survey results revealed strong climate concern among residents and informed priorities and baseline assumptions for the CAP. [28]

County of Kaua‘i - Kaua‘i conducted both in-person and online workshops in 2023 to gather public input on potential greenhouse gas reduction strategies. Workshops included presentations, polling via Menti, and Q&A sessions. Community feedback helped prioritize and refine the Kaua‘i Climate Adaptation and Action Plan (KCAAP). An online survey using the “Consider.It” platform garnered 608 opinions on proposed strategies, plus additional feedback on six new community-suggested actions. Outreach included social media, listservs, and public events. [29]

County of Maui - Maui’s Climate Action and Resilience Plan (CARP) focused on climate justice and lifting up vulnerable and marginalized communities. Outreach included over 1,000 voices via surveys, interviews, focus groups, and community site visits. Engagement featured 70 community advisors, 21 advisor workshops, and 800+ survey responses. Native Hawaiian cultural values and

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[27] County of Hawai‘i Planning Department (2023). Integrated Climate Action Plan for the Island of Hawai‘i: Greenhouse Gas Reduction and Climate Adaptation Actions to Build Local Resilience to Climate Change, https://cohplanning.konveio.com/integrated-climate-action-plan-icap-island-hawaii?document=1

[28] City & County of Honolulu (n.d.) One Climate One O‘ahu Climate Action Plan 2020-2025, https://static1.squarespace.com/static/5e3885654a153a6ef84e6c9c/t/6080c33e91bbf23a20b74159/1619051381131/2020-2025+Climate+Action+Plan.pdf

[29] County of Kaua‘i (2023). Kaua‘i Climate Adaptation and Action Plan https://kauaiadaptation.com/wp-content/uploads/2023/12/KCAAP_Survey3_Summary_Mitigation_121323.pdf

environmental stewardship were integral to planning, emphasizing the importance of mana (authority) and pilina (relationship) to ʻāina (land) in climate solutions. [30]

This cross-county engagement model illustrates the importance of local knowledge and community partnership in shaping equitable and effective climate policies across the state.

[30] County of Maui (2022). Climate Action and Resiliency Plan, https://www.resilientmauinui.org/pages/climate-action-resiliency-plan

3. Greenhouse Gas Emissions Inventory and Emissions Projections

3.1 Greenhouse Gas (GHG) Emissions Inventory

The State of Hawai‘i is committed to reducing its contribution to global climate change and has taken efforts to measure and reduce statewide greenhouse gas (GHG) emissions. In 2007, the State of Hawai‘i passed Act 234, Session Laws of Hawai‘i 2007 (Act 234 of 2007), to establish the state's policy framework and requirements to address GHG emissions. The law sought to achieve emission levels at or below Hawai‘i's 1990 GHG emissions by January 1, 2020 (excluding emissions from airplanes). In 2008, the State of Hawai‘i developed statewide GHG emission inventories for 1990 and 2007. To help Hawai‘i meet the emissions target, Hawai‘i Administrative Rules (HAR), Chapter 11-60.1 was amended in 2014 to establish a facility-level GHG emissions cap for large existing stationary sources with potential GHG emissions at or above 100,000 tons of CO2 Eq. per year. In recent years, further GHG emissions goals have been set.

In an effort to track progress toward achieving the state's 2020, 2030, and 2045 GHG reduction goals, the Hawai‘i Greenhouse Gas Emissions Report 2025 presents updated 1990, 2005, 2007, 2010, 2015, 2016, 2017, 2018, 2019, 2020, and 2021 emissions estimates; emissions estimates developed for 2022; and emission projections for 2025, 2030, 2035, 2040, and 2045.[31]

Based on the analysis presented in the 2025 report, net GHG emissions (excluding aviation) in 2020 are estimated to have been lower than net GHG emissions (excluding aviation) in 1990 meeting the target set by Act 2342. Net GHG emissions (including aviation) in 2030 are projected to be greater than the target emissions level of 50 percent below 2005 levels (including aviation) pursuant to Act 238, and in 2045 are projected to be greater than the target of net-negative levels pursuant to Act 15. While the development of future inventory reports as well as ongoing quantitative assessment of uncertainties will further inform whether Hawai‘i will meet the 2030 and 2045 statewide targets, this report finds that Hawai‘i met the 2020 target, but—given existing policies, anticipated adoption of technologies, and economic expectations—is not expected to meet the 2030 and 2045 targets.

3.2 GHG Methodology

The Hawai‘i Department of Health uses standards from the IPCC to estimate Hawai‘i's GHG emissions.[32] The 2006 IPCC Inventory Guidelines are a nationally and internationally recognized

[31] DOH, *Hawai‘i Greenhouse Gas Emissions Report for 2022*, April 2025, available from https://health.hawaii.gov/cab/files/2025/04/Final-2022-GHG-Emissions-Report.pdf

[32] Hawai‘i State Energy Office. (2023, December). *Hawai‘i Pathways to Decarbonization: Act 238, Session Laws of Hawai‘i 2022*. https://energy.hawaii.gov/wp-content/uploads/2024/01/Act 238_HSEO_Decarbonization_Report.pdf

standard accepted by the United Nations Framework Convention on Climate Change (UNFCCC) and the US Environmental Protection Agency (EPA).[33]

3.3 GHG Emissions by Sector

Table 2: Hawai‘i GHG Emissions by Sector (Including Sinks and Aviation) below shows GHG emissions by sector (including sinks and aviation) for each inventory year in Hawai‘i. In all inventory years, emissions from the Energy sector accounted for the largest portion (more than 85 percent) of total emissions in Hawai‘i. As the largest source of emissions in Hawai‘i, the Energy sector is a major driver of the overall emissions trends, accounting for 81.4 percent of the emissions increase from 1990 to 2007 and 87.5 percent of reductions between 2007 and 2022. Transportation emissions - which increased between 1990 and 2007 and then decreased through 2022 - accounted for the largest share of Energy sector emissions in all inventory years. Stationary combustion emissions - which similarly increased between 1990 and 2007, before decreasing through 2022 - are the second largest share of Energy sector emissions. This trend is driven by emissions from energy industries (electric power plants and petroleum refineries) as well as industrial and commercial emissions. The decrease in energy emissions is largely due to reduced fuel consumption across all subsectors, which is driven by increased energy efficiency and the growth of renewable energy.

[33] Intergovernmental Panel on Climate Change (2006). IPCC Guidelines for National Greenhouse Gas Inventories, https://www.ipcc-nggip.iges.or.jp/public/2006gl/

Sector/Category	1990	2005	2010	2015	2020	2022	Percent of Sector Totals in 2022
Energy	**20.25**	**22.72**	**19.38**	**18.50**	**14.66**	**17.95**	
Stationary Combustion	8.47	9.56	8.89	8.16	7.29	7.44	41.4%
Energy Industries	*6.38*	*8.33*	*7.86*	*7.11*	*6.48*	*6.37*	*85.7%*
Residential	*0.05*	*0.07*	*0.09*	*0.06*	*0.06*	*0.06*	*0.9%*
Commercial	*0.76*	*0.36*	*0.37*	*0.47*	*0.50*	*0.55*	*7.4%*
Industrial	*1.29*	*0.81*	*0.56*	*0.51*	*0.25*	*0.45*	*6.0%*
Transportation	11.13	12.58	9.92	9.72	6.96	10.12	56.3%
Ground	*3.71*	*5.04*	*4.20*	*4.29*	*3.13*	*3.47*	*34.3%*
Domestic Marine	*1.53*	*0.37*	*0.58*	*0.28*	*0.34*	*0.65*	*6.4%*
Domestic Aviation	*3.69*	*6.13*	*3.98*	*4.29*	*2.73*	*4.90*	*48.5%*
Military Aviation	*1.42*	*1.03*	*0.66*	*0.80*	*0.45*	*0.77*	*7.6%*
Military Non-Aviation	*0.77*	*0.02*	*0.51*	*0.05*	*0.32*	*0.32*	*3.2%*
Incineration of Waste	0.18	0.15	0.19	0.27	0.28	0.26	1.5%
Oil and Natural Gas Systems	0.43	0.39	0.32	0.31	0.10	0.10	0.5%
Non-Energy Uses	0.04	0.04	0.05	0.05	0.04	0.04	0.2%
International Bunker Fuels	*1.56*	*2.23*	*1.31*	*1.56*	*0.69*	*0.83*	4.6%
CO_2 from Wood Biomass and Biofuels Consumption	*2.43*	*1.04*	*1.24*	*1.41*	*1.16*	*1.19*	6.6%
IPPU	**0.18**	**0.50**	**0.67**	**0.79**	**0.76**	**0.85**	
Cement Production	0.10	0.00	0.00	0.00	0.00	0.00	0.0%
Substitution of Ozone Depleting Substances	+	0.46	0.65	0.77	0.75	0.84	98.7%
Electrical Transmission and Distribution	0.08	0.03	0.02	0.01	0.01	0.01	1.3%
AFOLU (Sources)	**1.47**	**1.10**	**1.08**	**1.09**	**1.10**	**1.11**	
Enteric Fermentation	0.35	0.31	0.30	0.26	0.28	0.29	26.2%
Manure Management	0.14	0.05	0.02	0.02	0.01	0.01	0.7%
Agricultural Soil Management	0.16	0.14	0.15	0.14	0.14	0.15	13.0%
Field Burning of Agricultural Residues	0.03	0.03	0.01	0.01	0.00	0.00	0.0%
Urea Application	+	+	+	+	+	+	0.1%
Agricultural Soil Carbon	0.76	0.50	0.57	0.57	0.58	0.58	52.4%
Forest Fires	0.02	0.06	0.03	0.09	0.09	0.08	7.5%
AFOLU (Sinks)	**(2.40)**	**(2.50)**	**(2.62)**	**(2.73)**	**(2.43)**	**(2.48)**	
Landfilled Yard Trimmings and Food Scraps	(0.12)	(0.05)	(0.05)	(0.05)	(0.04)	(0.05)	1.9%
Urban Trees	(0.48)	(0.60)	(0.62)	(0.60)	(0.58)	(0.60)	24.4%
Forest Carbon	(1.79)	(1.86)	(1.95)	(2.07)	(1.80)	(1.83)	73.8%
Waste	**1.01**	**0.98**	**0.60**	**0.51**	**0.41**	**0.40**	
Landfills	0.89	0.84	0.50	0.41	0.32	0.32	79.8%
Composting	0.02	0.03	0.03	0.03	0.04	0.03	6.7%
Wastewater Treatment	0.09	0.11	0.06	0.07	0.05	0.05	13.5%
Total Emissions (Excluding Sinks)	**22.90**	**25.29**	**21.71**	**20.88**	**16.93**	**20.32**	
Net Emissions (Including Sinks)	**20.51**	**22.78**	**19.09**	**18.16**	**14.50**	**17.83**	
Aviation	5.11	7.16	4.64	5.09	3.17	5.67	
Net Emissions (Including Sinks, Excluding Aviation)	**15.40**	**15.62**	**14.45**	**13.06**	**11.33**	**12.16**	

Table 3: Hawai'i GHG Emissions by Sector/Category (MMT CO2 Eq.). Note data from DOH, Hawai'i Greenhouse Gas Emissions Report for 2022.

The year 1990 marked peak emissions from AFOLU sources during the time period evaluated; emissions from AFOLU sources decreased by about 24.0 percent between 1990 and 2022. Similarly for the Waste sector, the year 1990 marked peak emissions during the time period evaluated and emissions decreased by about 60.7 percent between 1990 and 2022. Emissions from the IPPU sector have steadily increased since 1990 and were more than four times higher in 2022 compared to 1990 levels. The increase in IPPU emissions is attributable to the growth in hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs) used as substitutes for ozone-depleting substances (ODS); there is no longer cement production in Hawai‘i, and emissions from electrical transmission and distribution has decreased over the time period 1990 to 2022. Lastly, carbon removals from AFOLU sinks have also increased since 1990, growing by roughly 3.6 percent between 1990 and 2022.

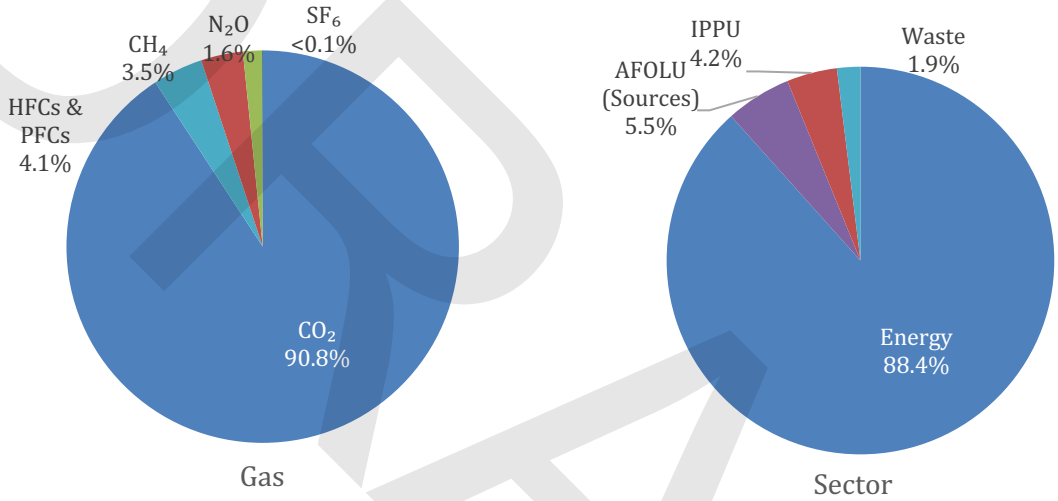

Figure 3: Hawai‘i 2022 GHG Emissions by Sector and Gas. Note data from DOH, Hawai‘i Greenhouse Gas Emissions Report for 2022.

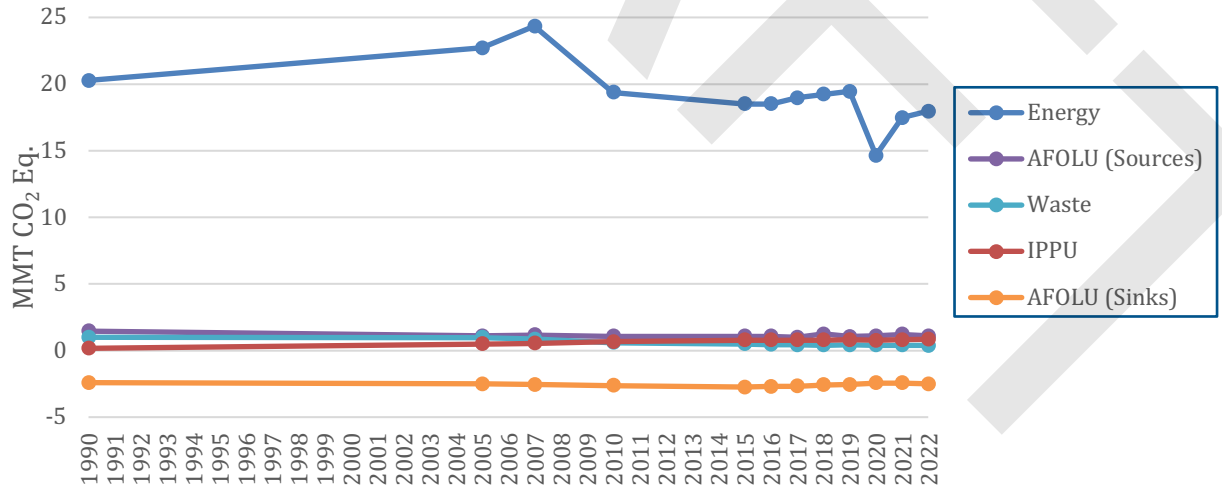

Figure 4: Hawai‘i GHG Emissions by Sector (Including Sinks and Aviation). Note data from DOH, Hawai‘i Greenhouse Gas Emissions Report for 2022.

Additionally, county level emissions were estimated for 2022. In 2022, Honolulu County accounted for the largest share of net GHG emissions (71.3 percent), followed by Maui County (15.3 percent), Hawai‘i County (8.6 percent), and Kaua‘i County (4.8 percent).

3.4 Emission Projections

The projections analysis uses a combination of top-down and bottom-up approaches to develop baseline projections of statewide and county-level GHG emissions for the years 2025, 2030, 2035, 2040, and 2045. The projections for several sources (residential, commercial, and industrial energy use, domestic and international aviation, non-energy uses, composting and wastewater treatment) are based on either a long-range forecast for gross state/county product or future population (including visitor arrivals), using the 2022 statewide GHG inventory as a starting point. Source-specific approaches were taken for several small categories. For example, electricity sales forecasts were used to project GHG emissions for electrical transmission and distribution. Emissions for AFOLU categories and landfill waste are projected by forecasting activity data using historical trends and published information available on expected future trends. Bottom-up approaches are used for GHG emitting sources with substantial federal and state policy intervention (energy industries, substitution of ozone depleting substances, and transportation). Due to policies that affect these sources, projected economic activities are only one component of future GHG emissions. Therefore, a more comprehensive sectoral approach was used to develop baseline projections for these emission sources.

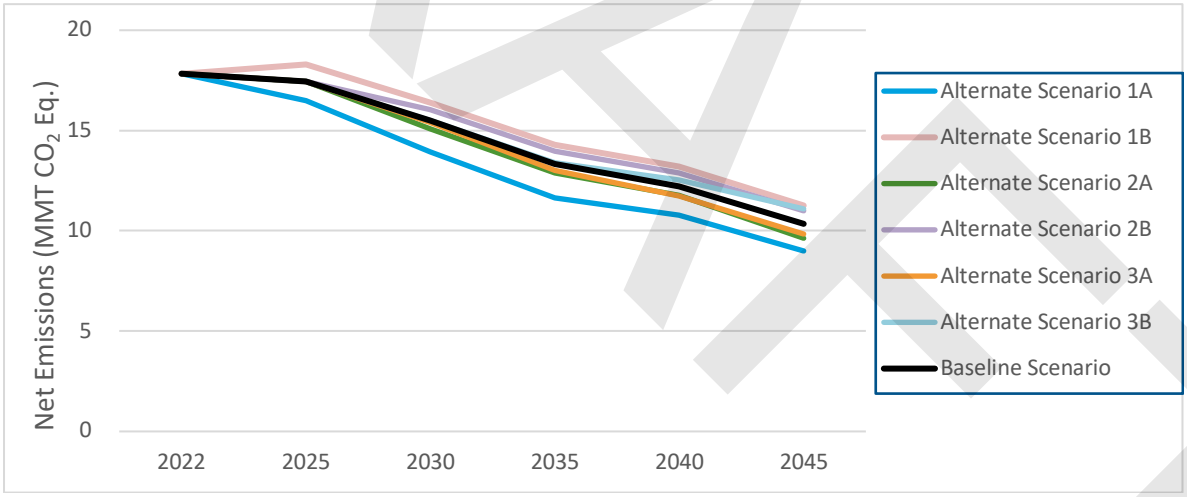

Figure 5: Hawai‘i Net GHG Emissions Projections (MMT CO2 Eq.) (Including Sinks and Aviation). Note data from DOH, Hawai‘i Greenhouse Gas Emissions Report for 2022.

Figure 5 shows net GHG emissions for the current inventory year and projected inventory years under different scenarios. In addition to the baseline scenario, three major points of uncertainty, namely world oil prices, renewable energy deployment, and ground transportation technology adoption, were assessed by modeling six alternate scenarios for statewide GHG emissions in 2025, 2030, 2035, 2040, and 2045. Alternate Scenario 1A and 1B are based on world oil prices. This alternate scenario looks at both high (Alternate Scenario 1A) and low (Alternate Scenario 1B) future oil price pathways. Alternate Scenario 2A and 2B are based on renewable energy

deployment. Alternate Scenario 2A assumes a more aggressive path for renewable energy deployment than the Baseline Scenario. Alternate Scenario 2B projects renewable energy deployment based on the rate of deployment since 2016. Alternate Scenario 3A and 3B are based on ground transportation technology adoption. This alternate scenario creates a high EV adoption scenario (Alternate Scenario 3A) and a low EV adoption scenario (Alternate Scenario 3B). Hawai‘i GHG emissions for 1990, 2005, 2020, and 2022 and projections of statewide emissions and sinks by sector for 2025, 2030, 2035, 2040, and 2045 are summarized in Table 3.

Relative to 2022, total emissions under the baseline scenario are projected to gradually decrease

Sector	1990	2005	2020	2022[34]	2025 Baseline	2030 Baseline	2035 Baseline	2040 Baseline	2045 Baseline
Energy[35]	20.25	22.72	14.66	17.95	17.69	15.92	14.08	13.25	11.52
Industrial Processes and Product Use (IPPU)	0.18	0.50	0.76	0.85	0.80	0.66	0.44	0.28	0.26
AFOLU (Sources)	1.47	1.10	1.10	1.11	1.03	0.98	0.93	0.89	0.85
AFOLU (Sinks)	(2.40)	(2.50)	(2.43)	(2.48)	(2.44)	(2.41)	(2.44)	(2.52)	(2.60)
Waste	1.01	0.98	0.41	0.40	0.36	0.35	0.34	0.33	0.32
Total Emissions (Excluding Sinks)	**22.90**	**25.29**	**16.93**	**20.32**	**19.89**	**17.91**	**15.79**	**14.74**	**12.95**
Net Emissions (Including Sinks)	**20.51**	**22.78**	**14.50**	**17.83**	**17.45**	**15.51**	**13.34**	**12.23**	**10.35**
Aviation[36]	5.11	7.16	3.17	5.67	6.10	6.24	6.32	6.38	6.40
Net Emissions (Including Sinks, Excluding Aviation)[37]	**15.40**	**15.62**	**11.33**	**12.16**	**11.35**	**9.26**	**7.02**	**5.85**	**3.94**

Table 4: Hawai‘i GHG Emissions for 1990, 2005, 2020, and 2022 and Projections by Sector under the Baseline Scenario for 2025, 2030, 2035, 2040, and 2045 (MMT CO2 Eq.) Note data from DOH, Hawai‘i Greenhouse Gas Emissions Report for 2022.

through 2025, with more significant reductions expected through 2045. Over the same period, net emissions, which take into account carbon sinks and are relevant for tracking progress toward the 2030 GHG target pursuant to Act 238 of 2022, are also expected to follow a similar downward trend, with a slight decrease from 2022 to 2025, followed by more substantial decreases through 2045. When excluding aviation, net emissions are projected to decrease at a faster rate, with reductions lower in 2030, 2045, and 2050.

[34] Inventory year 2022 is included as it is used as the starting point of emissions projections.
[35] Emissions from international bunker fuels are not included in the totals, as per IPCC (2006) guidelines.
[36] Domestic aviation and military emissions, which are reported under the Energy sector, are excluded from Hawai‘i’s GHG emission reduction goal established in Act 234 of 2007.
[37] Totals may not sum due to independent rounding. Parentheses indicate negative values or sequestration.

Projections indicated that business-as-usual practices will not meet GHG reduction targets. Net emissions are projected to be 17.45 MMT CO2e in 2025, 15.51 MMT CO2e in 2030, and 10.35 MMT CO2e in 2045 far overshooting set goals. Relative to 2019, total emissions under the baseline projection scenario are modeled to decrease by 16% by 2025, 21% by 2030, and 37% by 2045. This trend is largely driven by the projected trend in emissions reduction from energy industries (i.e., electric power plant conversion to comply with RPS mandates), which are expected to decrease substantially between 2019 and 2045.[38]

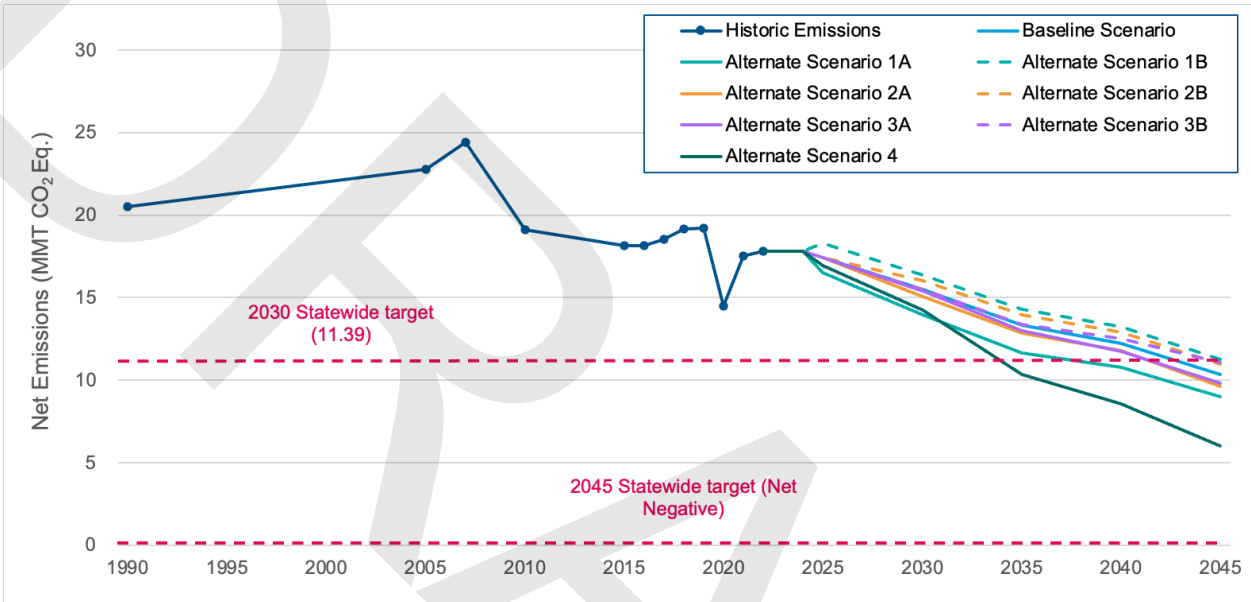

Figure 6: Hawai'i Net GHG Emissions Estimates and Projections (MMT CO2 Eq.) (Including Sinks and Aviation). Note, Emission estimates include sinks and domestic aviation emissions, figure taken from DOH, Hawai'i Greenhouse Gas Emissions Report for 2022.

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[38] Hawai'i State Energy Office. (2023, December). *Hawai'i Pathways to Decarbonization: Act 238, Session Laws of Hawai'i 2022* (p. ES-9). https://energy.hawaii.gov/wp-content/uploads/2024/01/Act238_HSEO_Decarbonization_Report.pdf

4. Overview of Current State Policies

The State's role in providing an enabling policy and legislative framework is essential for local jurisdictions and communities to adequately address equity issues of mitigation, adaptation, and resilience.[39] Over the past two and a half decades, several state laws have been established to address climate change mitigation, adaptation, and resilience. As summarized in Act 32, SLH 2017, "Hawai'i has a tradition of environmental leadership, having prioritized policies regarding conservation, reduction in greenhouse gas emissions, and development and use of alternative renewable energy. The legislature has passed numerous policies and mandates over the last decade to address climate change".[40]

The measures listed within this CAP complement existing policy or provide GHG reduction where policies and/or targets are lacking enforcement mechanisms or funding.

Key laws driving GHG mitigation and emission reduction in Hawai'i include:

1) **HRS §225P-5 GHG Emission and Sequestration Target.** Established target to "sequester more atmospheric carbon and greenhouse gases than emitted within the State as quickly as practicable, but no later than 2045", effectively establishing a net-negative emissions target.
2) **HRS §342B Part VI. Relates to Air Pollution Control and Greenhouse Gas Emissions.** Requires the State DOH-CAB to complete a greenhouse gas emissions inventory report each year beginning after 2017 to track emissions and determine the State's progress in the reduction of greenhouse gas emissions; establishes a GHG emission limit.
3) **HRS §269-92. Renewable Energy Portfolio Standard.** Requires each electric utility to meet 100% renewable energy generation by 2045. Establishes interim targets of 40% net electricity generation by December 31, 2030; 70% of its net electricity generation by December 31, 2040; and 100% of its net electricity generation by December 31, 2045. Previous target years of 10% by 2010, 15% by 2015, and 30% by 2020 were all met.
4) **HRS §196-10.5. Hawai'i Clean Energy Initiative.** Hawai'i's energy transition conversation first launched as the Hawai'i Clean Energy Initiative (HCEI) in 2008. In 2014, the HCEI renewed Hawai'i's commitment to setting bold clean energy goals, including achieving the nation's first-ever 100 percent renewable portfolio standards (RPS) by 2045.
5) **HRS §225P-3. Establishes a statewide Climate Change Mitigation and Adaptation Commission (CCMAC).** Affirms commitment to the US's pledges under the Paris Agreement to combat climate change by systematically reducing greenhouse gas emissions and improving resilience to climate change. Requires participation of the heads of several key state agencies and legislative committees.
6) **HRS §269-96. Energy Efficiency Portfolio Standard (EEPS).** 4,300 gigawatt hours of electricity use reductions statewide by 2030. The HPUC may establish incentives and penalties based on performance in achieving the energy-efficiency portfolio standards

[40] Act 32, SLH (2017). A Bill for an Act Relating to Climate Change, https://www.capitol.hawaii.gov/slh/Years/SLH2017/SLH2017_Act32.pdf

(EEPS) by rule or order. There is a current administrative, governor-supported bill to extend the EEPS to 2045.

7) **HRS §269-121. Public benefits fee authorization.** Allows a portion of the moneys collected by Hawai'i's electric utilities from its ratepayers through a demand-side management surcharge to establish public benefits fee. The public benefits fee shall be used to support clean energy technology, demand response technology, and energy use reduction, and demand-side management infrastructure, programs, and services
8) **HRS §196-63 and 196-64. Hawai'i Green Infrastructure Authority (HGIA).** The HGIA manages the Hawai'i Green Energy Market Securitization (GEMS) Program and brings clean energy technologies to Hawai'i ratepayers, including those who are underserved, by providing innovative financing products that result in electricity bill savings for customers with no money down. The GEMS Program is intended to create a sustainable financing structure through market-driven public-private partnerships that will open access to financing for more Hawai'i customers and democratize access to clean energy.
9) **HRS §196. Act 239 (2022)** added two new sections addressing energy efficiency implementation for state facilities. Requires state facilities over 10,000 square feet to implement cost-effective energy efficiency measures, requires, where feasible and cost-effective, the design of all new state building construction to maximize energy and water efficiency and energy generation potential and to use building materials that reduce the carbon footprint of the project.
10) **HRS §103D-412. Motor Vehicle requirements for state fleets.** All agencies purchasing or leasing light-, medium-, and heavy-duty motor vehicles shall seek vehicles that reduce dependence on petroleum-based fuels that meet the needs of the agency. Priority shall be 1) ZEVs, 2) plug-in hybrid electric vehicles, 3) alternative fuel vehicles; and 4) hybrid electric vehicles.
11) **Act 060 (SB946) Relating to wastewater management.** Clarifies that the prohibition against discharging wastewater or raw sewage into state waters after 12/31/2026 includes treatment plants. Repeals the exemption from the prohibition for treatment plants that utilize sewage to produce clean energy.
12) **Act 096 (SB1396) Relating to economic development.** Beginning 7/1/2025, requires the Governor to request in the executive budget or supplemental budget that an amount of general funds that approximates the additional Transient Accommodations Tax revenue generated by this Act be expended to advance certain climate change mitigation and tourism projects. Increases the Transient Accommodations Tax rate beginning on 1/1/2026. Assesses the Transient Accommodations Tax on gross rental proceeds derived from cruise fares. Amends the amount of Transient Accommodation Tax that shall be deposited into the Mass Transit Special Fund. Amends the allowable uses of the Special Land and Development Fund and the portion of Transient Accommodations Tax collections that are allocated to the Special Land and Development Fund. Effective 1/1/2026.
13) **Act 101 (HB316) Relating to the green jobs youth corps.** Appropriates funds to the Department of Land and Natural Resources to continue the Green Jobs Youth Corps Program.
14) **Act 103 (HB750) Extended producer responsibility program for packaging materials and paper products.** Establishes an advisory council to review the draft needs assessment and propose recommendations throughout the assessment process. Requires the

Department of Health to hold a public hearing on the draft needs assessment and complete and submit the needs assessment to the Legislature by 12/31/2027. Appropriates funds.

15) **Act 162 (SB1298) Relating to recycling.** Expands the types of electronic devices subject to the Electronic Device Recycling and Recovery Act to include electronic device peripherals and certain legacy devices. Excludes manufacturers of only electronic device peripherals and no other electronic devices. Allows, rather than requires, the Department of Health to determine additional penalties. Requires manufacturers' recycling plans to describe communication efforts with the State and counties to facilitate consumer education efforts. Repeals the requirement that recycling plans be implemented and fully operational by 1/1/2023 in order for manufacturer collaboration authority to apply. Establishes additional manufacturer recycling goals beginning on 1/1/2026 and 1/1/2027. Requires additional information to be included in manufacturers' reports containing information for calendar years 2025, 2026, and 2027. Requires collectors to report certain information regarding recyclers and refurbishers and allows the Department of Health to require submission of bills of lading and recycler receiving reports. Requires a report to the Legislature.
16) **Act 188 (HB879) Relating to cesspool conversions.** Appropriates funds to establish a position within the Department of Health to assist with the upgrade and conversion of cesspools and perform any other related responsibilities as designated by the Wastewater Branch of the Department of Health.
17) **Act 192 (SB1220) Relating to renewable gas tariff.** Requires gas utility companies to submit proposed renewable gas tariffs to the Public Utilities Commission by 8/31/2025. Requires the Public Utilities Commission to establish a renewable gas tariff within nine months of receiving a completed application for a proposed renewable gas tariff.
18) **Act 198 (HB736) Relating to wastewater systems.** Establishes and appropriates funds for fiscal year 2025-2026 for a three-year new wastewater system and individual wastewater system technology testing pilot program within the University of Hawai‘i Water Resources Research Center. Requires interim and final reports to the Legislature.
19) **Act 209 (HB242) Relating to electric vehicle batteries.** Establishes a working group within the Hawai‘i State Energy Office to examine how to maximize the recycling and reuse of electric vehicle batteries and recommend electric vehicle battery management practices. Requires a report to the Legislature.

5. GHG Reduction Measures

The following table summarizes the 23 measures that are key to meeting the targets set in this CAP. Details of each Measure are provided in the sector specific chapters which include: Overview; Key Features; Challenges and Opportunities; Numbers and Targets; Challenges and Innovations; County-Level Variations and Actions.

SECTOR	MEASURE DESCRIPTION	TARGET
ENERGY		
1. INCREASE RENEWABLE ENERGY GENERATION TO REPLACE FOSSIL FUEL ELECTRICITY GENERATION **EMISSION REDUCTIONS (2030-2045)** **- 20.6 MMT CO2e (Million Metric Tons of Carbon Dioxide Equivalent)**	Increase the presence of utility-scale and distributed solar photovoltaic (PV), onshore wind, geothermal, and biodiesel to replace current fossil fuel electricity generation. Support the development of utility-scale renewable energy projects for selected Stage 3 projects and forthcoming Integrated Grid Planning procurements, particularly paired solar projects. Consider an interagency task force under HRS §196-1.5 to regularly monitor development timelines, permit status, and identify potential roadblocks.	Increase electricity generation by: 273.66 GWh (gigawatt hour) biodiesel 1703.9 GWh distributed solar PV (photovoltaic) 318.0 GWh geothermal 984.3 GWh onshore wind 2645.5 GWh utility-scale solar PV by 2045.
2. PERMITTING IMPROVEMENTS TO MEET RENEWABLE PORTFOLIO STANDARD (RPS) TIMELINES	Identify permitting improvements to meet RPS timelines, facilitate community benefits, and explore dispute resolution outside of court.	
3. EFFICIENCY IMPROVEMENTS TO POWER PLANTS THAT USE FOSSIL FUELS	Require efficiency improvements to power plants that use fossil fuels to ensure that power plant replacements significantly reduce energy waste, which will save fuel cost and emissions.	

SECTOR	MEASURE DESCRIPTION	TARGET
ENERGY		
4. SOLAR PANELS **Implement solar PV and hot water in buildings.** **Renewable energy & storage** **EMISSION REDUCTIONS (2026-2050)** **- 10 MMT CO2e**	Increase access to residential solar, solar hot water and energy storage. Low-cost solar loans for low- and medium-income households providing lifetime savings. Utility energy buy back programs to help offset costs. Building code requirements for new buildings to be solar ready Increase solar on non-residential buildings. Deployment of renewable energy and storage systems for local government buildings to reduce energy costs, supply clean energy, and provide resilience in case of an electric grid outage.	Increase capacity of solar in residential buildings: - Solarizing 10,000 rooftops annually for 5 years until 2030 - From 2030 solarizing at an increase rate of 7% per year. Increase capacity of solar in non-residential buildings: - To reach a capacity of 4,146 MW (megawatt) by 2050. -Require new buildings to have solar. - Reduce energy consumption in new households an average of 19% through solar water heater installation.
5. BUILDING ENERGY EFFICIENCY AND UPGRADES **EMISSION REDUCTIONS (2026-2050)** **- 4.7 MMT CO2e**	Upgrade existing buildings to decrease energy consumption and reduce energy demand by increasing energy efficiency in residential and non-residential buildings. Continue to support energy efficiency programs, policies, and incentives that save residents money. Supporting Actions: -Energy Audits -Low flow and energy efficient appliances and fixtures -Weather proofing -Technical training for state and county facilities personnel	Reduce building energy consumption by 46.6% by 2040

SECTOR	MEASURE DESCRIPTION	TARGET
ENERGY		
6. NEW BUILDING CODES **EMISSION REDUCTIONS (2026-2050)** **- 0.0012 MMT CO2e**	Decrease energy consumption in new buildings by adopting the progressive energy efficiency building codes. Workshops and technical training for contractors and state and county facilities personnel.	Adopt 2021 International Energy Conservation Code building standards in new buildings by 2030 for a decrease of 10% in energy consumption.
GROUND TRANSPORTATION		
7. VEHICLES ELECTRIFICATION **Transit & government vehicles electrification** **Commercial vehicles electrification**	Electrify ground transportation - Transition all State fleets to electric vehicles. - Electrify County buses & vehicles. - Expand transportation options for visitors including electric vehicle rentals, shuttles and transportation passes. - Expand electric vehicle charging infrastructure - Require electric vehicle charging in new buildings	All state cars and light-duty trucks are electric or zero emission vehicles by 2030. All state medium- and heavy-duty vehicles are electric or zero emission vehicles by 2045. Require 25% of new commercial building parking spaces to have charging capacity for electric vehicles. Require 100% of all new residential buildings, hotels and long stay commercial building parking spaces to have charging capacity for electric vehicles.
8. FUEL DE-CARBONIZATION **EMISSION REDUCTIONS (2026-2050)** **- 35.6 MMT CO2e**	Decarbonize ground transportation fuels: - Support Clean Fuel Standard, tax dirty fuels or other legislation to increase clean fuel use. -Conduct an Affordability Study to find the best legal framework for Hawai‘i’s particular resources and challenges. - Develop infrastructure for Clean fuels and Blends - Incentivize locally grown clean fuels	Reduce vehicle fuel use emissions by decarbonizing gasoline with ethanol blends (20%, 25%, 50%, 85%). 100% of County bus fleets to use renewable fuel by 2035
9. MODE SHIFT **EMISSION REDUCTIONS**	Switch transportation modes to: walking, biking and transit.	Reduce VMT by 20% through active transportation, building compact, complete communities,

(2026-2050) **- 3.0 MMT CO2e**	- Implement 5-Yr Priority Multimodal Network connecting residents to work and play through bike lanes, sidewalks, bus-only transit lanes and streets and pedestrian prioritization. - Land Use Planning: strategically site & incentivize affordable, compact & transit-oriented development - Transit, Bicycling & Walking initiatives such as county transit free for youth, and rebates for electric bikes and scooters, incentives for ridesharing and vanpool participation - Assess and implement road usage pricing programs after multimodal infrastructure is installed.	increasing transit use, and road pricing programs actions.
SECTOR	**MEASURE DESCRIPTION**	**TARGET**
AIR TRANSPORTATION		
10. FUEL DE-CARBONIZATION **EMISSION REDUCTIONS (2026-2050)** **- 20.6 MMT CO2e**	Decarbonize air transportation fuels - Support Clean Fuel Standard, Tax Credit, Carbon Tax or other Legislation to increase Sustainable Aviation Fuel (SAF) affordability - Advise and participate in a SAF industry working group that meets quarterly and addresses barriers to meeting SAF goals and targets - Incentivize locally grown SAF farmers & producers - Assess existing infrastructure, Supply Chain and Distribution Pathways for SAF - Monitor developments in scale up of zero carbon fuels such as eSAF and green hydrogen - Engage with airlines regarding use of aircraft powered by zero carbon fuels for intra-island flights such as green hydrogen	Reduce airplane emissions by blending sustainable aviation fuels (SAF) with jetfuel (20% by 2040).
11. REDUCE FUEL CONSUMPTION IN AIR TRANSPORTATION	Reducing aviation fuel consumption in airports, through the supporting actions: - Revise airline scheduling to stagger departures and arrivals to reduce idling - Optimize aircraft ramp movements to prevent congestion and delays - Complete airspace modernization strategy and implement - Expand number of gates to reduce aircraft idling time following landing	Reduce airplane emissions by 20% of current levels by increasing the fuel-efficient operation of airplanes.

SECTOR	MEASURE DESCRIPTION	TARGET
AIR TRANSPORTATION		
12. ELECTRIFICATION	Electrify air transportation operations and aircrafts through the supporting actions: - Conversion of airfield vehicles to electric - Conversion of ground support equipment to electric - Installation/expansion of EV charging infrastructure to support landside vehicles - Engage with airlines regarding use of aircraft powered by electricity for intra-island flights Conversion of all mobile equipment to electric	Reduce airport operation and airplane emissions by electrifying aircraft and ground operations vehicles.
MARINE TRANSPORTATION		
13. FUEL DECARBONIZATION **EMISSION REDUCTIONS (2026-2050)** **- 1.5 MMT CO2e**	Promote the use of renewable fuels such as biodiesel, e-methanol, e-ammonia, bio-Liquified Natural Gas, and green hydrogen in marine transportation vessels.	Reduce marine vessel emissions through clean fuel blends (15% by 2050).
14. ENERGY EFFICIENCY IN CRUISE SHIPS **EMISSION REDUCTIONS (2026-2050)** **- 0.2 MMT CO2e**	Implement fuel consumption efficiency in cruise ships, some of the supporting actions are: - Reduce number of cruise ship calls - Reduce size of cruise ships allowed to dock	Reduce cruise ship emissions through fuel efficiency measures (10% more efficient by 2035).
AFOLU		
15.AGRICULTURAL SOIL AMENDMENT **EMISSION REDUCTIONS**	Capture carbon in soils - Integrate waste and land management systems to recapture nutrients and generate soil carbon amendments integrating ʻāina stewards, local meat processors, and agricultural producers. - Biochar pilot program for carbon soil capture. - Invest in infrastructure and facilitates for climate-smart implementation practices	Improve soil management to capture and store 10% more carbon.

(2026-2050) **- 0.2 MMT CO2e**	- Increase technical assistance and resources for land stewardship and agricultural production.	
16. NATURE BASED SOLUTIONS (FORESTS AND WETLANDS) **EMISSION REDUCTIONS (2026-2050)** **- 20.8 MMT CO2e**	Restore forests and wetlands and protect existing native ecosystems through land acquisition, invasive species management, and wildfire prevention. Implement the Strategic Plan for Hawai‘i Wetlands Enhance tree equity in urban spaces increasing resilience and offsetting urban heat island effect.	Planting 11 million native trees. Preserve 23,000 acres of forested lands. Protecting 30% of Priority Watersheds, 843,000 acres, by2030. Restore 20 wetland and loko‘ia(traditional fishpond aquaculture) Increase urban forestry canopy
SECTOR	**MEASURE DESCRIPTION**	**TARGET**
WASTE		
17. WASTE DIVERSION **Waste Diversion Centers.** **EMISSION REDUCTIONS (2026-2050)** **- 4.7 MMT CO2e**	Divert waste from final disposal (landfill or waste to energy). - Infrastructure investments in Regional Material Recovery Hubs with advanced sorting facilities, remanufacturing centers, repair and reuse marketplaces. *Battery and solar panel repurposing *Construction material/waste recycling hubs - Extension of the O‘ahu Island "Transfer Station Reusable Material Collection Site" project. - Installation of dishwashers and mobile washing stations to reduce food waste and reliance on single-use materials. - Implementing a reuse and refill program for food and beverage packaging (collection, washing, and logistics infrastructure to support the circulation of reusable items). -Urban mining ventures recovering metals from landfills	Waste being diverted from final disposal or treatment to reach: - 70% by 2030 - 90% by 2050
18. COMPOSTING **Decentralized Compost Network for Hawai‘i.** **EMISSION REDUCTIONS (2026-2050)** **- 4.3 MMT CO2e**	Divert organic waste from landfills through composting. - Expanding the production, distribution, and application of compost by building a decentralized, community-based compost network in controlled conditions in sealed containers for accelerated composting.	As part of overall waste reduction goals: - 70% by 2030 - 90% by 2050

SECTOR	MEASURE DESCRIPTION	TARGET
WASTE		
19. AVOIDING WASTE GENERATION **EMISSION REDUCTIONS (2026-2050)** **- 0.2 MMT CO2e**	Legislation that enhances the Advisory Council Structure envisioned in H.B.1326, Zero Waste Bill (2023). Implement recommendations from Department of Health's upcoming Extended Producer Responsibility Report requiring manufacturers to be responsible for waste produced in packaging and end of life of products.	Existing Packaging Waste Advisory Council expands into the Hawai'i Circular Economy Commission, incorporating: - Representatives from tourism, construction, and shipping industries and Environmental justice advocates 10% reduction in waste generation rates by 2040.
CIRCULAR AND WELLBEING ECONOMY		
20. ECONOMIC INCENTIVES TO ACCELERATE CIRCULAR INNOVATION	Tax reforms favoring circular practices such as products and materials that can be repaired, reused or composted, use of and reuse or products for a long period of time and sharing of resources and materials. Establish statewide Buy Clean policies to purchase low carbon products. Incorporate Green Budgeting in the state budget process to track where funding is being spent. Supporting actions: -Improve incorporation options for cooperatives: multi-stakeholder cooperatives and worker-owned cooperatives. -Establish a Circular Economy consortium to support transition and encourage innovation in the sector	30% tax rebates for companies achieving 50% closed-loop material use. Levies on non-recycled plastics, metals, and textiles: 5% in 2026 to 20% by 2030 Establish Buy Clean standards across8 categories (paper, construction, etc.) Green budgeting for "Green Fee" by 2026 and State budget by 2030.
21. CULTURAL INTEGRATION AND COMMUNITY EMPOWERMENT	Establish resilience grant program in collaboration with state and counties offices to support programs that build community resilience to climate hazards, threats, risks and impacts. Examples could include: - Tool libraries for appliances, gear. - Repair circles and material swaps - Microgrids - Food banks - Emergency management - Job and skill training	Resilience programs in all identified LIDAC communities

SECTOR	MEASURE DESCRIPTION	TARGET
CIRCULAR AND WELLBEING ECONOMY		
22. MONITORING FRAMEWORK	Ensure regulating agencies are adequately staffed and compensated to ensure thorough expert, timely approvals, and robust enforcement. Consumption-based inventory of GHG to supplement the production-based inventory to more holistically account for imported emissions. Development of Circular Economy Index (measuring re-use of materials) and ʻĀina Resilience Matrix (combining measures of soil health and native species recovery metrics). Tourism Industry specific accounting of energy use, vehicle miles travelled and waste.	
23. EDUCATION & WORKFORCE DEVELOPMENT	Expand Department of Education's Career and Technical Education Program for high schools and Hawaiʻi community colleges to include more green jobs and externship opportunities. -Identify skillsets and pathways needed in different green job sectors -Additional positions at DOE -Integrate stackable credentials to create carer pathways Expanding opportunities and incentives for teacher training and curriculum development in green jobs. Increase the number of paid apprenticeships, pre-apprenticeship and project-based learning in the workplace in green job sectors. - Increase capacity at DLIR to coordinate. -Integrate stackable credentials to create carer pathways - Collaboration across government, communities, workforce systems, labor unions, industry, community-based organizations, and educational institutions.	Strengthen the ecosystem of state, non-profit and private actors working in the green jobs and climate education and circular economy space through supporting initiatives that: - bring climate education to schools - bridge schools with the workplace offering project-based learning opportunities.

Table 5: Summary of CAP Measures

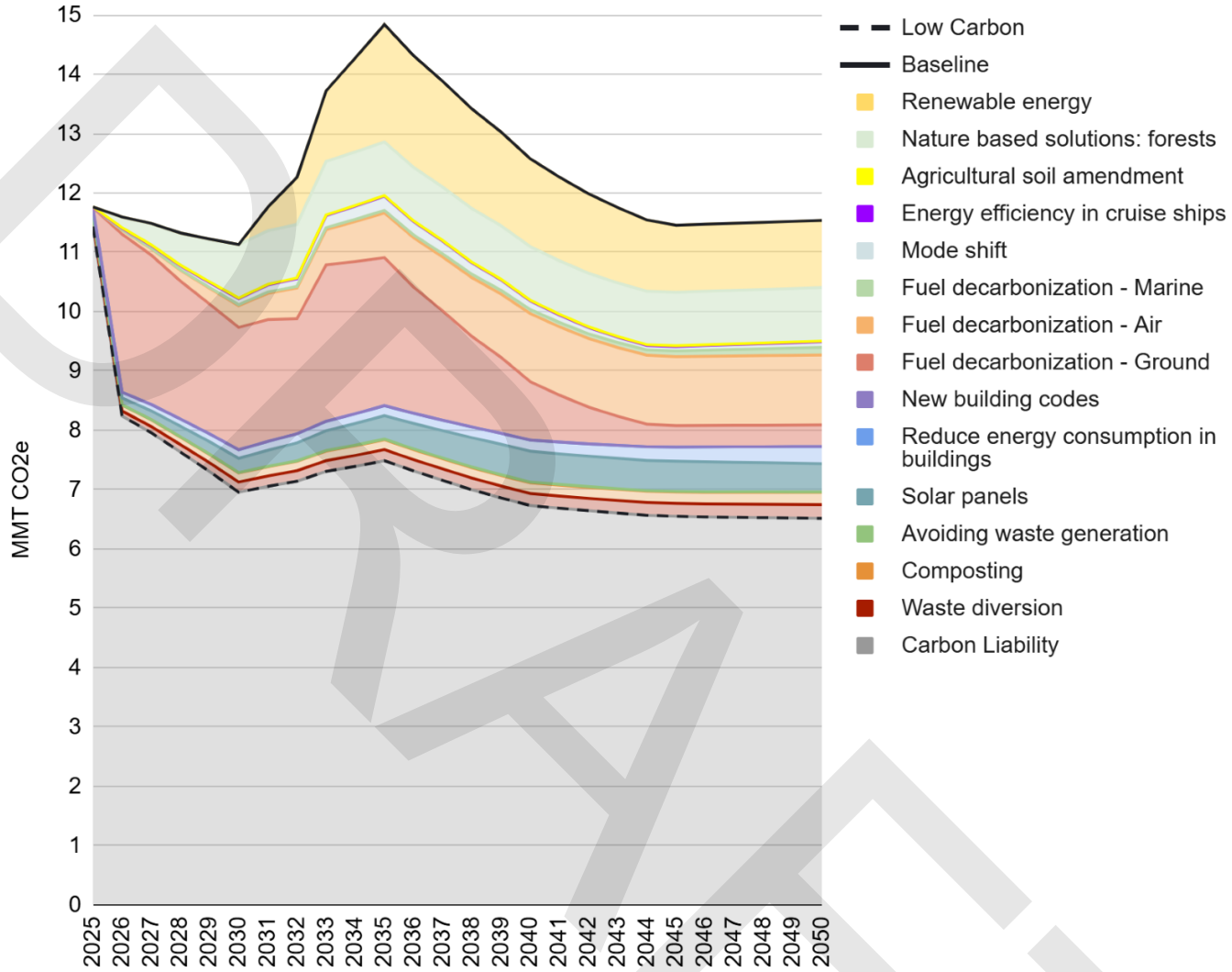

Figure 7: Combined Reduction in GHG from Measures in the CAP

5.1 Energy Industries

5.1.1 Overview:

Hawai‘i stands at a pivotal juncture in its energy evolution, grappling with unique challenges while simultaneously pioneering a transformative shift towards a sustainable, renewable future. The Hawaiian Islands, by virtue of their geographic isolation, have historically faced distinct energy challenges. A heavy dependence on imported fossil fuels, predominantly for electricity generation and transportation has had profound economic consequences, contributing to Hawai‘i consistently experiencing the highest electricity costs in the United States, more than triple the U.S. average price, a significant burden on both residents and businesses.[41] Furthermore, the state's finite land area high land costs, and diverse and sensitive ecosystems present inherent complexities for the development of large-scale utility energy infrastructure, demanding meticulous planning and innovative approaches for the deployment of renewable energy technologies.

The combination of persistently high fossil fuel costs and the inherent vulnerability of its geographic isolation has created a compelling economic impetus for Hawai‘i to transition rapidly to renewable energy sources. This goes beyond environmental considerations. For Hawai‘i, investing in renewable energy directly addresses a core economic vulnerability—the high and volatile cost of electricity—by replacing an expensive, imported input with stable, locally generated power from local resources like sun, wind, and geothermal. This economic driver provides a robust and enduring foundation for the state's policy commitments, distinguishing Hawai‘i's energy transition from that of many continental states where renewable energy adoption might be perceived primarily as an environmental choice. This fundamental economic imperative strengthens the state's resolve and provides a powerful, sustained political and public motivation for achieving its ambitious energy goals, positioning the 100% Renewable Portfolio Standard (RPS) not merely as an environmental aspiration but as an economic necessity for the state's long-term prosperity and energy security.

This commitment to decarbonizing the electricity sector is a cornerstone of Hawai‘i's broader climate goals, which aim for substantial greenhouse gas (GHG) emission reductions across all economic sectors. These targets include a 50% reduction in statewide GHG emissions below 2005 levels by 2030, established by Act 238 (2022) and the ambitious long-term goal of achieving net-negative emissions by 2045, established by Act 15 (2018) The comprehensive transformation of the energy sector, particularly electricity generation, is foundational to realizing these overarching climate objectives.

Hawai‘i's 100% RPS by 2045 represents more than just an aggressive target; it embodies a pioneering legislative and operational framework for island states and isolated grids worldwide. The state’s pursuit of this goal, given its unique grid characteristics and geographical constraints, is an unprecedented undertaking for an entire state-level energy system. The strategies, technologies, policy innovations, and even the lessons learned from challenges experienced by

[41] U.S. Energy Information Administration. (n.d.). *Hawaii Profile*. Retrieved June 16, 2025, from https://www.eia.gov/state/print.php?sid=HI

Hawai‘i in this endeavor will offer invaluable, real-world case studies for other island nations, remote communities, and even larger grids striving for high renewable energy penetration. This positions Hawai‘i as a global leader and a critical source of practical knowledge and experience in the complex global energy transition.

5.2.2 Key Features

Hawai‘i's energy policy has undergone a profound transformation, shifting from a traditional model heavily reliant on fossil fuels to a progressive clean energy framework. This evolution is marked by several key legislative milestones, including Act 234 (2007), Act 97 (2015), Act 15 (2018), Act 74 (2021), and Act 238 (2022). Most notably, Act 15 (2015) legally enshrined the 100% Renewable Portfolio Standard (RPS) by 2045, making Hawai‘i the first U.S. state to adopt such a comprehensive mandate. These legislative actions provide a clear, long-term directive for the state's energy future.[42]

The Hawai‘i Public Utilities Commission (PUC) serves as a central regulatory authority, overseeing the state's utilities, reviewing and approving power purchase agreements, and guiding grid modernization initiatives. The PUC's decisions are instrumental in determining the pace and direction of the energy transition, balancing the state's ambitious goals with considerations of cost-effectiveness, grid reliability, and public interest. This creates a unique dynamic: while the 100% RPS mandate provides an unequivocal goal, the PUC's role in approving specific projects and associated costs means that the speed of the transition is also heavily influenced by regulatory prudence and its interpretation of public interest considerations. This dynamic can lead to both potential bottlenecks and, conversely, innovative regulatory approaches designed to accelerate the transition while safeguarding consumer interests and grid stability. The PUC's willingness to approve innovative, potentially higher-cost, but necessary projects—such as advanced energy storage and significant grid upgrades—will be as critical to meeting the 2045 goal as the technological advancements themselves, highlighting the importance of regulatory foresight and flexibility. The PUC also opened the Energy Equity and Justice Docket (EEJD) in 2022, a proceeding aimed at ensuring fairness and justice in the energy transition, particularly for environmental justice, frontline, and low-income communities.[43]

Other influential bodies contributing to Hawai‘i's energy landscape include the Hawai‘i State Energy Office (HSEO), which provides essential data, analysis, and policy recommendations, and the Hawai‘i Climate Change Mitigation and Adaptation Commission, responsible for recommending overarching greenhouse gas (GHG) reduction targets for the state.

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[42] Hawai‘i State Energy Office. (2023, December). *Hawai‘i Pathways to Decarbonization: Act 238, Session Laws of Hawai‘i 2022* (p. 29) https://energy.hawaii.gov/wp-content/uploads/2024/01/Act 238_HSEO_Decarbonization_Report.pdf

[43] Hawai‘i Public Utilities Commission. (n.d.). *Energy Equity and Justice (Docket 2022-0250)*. Retrieved June 16, 2025, from https://puc.hawaii.gov/dockets/docket-2022-0250-energy-equity-and-justice/

Main Energy Stakeholders:

The energy transition in Hawai‘i involves a diverse array of stakeholders, each playing a crucial role:

- **Hawaiian Electric Company (HECO) and Subsidiaries:** HECO, along with its subsidiaries Maui Electric and Hawai‘i Electric Light, provides electricity to approximately 95% of Hawai‘i's population across O‘ahu, Maui, Lāna‘i, Moloka‘i, and Hawai‘i Island. As the primary utility, HECO's investment strategies, grid modernization plans, and renewable energy procurement efforts are central to the state's energy transformation.
- **Kaua‘i Island Utility Cooperative (KIUC):** KIUC is a unique, member-owned cooperative serving Kaua‘i. It has distinguished itself as a leader in renewable energy integration, achieving high levels of renewable penetration significantly ahead of state targets. KIUC achieved 51% renewable energy for its generation mix in 2024 and has set an ambitious goal to reach 100% renewable energy by 2035, accelerating the state's 2045 timeline by more than a decade.[44] Its cooperative model offers valuable insights into community-centric energy development.
- **Independent Power Producers (IPPs):** IPPs are vital to the state's renewable energy growth, developing and operating large-scale renewable energy projects such as solar farms, wind farms, and geothermal plants. They sell the generated power to utilities under long-term power purchase agreements, contributing significantly to the state's renewable energy supply.
- **Community and Environmental Groups:** These groups are increasingly influential in project siting decisions, land use planning, and advocating for equitable benefits from the energy transition. Their engagement is critical for ensuring that renewable energy development aligns with community values and environmental protection. HSEO and the PUC actively seek community input through various engagement activities, including public webinars and stakeholder discussions, to ensure that decarbonization solutions are implemented in a manner that is "pono" (righteous) and effectively manages the cost of living while improving the quality of life in the islands.[45]

Current Renewable Energy Penetration and Key Technologies:

As of 2024, Hawai‘i’s consolidated Renewable Portfolio Standard (RPS) for electricity generation reached 36%.

The state's renewable energy mix is dominated by several key technologies:

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[44] Kaua‘i Island Utility Cooperative. (2022). *2022 Annual Report* (p. 4). Retrieved from https://kiuc.coop/sites/default/files/documents/annual_reports/2022%20Annual%20Report_web.pdf

[45] Hawai‘i State Energy Office. (2023, December). *Hawai‘i Pathways to Decarbonization: Act 238, Session Laws of Hawai‘i 2022* (p. 4). https://energy.hawaii.gov/wp-content/uploads/2022/10/Act-238_HSEO_Decarbonization_FinalReport_2023.pdf

- **Solar PV:** Both utility-scale solar farms and distributed rooftop solar photovoltaic (PV) systems are leading contributors to Hawai‘i's renewable energy supply, with approximately two-thirds of solar power coming from small-scale, customer-sited systems.[46]
- **Wind Power:** Utility-scale wind farms also make substantial contributions, particularly on islands like O‘ahu and Maui.
- **Geothermal:** Hawai‘i Island is unique in its utilization of geothermal energy. The Puna Geothermal Venture (PGV) provides a crucial source of baseload renewable power, offering a non-intermittent complement to variable solar and wind resources.
- **Biomass and Hydro:** Smaller, but still important, contributions come from sustainable biomass and existing hydroelectric facilities.
- **Energy Storage:** The rapid deployment of utility-scale battery energy storage systems (BESS) is absolutely critical for firming variable renewable generation, providing essential ancillary services, and maintaining overall grid stability. This makes Hawai‘i a leading case study for how to integrate very high levels of variable renewables into constrained grids, setting a precedent for the critical role of energy storage in future decarbonized grids globally.

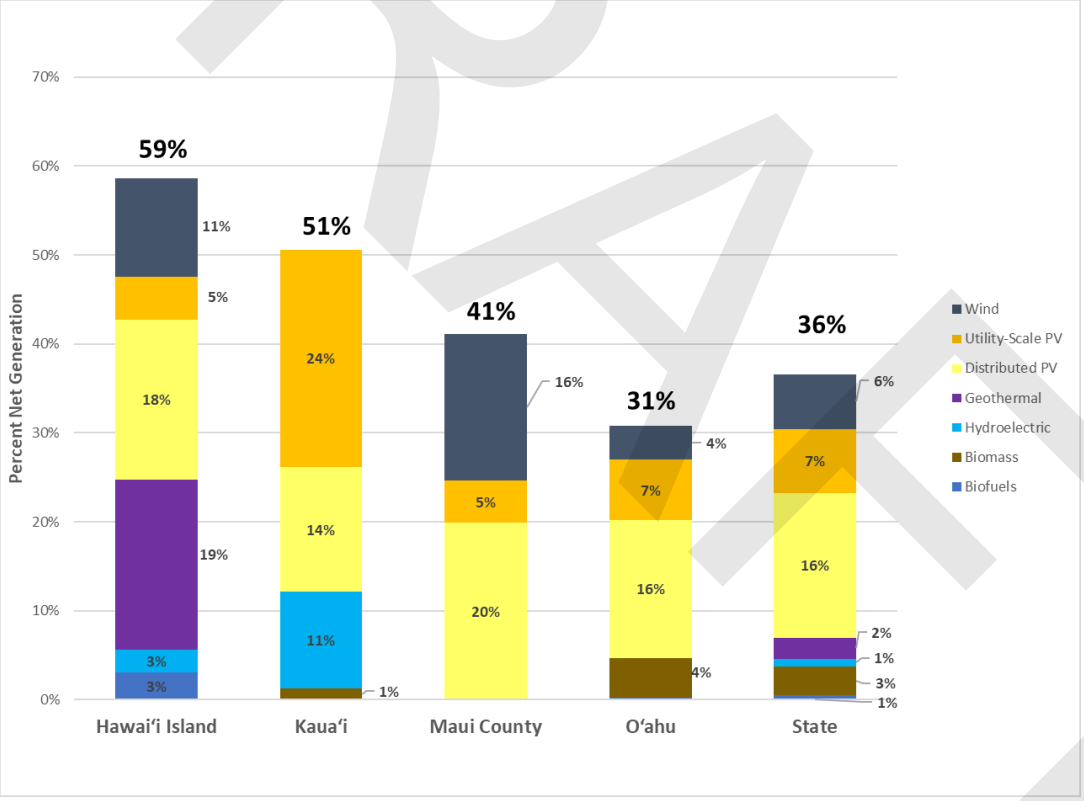

Figure 8: Renewable Portfolio Standards by Energy for 2024, Source PUC Docket 2007-0008, compiled by Hawai‘i State Energy Office

[46] U.S. Energy Information Administration. (n.d.). *Hawai‘i Profile*. Retrieved June 16, 2025, from https://www.eia.gov/state/print.php?sid=HI

5.1.3 Numbers and Targets: Current Status and Future Goals

Despite the significant strides made in renewable energy deployment, fossil fuels continue to constitute a substantial portion of Hawai‘i's electricity generation. In 2022, total GHG emissions in Hawai‘i were 20.32 MMT CO2 Eq., with net emissions (including carbon sinks) at 17.83 MMT CO2 Eq.13,32. The Energy sector accounted for the largest portion of total emissions in Hawai‘i in 2022, at 88.4%. Within the Energy sector, transportation emissions accounted for the largest share (56.3%), followed by stationary combustion (41.4%).[47]

The total electricity generated across Hawai‘i in 2022 was approximately 11,362 GWh.[48] In 2021, about 67.0% of the electricity generated by the electric power industry was from petroleum fuel, a 23.0 percentage point decrease from 1990.[49] This highlights the considerable scale of the remaining transition required to achieve the state's 100% renewable energy goal.

The table 4 below provides a clear, concise snapshot of the state's energy reliance and its direct environmental impact from electricity generation. It establishes the baseline against which all future progress and targets will be measured, which is a key requirement for EPA CPRG reporting. The dominance of fossil fuels and the magnitude of associated emissions underscore the imperative for the energy transition.

Energy Source (Fuel Type)	Electricity Generated (GWh)	Percentage of Total Generation	Associated GHG Emissions (MMT CO2e)
Petroleum	5,662	60.7%	(Included in Total)
Coal	495	5.3%	(Included in Total)
Other Fossil Fuels	0	0.0%	(Included in Total)
Total Fossil Fuels	**6,157**	**66.0%**	**5.8 MMT CO2e (Total Electricity Sector)**
Solar PV	1,770	19.0%	0
Wind	942	10.1%	0
Geothermal	291	3.1%	0
Hydro	103	1.1%	0
Biomass	72	0.8%	0
Other Renewables	0	0.0%	0
Total Renewables	**3,178**	**34.0%**	**0**
Total All Sources	**9,335**	**100.0%**	**5.8 MMT CO2e**

Table 6: Hawai‘i's Current Electricity Generation Mix and Associated GHG Emissions (2021 Data) Note: Data for 2021. Source: Hawai‘i State Energy Office. Percentages may not sum to

[47] Hawai‘i Department of Health. (2025, April). *Hawai‘i Greenhouse Gas Emissions Report for 2022* (pp. 27, 35). https://health.hawaii.gov/cab/files/2025/04/Final-2022-GHG-Emissions-Report.pdf
[48] Hawai‘i State Energy Office. (2023). *Electricity Trends Report 2023* (p. 5, 6). Retrieved from https://files.hawaii.gov/dbedt/economic/data_reports/reports-studies/ElectricityTrendsReport2023.pdf
[49] Ibid.

100% due to rounding. The total electricity generated in 2022 was 11,362 GWh36, with total GHG emissions from the energy sector in 2022 at 17.95 MMT CO2 Eq.

Reduction Targets (2030 and 2045):

Hawai‘i has established a clear and aggressive roadmap for its energy and climate future, marked by specific, legally mandated reduction targets.

Renewable Portfolio Standard (RPS) Targets:

- **2030 Target:** 40% of electricity sales from renewable energy sources.
- **2040 Target:** 70% of electricity sales from renewable energy sources.
- **2045 Target:** 100% of electricity sales from renewable energy sources.

Hawaiian Electric's consolidated RPS reached 32% by 2022, demonstrating consistent progress towards these ambitious goals.[50] The forecasted electricity demand for 2030 is approximately 10,000 GWh, necessitating a significant increase in renewable generation capacity and associated infrastructure to meet the 40% RPS target.

State-Level GHG Emission Reduction Targets (Overall and Energy Sector Contribution):

- **2030 Target:** Reduce statewide GHG emissions by 50% below 2005 levels, established by Act 238 (2022). The electricity generation sector is expected to contribute substantially to this reduction through the rapid deployment of renewables and the systematic phasing out of fossil fuel power plants. The 2005 baseline (including aviation) was 22.78 MMT CO2 Eq., setting the 2030 target level at 11.39 MMT CO2 Eq.13.
- **2045 Target:** Achieve net-negative GHG emissions statewide, established by Act 15 (2018). This highly ambitious long-term goal necessitates a complete decarbonization of the electricity sector and may eventually require the implementation of carbon removal technologies to offset residual emissions from harder-to-abate sectors.[51]

Progress Towards Targets:

While Hawai‘i met its 2020 GHG emissions target (excluding aviation), current projections indicate that the state is not on track to meet the more ambitious 2030 or 2045 statewide emissions targets. Projected 2030 emissions (including aviation) are 33% higher than the target. Similarly,

[50] Hawaiian Electric. (2023, June 17). *Hawaiian Electric achieves 32% renewable energy in 2022*. Retrieved from https://www.hawaiianelectric.com/hawaiian-electric-achieves-32-renewable-energy-in-2022

[51] Hawai‘i Department of Health. (2025, April). *Hawai‘i Greenhouse Gas Emissions Report for 2022* (p. ES-1, ES-3, ES-10, 9, 12). https://health.hawaii.gov/cab/files/2025/04/Final-2022-GHG-Emissions-Report.pdf

projected 2045 emissions (including aviation) indicate that emissions are still greater than sequestration, thus not meeting the net-negative target.[52]

Key Metrics for Tracking Progress:

Progress towards these targets is rigorously tracked using several key metrics:

- Renewable Portfolio Standard (RPS) percentage.
- Gigawatt-hours (GWh) of renewable electricity generated.
- Megawatts (MW) of installed renewable energy capacity (across solar, wind, geothermal, and storage).
- Million Metric Tons of Carbon Dioxide Equivalent (MMT CO2e) from the electricity sector.

5.1.4 Challenges and Innovations

The path to 100% renewable energy is fraught with technical, economic, and social complexities.

- **High Energy Costs:** The historical reliance on imported fossil fuels has resulted in some of the nation's highest electricity prices, more than triple the U.S. average. While this provides a strong economic incentive for renewable energy, it also means that the significant costs associated with grid upgrades and new infrastructure must be meticulously managed to prevent further burdening consumers.
- **Grid Modernization and Integration of High Levels of Variable Renewable Energy:** Integrating large quantities of intermittent solar and wind power into small, isolated island grids presents formidable technical challenges. These include maintaining grid stability (frequency and voltage), managing rapid fluctuations in generation (known as "ramps"), and ensuring continuous reliability during periods of low renewable output or high demand. The existing transmission and distribution infrastructure, originally designed for centralized fossil fuel generation, is not inherently suited for a high penetration of distributed and variable renewable sources. This necessitates substantial upgrades and the widespread implementation of smart grid technologies to enhance grid visibility, control, and responsiveness. The increasing unavailability of Hawaiian Electric's firm generators due to unplanned outages, with approximately 20% of the fleet recently offline or operating at derated capacity, further highlights the urgent need for grid modernization and replacement capacity.[53]
- **Energy Storage Requirements and Deployment Challenges:** Energy storage, primarily in the form of large-scale battery systems, is indispensable for firming variable renewable energy, providing essential ancillary services (like frequency regulation), and shifting renewable energy generation to align with periods of peak demand. However, the

[52] Ibid.
[53] Hawai‘i State Energy Office. (2025, January). *Alternative Fuel, Repowering, and Energy Transition Study* (p. 6, Figure 4). https://energy.hawaii.gov/wp-content/uploads/2025/01/HSEO-Alternative-Fuels-Study-Final-Report.pdf

deployment of these critical systems faces hurdles, including the high capital costs associated with battery technology, global supply chain constraints that can impact availability and pricing, and the complex siting and permitting processes required for large-scale facilities.

- **Land Use, Permitting, and Community Acceptance Issues:** Siting new utility-scale renewable energy projects, such as solar farms and wind farms, is a major challenge in Hawai‘i due to the state's limited land area and the competing demands for agricultural, conservation, and culturally significant lands. Strong community opposition can arise due to concerns about visual impacts, noise pollution, or perceived threats to cultural sites. The persistent challenge of securing community acceptance and navigating complex land use regulations indicates that technological solutions alone are insufficient for Hawai‘i's energy transition. The social license to operate is as critical as technical feasibility. This suggests that future project development will increasingly require innovative community engagement models, equitable benefit-sharing schemes, and potentially a strategic shift towards less land-intensive or offshore solutions to mitigate land-use conflicts. The regulatory and permitting process, involving a mix of state and county jurisdiction, has been identified as a significant barrier to completing projects in a timely manner, potentially impacting fossil fuel retirement timelines.[54]

Despite the challenges, Hawai‘i is at the forefront of developing and deploying innovative solutions to accelerate its clean energy transition.

- **Abundant Renewable Resources:** Hawai‘i is endowed with exceptional solar insolation and strong, consistent wind patterns. Hawai‘i also possesses significant geothermal potential. Furthermore, studies indicate substantial offshore wind potential, particularly off O‘ahu, offering a long-term, high-capacity solution that could alleviate onshore land-use pressures.[55]
- **Innovation Catalyst:** The formidable challenges inherent in managing isolated island grids compel Hawai‘i to innovate in critical areas such as grid modernization, advanced energy storage, and microgrid development. This necessity effectively positions the state as a living laboratory and a global leader in developing and deploying advanced energy solutions. This generates invaluable expertise and practical solutions that can be exported or replicated in other isolated or vulnerable energy systems worldwide, making Hawai‘i a key contributor to the global energy transition.
- **Advanced Grid Technologies (Smart Grids, Microgrids):** Hawai‘i is making significant investments in smart grid technologies to enhance grid visibility, control, and resilience. This includes the deployment of advanced metering infrastructure, sophisticated distribution automation systems, and intelligent grid management platforms. Concurrently, microgrids are being developed for critical facilities and communities, offering localized

[54] Hawai‘i State Energy Office. (2023, December). *Hawai‘i Pathways to Decarbonization: Act 238, Session Laws of Hawai‘i 2022* (p. 10). https://energy.hawaii.gov/wp-content/uploads/2024/01/Act238_HSEO_Decarbonization_Report.pdf

[55] National Renewable Energy Laboratory. (n.d.). *Economic Impacts of Floating Offshore Wind in Hawai‘i* (p. ES-1). Retrieved from https://docs.nrel.gov/docs/fy16osti/65481.pdf

energy resilience and the ability to operate independently during broader grid outages, thereby enhancing overall reliability.[56]

- **Utility-Scale Battery Storage Projects:** These projects are crucial for integrating variable renewables, providing grid stability, and enabling the retirement of fossil fuel power plants. Notable examples include:
    - **Kapolei Energy Storage (KES):** A substantial 185 MW/565 MWh battery system on O‘ahu, which is among the largest in the world and designed to provide critical firming capacity and essential grid services.[57]
    - AES West O‘ahu: A 12.5 MW/50 MWh solar-plus-storage project in Kapolei, O‘ahu.

The rapid deployment of these cutting-edge, utility-scale battery storage solutions is not merely an innovation; it represents a strategic necessity that defines Hawai‘i's approach to grid decarbonization. This signifies a fundamental shift from a mindset of simply "building more renewables" to one focused on "building a resilient, dispatchable renewable grid." This approach acknowledges that energy storage is the lynchpin for achieving 100% RPS on isolated grids without compromising reliability. This heavy investment in storage, alongside renewable generation, indicates a clear understanding that achieving 100% renewables on isolated grids requires robust firming capacity and grid stability that only advanced storage uniquely provides. This strategic prioritization of storage demonstrates Hawai‘i's pragmatic approach to its ambitious goals, recognizing that simply adding more solar and wind could destabilize the grid. Instead, dispatchable, reliable power enabled by storage is essential. This makes Hawai‘i a leading case study for how to integrate very high levels of variable renewables into constrained grids, setting a precedent for the critical role of energy storage in future decarbonized grids globally.

- **Development of Diverse Renewable Energy Sources:** While solar and wind are dominant, Hawai‘i is actively exploring and leveraging other indigenous resources:
    - **Geothermal Expansion:** Hawai‘i Island continues to utilize the Puna Geothermal Venture (PGV) for baseload renewable power, offering a stable, non-intermittent renewable source that complements variable renewables.[58]
- **Alternative Fuels as Bridging Solutions:** Recognizing the need for firm, dispatchable generation during the transition, Hawai‘i is evaluating alternative fuels. Liquefied Natural Gas (LNG) is being considered as a near-term bridging solution to replace high-carbon LSFO, with the flexibility to transition to lower-carbon, fossil-free alternatives like hydrogen and ammonia in the long term (post-2045).[59] This approach aims to reduce

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[56] Hawai‘i State Energy Office. (2023, December). *Hawai‘i Pathways to Decarbonization: Act 238, Session Laws of Hawai‘i 2022* (p. 4, 9, A-2). https://energy.hawaii.gov/wp-content/uploads/2024/01/Act238_HSEO_Decarbonization_Report.pdf

[57] AES Hawai‘i. (n.d.). *Hawai‘i Projects*. Retrieved June 16, 2025, from https://www.aes-hawaii.com/hawaii

[58] Hawai‘i State Energy Office. (2025, January). *Alternative Fuel, Repowering, and Energy Transition Study* (p. 29). https://energy.hawaii.gov/wp-content/uploads/2025/01/HSEO-Alternative-Fuels-Study-Final-Report.pdf

[59] Ibid, p14

lifecycle carbon intensity, with LNG offering a 38% to 44% reduction compared to LSFO when used in more efficient power plants, while hydrogen offers a significantly lower carbon intensity (40 gCO2e/kWh) compared to LNG (630 gCO2e/kWh) or biodiesel (200-410 gCO2e/kWh)4,39. This strategy minimizes stranded asset risks by incorporating dual-fuel infrastructure that can adapt to technological and economic advancements.[60]

- **Demand-Side Management and Grid Services from Distributed Energy Resources (DERs):**Programs are being developed to harness the collective potential of distributed energy resources, including rooftop solar, electric vehicles, and smart appliances. These resources can provide valuable grid services, enable load shifting, and enhance overall grid flexibility. This includes the development of virtual power plants (VPPs) that aggregate and manage numerous DERs to act as a single, dispatchable resource.
- **Permitting Streamlining and Regulatory Improvements:** To accelerate project timelines, policy recommendations include prioritizing brownfield development and infrastructure reuse, implementing permit assistance programs, and assigning dedicated staff at state and county agencies to focus exclusively on energy development permits. This aims to streamline processes without bypassing necessary regulatory reviews or safeguards, while ensuring thorough environmental impact evaluation and public participation through processes like the National Environmental Policy Act (NEPA) and Hawai‘i Environmental Policy Act (HEPA).[61]
- **Research and Development Initiatives:** Ongoing research and development efforts are focused on optimizing renewable energy integration, improving the efficiency and cost-effectiveness of energy storage technologies, and exploring novel clean energy solutions specifically tailored to the unique conditions of island environments.

5.1.5 County-Level Variations and Actions

While the State of Hawai‘i sets overarching Renewable Portfolio Standard (RPS) and greenhouse gas (GHG) reduction targets, the implementation and progress of the energy transition vary significantly across Hawai‘i's four main counties City & County of Honolulu (O‘ahu), Maui County (Maui, Moloka‘i, Lāna‘i), Hawai‘i County (Hawai‘i Island), and Kaua‘i County (Kaua‘i). Each county—possesses distinct energy profiles, resource availability, land-use dynamics, and local initiatives.

Counties climate action plans and sustainability goals complement, and, in some cases, exceed state mandates. These localized efforts are crucial for implementing projects on the ground, addressing community-specific needs, and navigating unique local concerns. The Hawai‘i State Energy Office's RPS progress report provides island-specific data, illustrating the varied pace and composition of renewable energy adoption across the archipelago. This decentralized approach allows for tailored solutions that best fit each island's unique context. In 2022, Honolulu City and County accounted for the largest share of net GHG emissions (71.3%), followed by Maui County

[60] Ibid, p. 53
[61] Ibid, p. 74

(15.3%), Hawai‘i County (8.6%), and Kaua‘i County (4.8%).[62] The majority of emissions in all four counties were generated within the energy sector.

The distinct characteristics and progress of each county highlight the diverse pathways to achieving Hawai‘i's statewide renewable energy goals.

- **O‘ahu (City & County of Honolulu):**
  - As the most populous island, O‘ahu accounts for the largest share of the state's energy demand and has historically been the primary consumer of fossil fuels for electricity generation. Consequently, it is the focus of major utility-scale solar and battery storage projects, such as Kapolei Energy Storage (KES) and AES West O‘ahu, specifically designed to replace large fossil fuel power plants.
  - O‘ahu's energy transition strategy heavily relies on these large-scale utility projects and significant grid modernization efforts to meet its substantial demand and overcome limited land availability for widespread distributed generation.
  - In 2022, O‘ahu's RPS progress (for Hawaiian Electric) stood at 28%.[63]
  - The City & County of Honolulu has its own Climate Action Plan, which includes goals for reducing emissions and promoting clean energy.[64]
- **Maui County (Maui, Moloka‘i, Lāna‘i):**
  - Maui has experienced significant utility-scale solar and wind development. A key challenge for Maui County involves effectively managing grid stability with high renewable penetration across its smaller, interconnected island grids.
  - Maui County has also been proactive in developing local climate action plans and actively promoting community-based renewable energy projects, fostering greater local participation.
  - Maui County's RPS progress (for Hawaiian Electric) was 36% in 20223.
- **Hawai‘i Island (Hawai‘i County):**
  - Hawai‘i Island is unique for its utilization of baseload geothermal power from the Puna Geothermal Venture (PGV). This facility provides a stable, non-intermittent renewable energy source, diversifying the island's energy mix beyond variable solar and wind.[65]
  - The island faces specific challenges related to managing volcanic activity, which can impact energy infrastructure, and ensuring community acceptance for any potential expansion of geothermal operations.

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[62] Hawai‘i Department of Health. (2025, April). *Hawai‘i Greenhouse Gas Emissions Report for 2022* (p. ES-7). https://health.hawaii.gov/cab/files/2025/04/Final-2022-GHG-Emissions-Report.pdf

[63] Hawaiian Electric. (2023, June 17). *Hawaiian Electric achieves 32% renewable energy in 2022*. Retrieved from https://www.hawaiianelectric.com/hawaiian-electric-achieves-32-renewable-energy-in-2022

[64] City and County of Honolulu Office of Climate Change, Sustainability and Resiliency. (n.d.). *O‘ahu Climate Action Plan*. Retrieved June 16, 2025, from https://resilientoahu.org/s/Climate-Action-Plan.pdf

[65] Hawai‘i State Energy Office. (2025, January). *Alternative Fuel, Repowering, and Energy Transition Study* (p. 29). https://energy.hawaii.gov/wp-content/uploads/2025/01/HSEO-Alternative-Fuels-Study-Final-Report.pdf

- Hawai‘i Island demonstrated an RPS progress (for Hawaiian Electric) of 48% in 2022.

- **Kaua‘i (Kaua‘i County):**
  - The Kaua‘i Island Utility Cooperative (KIUC) stands out as a national and international leader in renewable energy integration. KIUC achieved an impressive 60.2% renewable energy for its generation mix in 2022, primarily through innovative solar-plus-storage projects.[66]
  - KIUC's member-owned cooperative model facilitates direct community engagement and enables innovative project financing, serving as a potential blueprint for other isolated island grids globally.
  - KIUC's Board of Directors updated its Strategic Plan to reach 100% renewable energy by 2033, accelerating the state's 2045 timeline by more than a decade.[67]

5.1.6 Measure Description and GHG reduction

Hawai’i State Energy Office (HSEO) has modeled various energy generation scenarios that can meet the current and projected demand for electricity and liquid fuel source energies. A mixture of sources will be required in the coming years to meet growing energy demand across the state. Under a conservatively ambitious renewable energy implementation scenario, several energy technologies can be implemented across the islands to reduce fossil fuel use in electricity production, as summarized in the following tables.

GWh	Hawai’i				Maui			
Source	**2030**	**2035**	**2040**	**2045**	**2030**	**2035**	**2040**	**2045**
Biodiesel	0	0	0	81	0	0	0	190
Biomass	0	0	0	0	0	0	0	0
Distributed solar PV	295.0	336.0	371.0	397.0	342.0	386.0	475.0	683.0
Fossil fuel	15.0	74.0	158.0	0	83.0	165.0	235.0	0
Geothermal	248.0	267.0	275.0	566.0	0	0	0	0
Hydro (run-of-river)	47.0	47.0	47.0	47.0	0	0	0	0
Natural gas	0	0	0	0	0	0	0	0
Onshore wind	106.0	351.0	552.0	542.0	221.0	274.0	426.0	557.0
Utility solar PV	576.0	579.0	614.0	659.0	666.0	741.0	721.0	724.0
Waste incineration to energy	0	0	0	0	0	0	0	0
Total	**1287.0**	**1654.0**	**2017.0**	**2292.0**	**1312.0**	**1566.0**	**1857.0**	**2154.0**

[66] Kaua‘i Island Utility Cooperative. (2022). *2022 Annual Report* (p. 4). Retrieved from https://kiuc.coop/sites/default/files/documents/annual_reports/2022%20Annual%20Report_web.pdf)
[67] Ibid.

Table 7: Modeled electricity generation for Hawai'i and Maui lslands between 2030 and 2045.

Hawai'i Island sees powerplant biodiesel use arrive in 2045 to replace remaining fossil fuel use. Distributed and powerplant solar PV steady increase over the time period. Geothermal energy more than doubles from expected 2030 levels and onshore wind increases five-fold.

Maui Island sees increases in distributed and utility solar PV generation, as well as a large increase in onshore wind power. Biodiesel replaces the remaining fossil fuel generation by 2045.

GWh	O'ahu					Kaua'i		
Source	2030	2035	2040	2045	2030	2035	2040	2045
Biodiesel	0	0	0	0	0	0	0	2.41
Biomass	0	0	0	0	3.40	3.27	3.41	2.45
Distributed solar PV	1,829.2	2,743.3	3,124.2	3,087.6	7.89	8.88	9.59	9.94
Fossil fuel	2,242.1	69.6	96.6	60.1	2.50	2.76	3.42	0
Geothermal	0	0	0	0	0	0	0	0
Hydro (run-of-river)	0	0	0	0	6.44	6.46	6.47	6.35
Natural gas	367.9	1692.8	2215.3	3165.7	0	0	0	0
Onshore wind	1036.2	1305.7	1346.7	1248.5	0	0	0	0
Utility solar PV	1394.7	2263.9	3225.3	3881.6	40.17	43.46	47.94	55.7
Waste incineration to energy	582.1	582.1	582.1	583.7	0	0	0	0
Total	**7452.2**	**8657.4**	**10,590.2**	**12,027.2**	**60.4**	**64.8**	**70.8**	**76.9**

Table 8: Modeled electricity generation for Kaua'i and Maui lslands between 2030 and 2045.

O'ahu Island has large, continued energy use growth that is not met by renewables alone under this scenario. Despite added solar and wind capacity, natural gas use grows even as other fossil fuel generation is phased out.

Kaua'i Island's biomass and fossil fuel generation decrease under this scenario, replaced with solar PV over the years and biodiesel in 2045.

GWh	Lana'i					Molokai		
Source	2030	2035	2040	2045	2030	2035	2040	2045
Biodiesel	0	0	0	0.14	0	0	0	0.11
Biomass	0	0	0	0	0	0	0	0
Distributed solar PV	0.22	0.27	0.3	0.33	0.76	0.85	0.91	1.12
Fossil fuel	0.14	0.15	0.16	0	0.32	0.31	0.3	0
Geothermal	0	0	0	0	0	0	0	0

Hydro (run-of-river)	0	0	0	0		0	0	0	0
Natural gas	0	0	0	0		0	0	0	0
Onshore wind	0	0	0	0		0	0	0	0
Utility solar PV	3.43	3.57	3.82	4.06		3.07	3.43	3.97	4.49
Waste incineration to energy	0	0	0	0		0	0	0	0
Total	**3.8**	**4.0**	**4.3**	**4.5**		**4.2**	**4.6**	**5.2**	**5.7**

Table 9: Modeled electricity generation for Lana'i and Molokai lslands between 2030 and 2045.

Lana'i Island's existing fossil fuel generation is ramped down by 2045, replaced by solar PV. Biodiesel replaces any remaining fossil fuel use in 2045.

Molokai Island's fossil fuel electricity generation is also replaced with solar PV, as well as biodiesel in 2045.

	Total energy by source (GWh)			
Source	**2030**	**2035**	**2040**	**2045**
Biodiesel	0	0	0	273.66
Biomass	3.4	3.27	3.41	2.45
Distributed solar PV	2475.1	3475.3	3981.0	4179.0
Fossil fuel	2343.1	311.8	493.5	60.1
Geothermal	248.0	267.0	275.0	566.0
Hydro (run-of-river)	53.4	53.5	53.5	53.4
Natural gas	367.9	1692.8	2215.3	3165.7
Onshore wind	1363.2	1930.7	2324.7	2347.5
Utility solar PV	2683.4	3634.4	4616.0	5328.9
Waste incineration to energy	582.1	582.1	582.1	583.7
Total	**10,120**	**11,951**	**14,544**	**16,560**

Table 10: Total energy generation by fuel type and year for all of Hawai'i state.

Each electricity generating power plant that uses fossil fuels has a different emission factor (the amount of GHG emissions produced per gallon of fuel used). The table below summarizes the emission factors for each electricity generation type on each island.

Emission Factors (MT CO2e/GWh) (from DLNR and eGRID)						
Source	**Hawai'i**	**Maui**	**O'ahu**	**Kaua'i**	**Lanai**	**Molokai**
Biodiesel	213	213	213	213	213	213

Biomass			40	40		
Distributed solar PV	0	0	0	0	0	0
Fossil fuel	865	764	766	744	764	764
Geothermal	0	0	0	0	0	0
Hydro (run-of-river)	0	0	0	0	0	0
Natural gas			466			
Onshore wind	0	0	0	0	0	0
Utility solar PV	0	0	0	0	0	0
Waste incineration to energy			1046			

Table 11: Emissions factors for each electricity generation type, by island.

The following table and chart summarize the state's total emissions by fuel type for the modeled conservative renewable energy adoption scenario versus for a scenario under which all new energy generation is supplied by fossil fuel (diesel) generation. This demonstrates the emissions reductions achievable under the conservative renewable energy adoption approach.

	Conservative Renewable Energy Adoption Scenario Total emissions by source (MM TCO2e)				**All Post-2030 New Generation Provided by Diesel Scenario Total emissions by source (MM TCO2e)**			
Source	**2030**	**2035**	**2040**	**2045**	**2030**	**2035**	**2040**	**2045**
Biodiesel	0	0	0	0.058	0	0	0	0
Biomass	0	0	0	0	0.00014	0.00014	0.00014	0.00014
Distributed solar PV	0	0	0	0	0	0	0	0
Fossil fuel	1.796	0.246	0.393	0.046	1.796	2.220	1.868	1.236
Geothermal	0	0	0	0	0	0	0	0
Hydro (run-of-river)	0	0	0	0	0	0	0	0
Natural gas	0.171	0.789	1.032	1.475	0.171	0.789	1.032	1.475
Onshore wind	0	0	0	0	0	0	0	0
Utility solar PV	0	0	0	0	0	0	0	0

Waste incineration to energy	0.609	0.609	0.609	0.611	0.609	0.609	0.609	0.609
Total	**2.58**	**1.64**	**2.03**	**2.19**	**2.58**	**3.62**	**3.51**	**3.32**

Table 12: Comparison of emissions between a conservative renewable energy adoption scenario and a scenario in which all post-2030 new electricity generation is supplied by diesel.

The total, cumulative, year-over-year avoided emissions of the conservative renewable energy adoption scenario is 20.6 MM TCO2e.

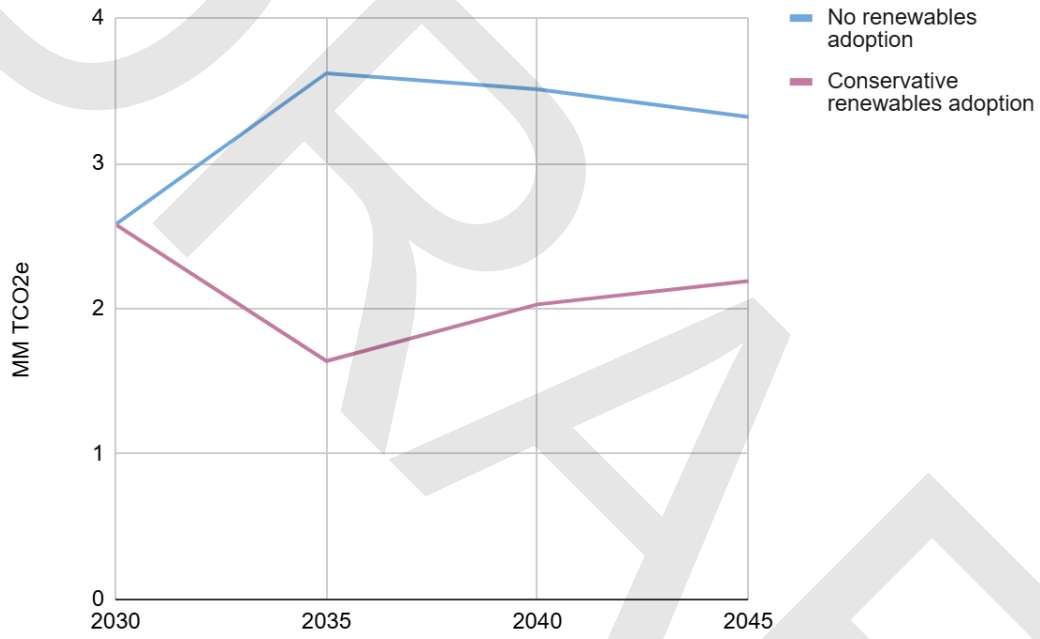

Figure 9: Comparison of emissions between a conservative renewable energy adoption scenario and a scenario in which all post-2030 new electricity generation is supplied by diesel.

5.1.7 Key implementing agency (or agencies)

The renewable energy adoption and other fuel use changes in powerplants will be led by Hawaiian Electric and KIUC, overseen by the PUC. HSEO provides technical and policy assistance. Permitting agencies include the counties, Land Use Commission, State Historic Preservation Department, and DLNR.

5.1.8 Implementation schedule and milestones and Metrics for tracking progress

RENEWABLE ENERGY		
Action	**Schedule**	**Metrics**
Increase renewable energy generation to replace fossil fuel electricity generation	5,925 GWh of generation is added: 1,831 GWh between 2030 and 2035, 2,594 GWh between 2036 and 2040, 2,016 GWh between 2041 and 2045.	Annual increase in GWh of electricity generation output by energy source type.
Permitting improvements to meet renewable portfolio standard (RPS) timelines		Permitting improvements to meet RPS timelines, facilitate community benefits, and explore dispute resolution outside of court.
Efficiency improvements to power plants that use fossil fuels		Efficiency improvements to power plants that use fossil fuels to ensure that power plant replacements significantly reduce energy waste, which will save fuel cost and emissions.

Table 13: Energy Sector Measures Implementation Schedule and Milestones.

5.1.9 Cost estimates for implementation

Calculations for this cost are in the process of being calculated.

5.1.10 Funding source

Hawai‘i’s Climate Action Plan (CAP) outlines major projects across sectors that depend on sustained federal support and supplemental funding sources:

- DOE Energy Efficiency and Conservation Block Grants
- EPA Greenhouse Gas Reduction Fund
- FEMA Building Resilient Infrastructure and Communities (BRIC)

5.2 Buildings and Energy Efficiency

5.2.1 Overview:

Energy efficiency and conservation are the single most important and most cost-effective measure to meaningfully reduce electricity demand.[68] Hawai‘i's unique geographic and economic context makes energy efficiency in its buildings sector a critical component of its broader climate action and decarbonization strategy. The state faces the highest average electricity prices in the nation, more than triple the U.S. average, primarily due to its heavy reliance on imported petroleum, which accounts for approximately 80% of its total energy consumption, the highest share for any state.[69],[70],[71] This dependence creates significant energy security vulnerabilities and economic burdens for residents and businesses alike. Despite having the third-lowest total energy consumption per capita among U.S. states, particularly in the residential sector due to the mild climate minimizing heating needs, higher temperatures are increasing adoption of air conditioning often in homes not built with insulation to keep the cold air in. The imperative for energy efficiency remains paramount to reduce costs, enhance resilience, and meet ambitious climate goals.[72]

The buildings sector is a major energy consumer and contributor to greenhouse gas (GHG) emissions across the islands. The building sector's electricity consumption contributes to approximately one-third of O‘ahu's total GHG emissions originating from electricity generation.[73] Energy efficient buildings are crucial for minimizing the need for new energy generation infrastructure and reducing emissions associated with electricity generation, thereby serving as a foundational element in the state's decarbonization efforts.[74] Hawai'i has a long-standing commitment to clean energy, launching the Hawai'i Clean Energy Initiative (HCEI) in 2008 in partnership with the U.S. Department of Energy to reduce dependence on imported fossil fuels. This initiative set a foundational goal of meeting 70% of the state's energy needs through

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[68] Hawai‘i State Energy Office. (2023, December). *Hawai‘i Pathways to Decarbonization: Act 238, Session Laws of Hawai‘i 2022* (p. 10). https://energy.hawaii.gov/wp-content/uploads/2024/01/Act238_HSEO_Decarbonization_Report.pdf

[69] U.S. Energy Information Administration. *Hawai‘i Profile*. Accessed June 7, 2025. https://www.eia.gov/state/print.php?sid=HI

[70] EBSCO. *Hawaii's Energy Consumption*. Accessed June 7, 2025. https://www.ebsco.com/research-starters/power-and-energy/hawaiis-energy-consumption

[71] Department of Business, Economic Development & Tourism. *Energy Data Report 2023*. State of Hawai'i, 2023, p.4. https://files.hawaii.gov/dbedt/economic/data_reports/reports-studies/Energy_Data_Report_2023.pdf

[72] US Energy Information Administration, Rankings: Energy Consumed per Capita, 2022, Accessed June 7, 2025 https://www.eia.gov/state/rankings/

[73] City and County of Honolulu, Office of Climate Change, Sustainability and Resiliency. *Honolulu Better Buildings Benchmarking Program*. Accessed June 7, 2025. https://www.resilientoahu.org/benchmarking

[74] Hawai‘i Public Utilities Commission. *Hawai‘i's Renewable Energy and Energy Efficiency Policies*. Accessed June 7, 2025. https://puc.hawaii.gov/energy/hawaiis-renewable-energy-and-energy-efficiency-policies/

renewable energy (40%) and energy efficiency (30%) by 2030.[75] The significant reliance on imported petroleum and the resulting highest electricity prices underscore that energy efficiency is not merely an environmental objective but a critical energy security and economic affordability imperative for Hawai'i. This fundamental understanding means that energy efficiency efforts are aimed at stabilizing the economy, improving residents' quality of life, and enhancing the state's self-sufficiency and resilience against external energy shocks.

5.2.2 Key Features

Hawai'i's approach to building energy efficiency is anchored in a progressive regulatory framework and a commitment to continuous improvement. The state has systematically updated its building energy codes to align with national standards while incorporating local adaptations, recognizing that robust codes are the most cost-effective means of reducing energy use in new construction and major renovations.[76]

The Hawai'i State Building Code Council (SBCC) adopted the 2018 International Energy Conservation Code (IECC) with amendments in December 2020. As of 2024, all four counties—Honolulu, Hawai'i, Maui, and Kauai—have adopted and enforce the 2018 IECC, some with additional county-specific amendments. This ensures a consistent, yet adaptable, statewide standard for new construction. This represents a significant advancement from previous codes, such as the 2015 IECC (which counties adopted with their own amendments) and the pre-2015 codes that had limited residential requirements and older commercial standards. The systematic adoption of newer IECC versions and the forward-looking goal for zero net energy (ZNE) codes by 2030 demonstrate a clear, progressive policy trajectory. The fact that all four counties have adopted the 2018 IECC, even with county-specific amendments, indicates a pragmatic balance between statewide ambition and local flexibility, which is crucial for effective implementation across diverse island contexts. This distributed implementation model can lead to greater buy-in and more effective enforcement, providing a strong regulatory backbone for achieving energy efficiency targets and signaling to developers and industry that Hawai'i is serious about long-term decarbonization in the built environment.

While codes primarily address new construction, Hawai'i recognizes the critical need to improve the efficiency of its existing building stock. The state has joined the National Building Performance Standard (BPS) Coalition, committing to initiate state building retrofits and advance legislation or regulation by April 2026 to improve building standards for large commercial buildings.[77] The goal is for the International Codes Council (ICC) to adopt zero net energy (ZNE) codes by 2030, which Hawai'i aims to integrate. ZNE buildings minimize energy use and produce an equivalent amount

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[75] Hawai‘i State Energy Office. *Hawai‘i Clean Energy Initiative*. Accessed June 7, 2025. https://energy.hawaii.gov/hawaii-clean-energy-initiative/

[76] Hawai‘i State Energy Office. *Hawai‘i Building Energy Code*. Accessed June 7, 2025. https://energy.hawaii.gov/hawaii-building-energy-code/

[77] Hawai‘i State Energy Office. *Governor Josh Green, M.D. Joins National Building Standards Coalition to Improve Buildings and Lower Energy Costs*. Accessed June 7, 2025. https://energy.hawaii.gov/governor-josh-green-m-d-joins-national-building-standardscoalition-to-improve-buildings-and-lower-energy-costs/

of energy on-site or off-site, typically through solar and wind. HSEO provides extensive training and resources to help professionals comply with current energy codes, including webinars and educational modules, further supporting collaborative implementation efforts involving the SBCC, county Corporation Councils, County Council hearings, and local enforcement agencies.

5.2.3 Numbers and Targets: Current Status and Future Goals

The building sector on O‘ahu alone accounts for approximately one-third of the island's total greenhouse gas emissions.[78] Analysis of commercial building energy use indicates that buildings over 50,000 square feet, which constitute only 25% of commercial buildings, account for a disproportionately high 79% of energy use and 78% of emissions in this sector.[79] Within this segment, lodging buildings alone consume 49% of the energy used by commercial buildings over 50,000 square feet. This disproportionate impact means that policy interventions focused on a smaller subset of buildings, specifically the large ones, can yield substantial results in terms of overall energy savings and GHG reductions, allowing for a more efficient allocation of resources and policy development.

Hawai'i has set ambitious reduction targets to address these energy consumption and emission levels:

- **Energy Efficiency Portfolio Standard (EEPS):** Established by Act 155 (2009), the statewide EEPS goal was 4,300 GWh of electricity savings by 2030 relative to a 2008 baseline, a goal the state is currently on track to meet.[80] Act 272 (2025) establishes a new target: 6,000 GWh of cumulative persisting electricity savings statewide by 2045.[81] This extension and increase in the EEPS goal underscore Hawai'i's long-term commitment to energy efficiency as the most cost-effective way to reduce emissions and provide financial benefits to customers. This increased target reflects a more aggressive, yet realistic, long-term commitment to energy savings, highlighting a strong economic rationale that is crucial for sustained investment and public support.
- **O‘ahu Specific Target:** The Honolulu Better Buildings Benchmarking Program aims to reduce the electricity consumption of large buildings by nearly 7% by 2030.[82]

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[78] City and County of Honolulu, Office of Climate Change, Sustainability and Resiliency. *Honolulu Better Buildings Benchmarking Program*. Accessed June 7, 2025. https://www.resilientoahu.org/benchmarking

[79] National Renewable Energy Laboratory. *Commercial and Multifamily Building Energy and Emissions Data for Hawai‘i*. NREL/TP-7A40-86787, 2023, p. 4. https://docs.nrel.gov/docs/fy23osti/86787.pdf

[80] Hawai‘i Public Utilities Commission. *Hawai‘i's Renewable Energy and Energy Efficiency Policies*. Accessed June 7, 2025. https://puc.hawaii.gov/energy/hawaiis-renewable-energy-and-energy-efficiency-policies/

[81] Ibid.

[82] City and County of Honolulu, Office of Climate Change, Sustainability and Resiliency. *Honolulu Better Buildings Benchmarking Program*. Accessed June 7, 2025. https://www.resilientoahu.org/benchmarking

5.2.4 Challenges and Innovations

While Hawai'i demonstrates strong commitment to building energy efficiency, the sector faces unique challenges, particularly its geographic isolation, high material costs, and the need to address its diverse existing building stock. The state's electricity prices are the highest in the nation, making energy efficiency investments critical but higher material costs also can be more costly upfront.[83] While new construction is covered by codes, retrofitting the diverse aging existing building stock, especially large commercial ones, presents a significant challenge due to scale, cost, and varied ownership structures.

In response to these challenges, the state is implementing innovative policies and programs focusing on smart energy management, leveraging federal partnerships, and leading by example. Hawai‘i joined the National Building Performance Standard (BPS) Coalition in April 2025, a collaboration aimed at improving building standards for large commercial buildings, which account for 78% of the state's commercial building emissions. This engagement with the National BPS Coalition and the focus on "net zero"-ready codes and advanced demand-side management indicates a move beyond basic energy savings to a more holistic, integrated approach to building decarbonization. This includes not only reducing consumption but also enabling grid flexibility and resilience. This multi-pronged strategy demonstrates Hawai'i's sophisticated understanding that achieving deep decarbonization in the built environment requires a combination of regulatory updates for new construction, aggressive retrofits for existing buildings, and intelligent grid integration to manage renewable energy variability.

Future IECC measures in Hawai‘i aim to integrate ZNE codes by 2030, which focus on minimizing energy use and producing equivalent energy on-site. This also seeks to reduce "code fatigue" among developers. The state is actively exploring and implementing advanced demand-side management programs, such as demand response programs where customers voluntarily curtail power during supply shortages in exchange for lower utility prices, and time-of-use pricing, which encourages energy use when supply is plentiful. "Demand Response II," where PV batteries or electric vehicles (EVs) can also support demand management.[84]

Hawai‘i is leading by example with projects like the Pearl City Public Library Renovation and Expansion, designed to meet LEED Silver equivalent standards and generate at least 80% of its operating energy from an integrated PV system. HSEO also conducts high-level energy audits and multi-part energy strategies for small and medium-sized state agencies, demonstrating feasibility, building institutional knowledge, and serving as models for the private sector, thereby reducing perceived risk and encouraging broader adoption.

The implementation of benchmarking programs and state-led retrofit projects highlights a commitment to data-driven policy-making and leading by example. Benchmarking provides

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[83] U.S. Energy Information Administration. *Hawai‘i Profile*. Accessed June 7, 2025. https://www.eia.gov/state/print.php?sid=HI

[84] Hawai‘i State Energy Office. *Hawai‘i Building Energy Code*. Accessed June 7, 2025. https://energy.hawaii.gov/hawaii-building-energy-code/

crucial data on actual building performance, enabling targeted interventions and tracking progress, moving beyond theoretical savings to measurable outcomes.

5.2.5 County-Level Variations and Actions

While Hawai‘i sets statewide energy efficiency goals, the implementation and specific programming often occur at the county level, allowing for tailored approaches that address local needs, climate conditions, and community priorities. This decentralized yet coordinated effort is a hallmark of Hawai‘i's climate action strategy.

Each county has developed or participates in distinct initiatives:

- **Honolulu County:** The Better Buildings Benchmarking Program mandates annual reporting of electricity, gas, and water usage for large commercial and multi-family buildings over 25,000 sq ft, with a target to reduce electricity consumption by nearly 7% by 2030. Municipal buildings over 10,000 sq ft are also benchmarked. The City and County of Honolulu's Rehabilitation Loan Program offers low-interest loans to income-eligible homeowners for property repairs, including those that make rooftops solar-ready, and for installing solar water heating and solar PV systems.[85] O‘ahu's Climate Action Plan (CAP) aims for carbon neutrality by 2045, with strategies to expand energy efficiency and renewable energy infrastructure in the electricity sector.[86]
- **Maui County:** Hawaiian Electric, in partnership with the County of Maui, offers interest-free financing for solar water heaters, which can be combined with state rebates and tax credits. This program is open to all residents with a good payment history.[87] Maui County achieved a 41.1% Renewable Portfolio Standard (RPS) in 2024.[88]
- **Hawai‘i County:** The county is actively working to optimize energy efficiency in its facilities and is partnering with HSEO to adopt a Building Performance Standard. It also promotes federal tax credits (e.g., Residential Clean Energy Tax Credit, Energy Efficiency Home Improvement Credit) and state-level rebate programs (HEAR, HOMES, HEEHRA) for homeowners, which are administered by the HSEO.[89]
- **Kauai County:** The Kauai Island Utility Cooperative (KIUC) offers an interest-free Solar Water Heater Loan Program, with KIUC covering the interest and providing a $1,500 rebate. KIUC also has a Qualifying Member Appliance Replacement Program, offering free

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[85] Hawai‘i State Energy Office. *Energy Efficiency Programs, Rebates, and Solar Initiatives*. Accessed June 7, 2025. https://energy.hawaii.gov/what-we-do/financial-assistance-and-grants/financial-assistance-resources/energy-efficiency-programs-rebates-and-solar-initiatives/

[86] City and County of Honolulu, Office of Climate Change, Sustainability and Resiliency. *O‘ahu Climate Action Plan*. March 1, 2024. https://resilientoahu.org/s/Climate-Action-Plan.pdf

[87] Hawai‘i State Energy Office. *Energy Efficiency Programs, Rebates, and Solar Initiatives*. Accessed June 7, 2025. https://energy.hawaii.gov/what-we-do/financial-assistance-and-grants/financial-assistance-resources/energy-efficiency-programs-rebates-and-solar-initiatives/

[88] Hawaiian Electric. *Clean Energy Hawai‘i*. Accessed June 7, 2025. https://www.hawaiianelectric.com/clean-energy-hawaii

[89] Hawai‘i State Energy Office. *Energy Efficiency Programs, Rebates, and Solar Initiatives*. Accessed June 7, 2025. https://energy.hawaii.gov/what-we-do/financial-assistance-and-grants/financial-assistance-resources/energy-efficiency-programs-rebates-and-solar-initiatives/

replacement of old refrigerators and broken electric water heaters for qualifying low-income seniors.

Statewide programs also extend their reach to the counties. Hawai‘i Energy administers programs like Energy Smart 4 Homes (ES4H) for Hawai‘i, Honolulu, and Maui Counties, providing free energy-efficient products such as LEDs, high-efficiency showerheads, and advanced power strips. It also offers rebates for replacement of water heating, lighting, appliances, and air conditioning with energy efficient appliances across these counties.[90] New statewide programs like HEAR and HOMES Energy Rebate Programs are anticipated to launch in 2025, designed to help low- and moderate-income households with highly energy-efficient appliances and retrofits.[91] The Federal Weatherization Assistance Program (WAP) also assists low- to moderate-income residents statewide with free weatherization measures that assist in reducing energy needs.[92]

The prevalence of programs specifically targeting low- and moderate-income (LMI) households across multiple counties indicates a strong commitment to energy equity. This ensures that the benefits of energy efficiency, such as reduced energy burden and improved living conditions, are accessible to vulnerable populations. The consistent focus on LMI households across different counties and program types (rebates, direct installations, bill assistance, financing) demonstrates a systemic effort to address energy equity, actively mitigating the disproportionate impact of high energy costs on vulnerable communities. This strong equity component aligns directly with the goals of programs like the EPA's Climate Pollution Reduction Grants (CPRG), which emphasize equitable outcomes and benefits for disadvantaged communities.

The varied approaches taken by each county demonstrate that while the state sets overarching goals, local entities are empowered to implement diverse, tailored strategies. This reflects a strategic understanding that a "one-size-fits-all" approach may not be effective across islands with different demographics, building stocks, and utility structures. Local initiatives can be more responsive to specific community needs and leverage local partnerships. This blend of statewide policy frameworks and localized, diverse implementation strategies allows Hawai‘i to maximize the effectiveness of its energy efficiency efforts, adapting to the unique characteristics of each island while collectively contributing to the state's ambitious decarbonization goals.

5.2.6 Measure Description and GHG reduction

The HSEO has prioritized several emissions reduction and energy efficiency actions for the buildings sector. These aim to make the existing building stock more energy efficient, self-

[90] Hawai‘i Public Utilities Commission. *Hawai‘i's Renewable Energy and Energy Efficiency Policies*. Accessed June 7, 2025. https://puc.hawaii.gov/energy/hawaiis-renewable-energy-and-energy-efficiency-policies/

[91] HSEO Energy Efficiency Programs, Rebates, And Solar Initiatives. Accessed June 7, 2025. https://energy.hawaii.gov/energy-efficiency-programs-rebates-and-solar-initiatives/

[92] U.S. Department of Energy (DOE) Weatherization Assistance Program. Accessed June 7, 2025. https://www.energy.gov/scep/wap/weatherization-assistance-program

sufficient, and resilient to power outages. They also aim to ensure new buildings are made to high energy efficiency standards and avoid dependency on fossil fuels for their energy needs.

Solar Panels

Current policies toward implementing distributed solar capacity have achieved a cumulative installed capacity of 1,456 MW, equivalent to 115,987 panels (as of March 31st, 2025). The residential sector has approximately 45% of the installed capacity. The remaining capacity is at the commercial and utility scale. As per Governor Green's Executive Order No. 25-01, 10,000 rooftops will be solarized annually until 2030.

This action will increase the number of solar PV systems installed in residential buildings by 7% annually, reaching a cumulative installed capacity of 3,256 MW by 2050. This is 78% of the total technical potential capacity in the Hawaiian Electric Service territory.[93]

In the commercial sector, this action will reach a total capacity of 4,146 MW by 2050, which was calculated assuming that there is a proportional potential capacity in the Hawai'i Electric Light and Maui Electric service territories.

This action is supported by recent bill HB977, which dedicates new funding for solar and storage systems (both solar hot water and heat pump water heaters). The effort aims to help ensure that low- to moderate-income (LMI) households are able to access and pay for solar PV, battery energy storage, solar hot water systems, and heat pump water heaters through partnerships, outreach, and dedicated funding.

Emissions from building sector energy use are reduced as home and commercial buildings shift from the fossil fuel-intensive electricity grid to on-site solar PV systems.

Reducing energy consumption

This action aims at retrofitting existing buildings to decrease energy consumption and reduce energy demand by increasing energy efficiency (residential and non-residential buildings). Therefore, total energy consumption will be reduced 46.4% by 2040 and 60% by 2050.

This action is supported by the statewide Energy Efficiency Portfolio Standard EEPS goal of 4,300 gigawatt-hours (GWh) of cumulative electricity savings between 2009 and 2030. With this action cumulative savings are expected to reach 6,706 GWh by 2050. Other relevant policies that support this action are the development of Building Performance Standards (BPS) and the USDOE's Home Energy Retrofit program allocated to Hawai'i (funding of ~$64 million).

[93] Grue, Nick, Waechter, Katy, Williams, Travis, and Lockshin, Jane. 2020. *Assessment of Wind and Photovoltaic Technical Potential for the Hawaiian Electric Company.* Published by NREL. Link.

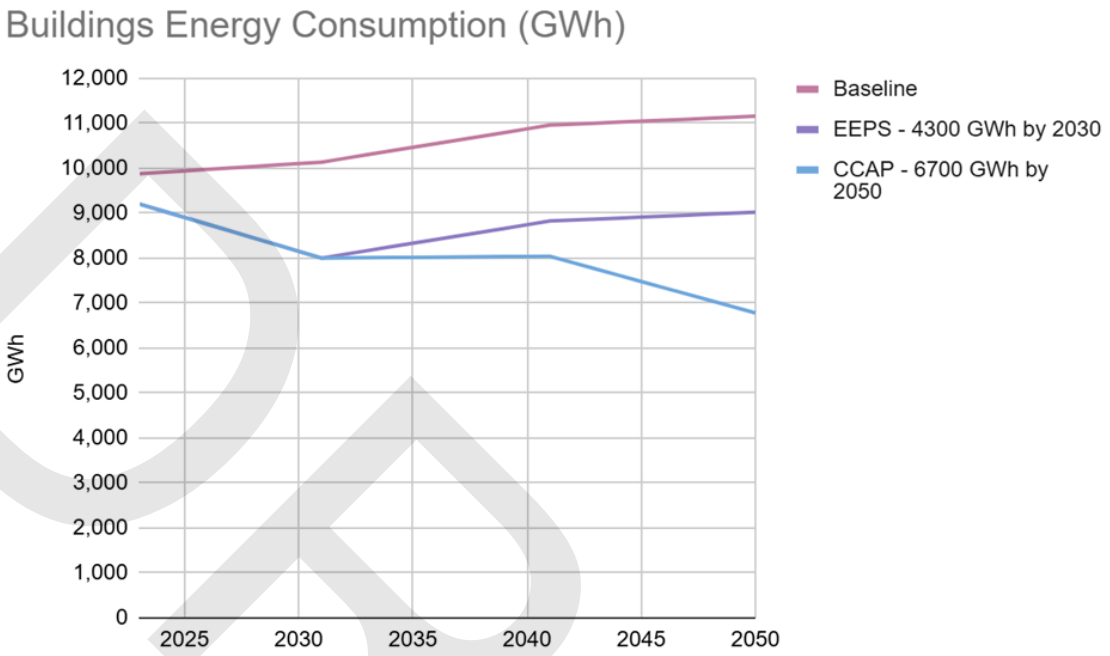

Figure 10: Effects of Efficiency Measures on Total Building Energy Consumption.

New building codes and solar water heaters

This action decreases energy consumption in new residential and commercial buildings by adopting more stringent energy building codes, particularly the 2021 IECC that will be adopted in new buildings by 2030. This will lead to a decrease of 10% in energy consumption. This action also considers that new residential buildings are built with a solar water heater, reducing an average of 19% of the energy consumption in households.

GHG Emissions Reductions

The figure below shows emission trajectories between 2022 and 2050 for each action in the buildings sector described above. Energy efficiency measures in existing buildings and installing solar panels have the greatest emissions reduction effects. New building codes achieve very small reductions, which is why the emissions trajectory does not appear to change with this action.

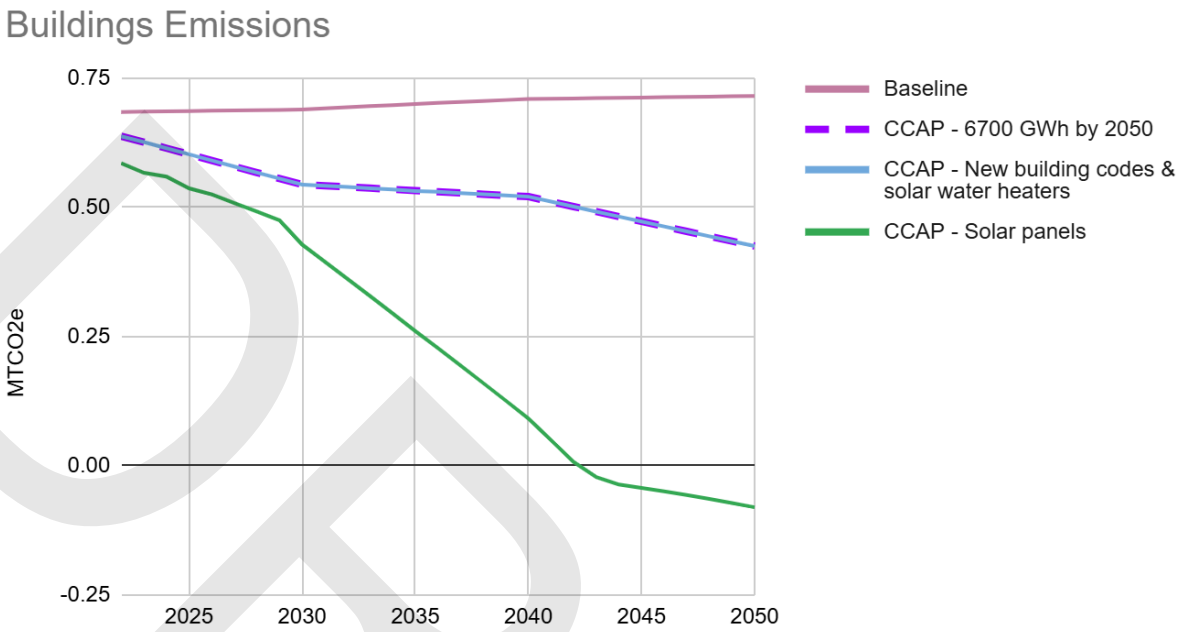

Figure 11: Impact of Efficiency Measures on Building Emissions.

The table below shows the projected baseline emissions of residential, commercial and military buildings. This is followed by a table illustrating emission reductions by action. By 2050, the three actions together reduce 11% more than the baseline emissions. This is due to the energy being generated by the solar panels, so there is a surplus of energy and therefore emissions being generated.

Baseline Emissions from Residential, Commercial and Military Buildings (MM TCO2e)					
2026	**2030**	**2035**	**2040**	**2045**	**2050**
0.69	0.69	0.70	0.71	0.71	0.72

Table 14: Baseline Emissions from Residential, Commercial and Military Buildings (MM TCO2e)

Action	**Emissions Reductions from Building Actions (MM TCO2e)**						**Cumulative 2026-2050**
	2026	**2030**	**2035**	**2040**	**2045**	**2050**	
Reducing energy consumption	0.10	0.15	0.17	0.19	0.24	0.29	4.7
New building codes & solar water heaters	0	0	0.0008	0.0001	0.0001	0.0001	0.0023
Solar panels	0.07	0.12	0.28	0.45	0.52	0.51	8.5

Table 15: Emissions Reductions from Building Actions (MM TCO2e)

5.2.7 Key implementing agency (or agencies)

Hawai‘i State Energy Office (HSEO) §HRS 196-71 outlines HSEO’s jurisdiction in taking the lead for the measures proposed in this sector.

Additionally, §HRS 196-72 enables the Chief Energy officer of the HSEO to “[d]evelop and recommend programs for, and assist public agencies in the implementation of, energy assurance and energy resilience”.

Act 239 (SLH 2022), Chapter 196, Hawai‘i Revised Statutes, added two new sections which requires all state facilities to implement cost-effective energy efficiency measures. Additionally, whenever new building codes or standards are adopted, all new state building construction must comply with the updated Hawai‘i state building codes within one year, ensuring that public buildings are designed and built to the most current energy and safety standards.

Hawai‘i Green Infrastructure Authority (HGIA). HGIA was established by HRS §196-63 as an instrumentality of the State. The functions, powers, and duties of HGIA are defined in HRS §196-64. The legislation authorizes the relevant state authority to administer a green infrastructure loan program by providing loans and funding for the purchase or installation of equipment that supports clean energy, demand response, and energy efficiency technologies. It also empowers the authority to contract consultants for expert advice and support, and to manage all necessary administrative aspects of the program—allowing these contracts to proceed without the usual public procurement process requirements under standard state law.

5.2.8 Implementation schedule and milestones and Metrics for tracking progress

BUILDINGS ENERGY EFFICIENCY		
Action	**Schedule**	**Metrics**
4. SOLAR PANELS	Increase capacity of PV systems in residential buildings: - 2026-2030: 10,000 units per year. - 2030-2050: Increase rate of 7% per year, equivalent to an average of 18,500 units per year in that period. Increase capacity of PV systems in non-residential buildings: 2026: Plan installations and establish PV panel sources. By 2050: reach a capacity of 4,146 MW.	Number and capacity (MW) of PV systems installed per year at residential and commercial buildings.

5. REDUCE ENERGY CONSUMPTION IN BUILDINGS	Reach reductions of baseline energy consumption forecasted (GWh): - 46.4% by 2040 - 60% by 2050 2026: Create a building retrofit funding incentive program. 2027: Target 1% of Hawai'i homes for retrofit. 2028-2035: Increase target by 2% of remaining homes to retrofit each year. 2036-2045: Increase retrofit target by 3% annually. 2046-2050: Increase target by 4% annually.	- Gigawatt-hours cumulative persisting energy efficiency savings in buildings. - Track energy consumption per building.
6. NEW BUILDING CODES & SOLAR WATER HEATERS	By 2030 adopt: - 2021 IECC building codes. - Solar water heaters in new residential buildings.	- Update of policies for buildings. - New building units with solar water heaters.

Table 16: Buildings Sector Measures Implementation Schedule and Milestones.

5.2.9 Cost estimates for implementation

Reducing energy consumption in buildings brings net implementation savings of over $6 billion. Costs of implementing the action consider an average cost of retrofitting per residential unit of $18,225. This cost was calculated using the affordable green housing action from the PCAP. Savings were calculated using the same source, where electricity rates ($/kWh) are projected from 2025 to 2050. In the case of commercial buildings, costs of envelope retrofits per square feet[94] were considered. The net present value of costs amounts to $11 billion while savings are $17 billion, leaving a net present value of revenues for the action.

New building codes involve net savings of $4 million, while implementing solar panels would require $4 billion in costs and more than $3 billion in savings, leading to $830 million of net costs for implementing the action.

[94] https://www.pembina.org/docs/event/netzeroforum-backgrounder-2016.pdf

Action	Emission reductions MMT CO2e (2026-2050)	Costs (M$) - Net Present Value
Reduce energy consumption in buildings	4.8	$ (6,251)
New building codes	0.0012	$ (4)
Solar panels	10	$ 830

5.2.10 Funding source

Hawai‘i’s Climate Action Plan (CAP) outlines major projects across sectors that depend on sustained federal support and supplemental funding sources:

- Hawai‘i State Energy Office IRA HOMES & HEAR programs
- Green Infrastructure Authority “Solar for All” funding
- FEMA funding for energy storage
- Private investment

5.3 Transportation: Ground/Air/Marine

5.3.1 Overview:

Hawai'i faces unique challenges in ensuring its energy security and sustainability. The transportation sector is a significant contributor to greenhouse gas (GHG) emissions in Hawai'i, and thus, its decarbonization is paramount to achieving the state's ambitious climate goals. The State of Hawai'i Department of Transportation (HDOT) has developed a comprehensive "Energy Security and Waste Reduction Plan" for 2025-2029, which outlines strategies for the reduction and eventual elimination of all transportation-related GHG emissions. This Plan is a direct response to the requirements of the Navahine Settlement Agreement and various state statutes, including Hawai'i Revised Statutes (HRS) § 225P-5, which establishes the 2030 and 2045 statewide emissions reduction targets.[95] HRS § 225P-7 mandates the decarbonization of the transportation sector and state agency fleets, while HRS § 225P-8 sets a statewide goal of zero emissions across all transportation modes: ground, sea, and air interisland transportation.[96]

Decarbonizing Hawai'i's transportation sector is a monumental task that necessitates active collaboration and participation from all stakeholders, including significant legislative actions to enable the implementation of proposed strategies. The HDOT Plan systematically details strategies organized by mode, Aviation, Marine, and Ground transportation, and identifies opportunities to increase carbon removals as a crucial supplement to emission reductions. Hawai‘i must make substantial investments in carbon removals and sequestration between 2025 and 2030 to offset anticipated residual GHG emissions and achieve its 2045 net-negative emissions target.[97]

Addressing all relevant GHG emission sources, regardless of size, is critical for achieving comprehensive decarbonization. The HDOT Plan acknowledges that some sources, such as long-haul aircraft, inter-state and intra-state marine vessels, and legacy internal combustion engine (ICE) vehicles, will be more challenging to decarbonize and may require longer periods for full transition. While predicting the precise benefits of each strategy with high certainty is difficult, the Plan represents HDOT's best estimate of the combination of strategies to put the state on a trajectory towards its GHG emission targets. This foundational work will be further refined through Annual Action Plans that provide updates and adjustments on specific actions, actors, and timelines as more data and insights become available.[98]

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[95] The Navahine Settlement Agreement reached in 2024 acknowledges the constitutional rights of Hawai‘i's youth to a life-sustaining climate and confirms the commitment by HDOT to plan and implement transformative changes of Hawai‘i's transportation system to achieve the state's goal of net-negative emissions by 2045. See https://governor.hawaii.gov/newsroom/office-of-the-governor-news-release-historic-agreement-settles-navahine-climate-litigation/

[96] Hawai'i Department of Transportation. (2025). *Energy Security and Waste Reduction Plan: A Plan to Increase Hawai'i's Energy Security and Access Options, and Reduce Inefficiencies in Transportation 2025-2029*. Executive Summary, pp. 2-4.

[97] Ibid.

[98] Ibid.

The core of the HDOT Plan emphasizes a multi-pronged approach, recognizing that no single strategy can achieve the ambitious goals. Key actions include:

- **Scaling up Electric Vehicles (EVs) and Charging Infrastructure:** Expanding public charging networks, converting transit vehicles to electric, and offering financial incentives for EV adoption.
- **Transitioning Aviation and Marine to Cleaner Fuels:** Promoting sustainable aviation fuel (SAF), bio-/renewable-diesel, and renewable liquid natural gas (LNG), with long-term plans for alternative clean fuels like green hydrogen.
- **Modernizing Ports and Airports:** Implementing energy efficiency measures and supporting the electrification of ground support equipment.
- **Promoting Low-Carbon Alternatives:** Expanding public transit, improving bicycle and pedestrian infrastructure, and encouraging ridesharing and compact development.
- **Engaging Stakeholders:** Collaborating with the HDOT Youth Council and other external partners to ensure broad support and effective implementation.[99]

A critical cross-cutting theme is electrification, which requires grid modernization and a successful transition to renewable energy sources by the energy sector, as outlined in the Hawai'i Statewide Decarbonization Plan and mandated by HRS § 269-92. The HDOT Plan views decarbonization not just as a means to reduce harm but as an opportunity for Hawai'i to partner, innovate, and invest in building a more efficient transportation system that enhances mobility, energy security, and economic activity for future generations.[100]

Priority actions are identified based on their potential for significant emission reductions or their ability to quickly make a meaningful difference. For aviation, these include creating a market and regulatory framework for Sustainable Aviation Fuel (SAF), deploying electrification strategies for airfield and ground access, adopting ramp efficiency optimization, and supporting inter-island aviation electrification. For marine transport, priorities involve policies to reduce cruise ship calls, market-based mechanisms for clean marine fuels, and developing infrastructure for bio-renewable-diesel and renewable Liquid Natural Gas (LNG). In ground transportation, key actions include increasing EV use through charging infrastructure expansion and financial incentives, expanding transportation choices (transit, bicycle, pedestrian), and promoting low-carbon fuels for hard-to-electrify vehicles. Administrative actions include workforce awareness, a Green Procurement Program, and energy efficiency in office spaces.[101]

Overall, alternative fuels for aviation, primarily SAF, represent the largest share of projected emission reductions. Vehicle and equipment electrification across aviation and ground transport follows as the next largest contributor. Fuel/energy reduction measures, such as optimizing aircraft movements, expanding multimodal transport, demand management to reduce Vehicle Miles Traveled (VMT), and limiting cruise ship trips, also play a significant role.[102]

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[99] Ibid.
[100] Ibid.
[101] Ibid.
[102] Ibid.

5.3.2 Key Features

Hawai'i's unique geography as an isolated island chain profoundly shapes its transportation sector. This isolation necessitates a heavy reliance on air and marine transport for connectivity, commerce, and tourism, in addition to extensive ground transportation networks within each island. Hawai'i's insular nature means that inter-island travel for both people and goods is predominantly by air or sea. This distinguishes its transportation challenges from the continent, where inter-state ground travel is common. The state's population is concentrated primarily on O'ahu, leading to significant intra-island traffic congestion in urban centers like Honolulu. The reliance on tourism further amplifies transportation demands, with millions of visitors annually utilizing air travel to reach the islands and ground transportation for local movement.

Hawai'i's transportation system is fundamentally intermodal, comprising:

- **Ground Transportation:** This includes personal vehicles, public transit (buses, and now Honolulu's rail system), bicycles, and pedestrian networks. Light-duty passenger vehicles constitute the majority of ground transportation emissions.[103] Efforts are underway to expand electric vehicle (EV) adoption, charging infrastructure, and promote alternative modes like walking, cycling, and public transit.
- **Aviation:** This sector is vital for inter-island travel, domestic connections to the U.S. mainland, and international tourism. Major airports on each island handle significant passenger and cargo volumes. Aviation emissions are primarily from the combustion of jet fuels.[104]
- **Marine Transportation:** This covers inter-island cargo shipping, domestic and international shipping (including cruise lines), and commercial harbor craft. Marine transport is critical for goods movement and tourism.[105]

Energy Dependence and Renewable Goals:

Hawai'i is heavily dependent on imported fossil fuels for its energy needs, including transportation. This dependence poses significant energy security risks and contributes to GHG emissions. The state has ambitious goals for transitioning to 100% clean and locally sourced renewable energy by 2045 across all sectors, including transportation. This overarching energy transition is foundational to decarbonizing the transport sector, as electrification strategies rely on a clean grid.[106]

Existing Infrastructure and Future Development:

Hawai'i possesses a comprehensive network of highways, airports, and harbors. However, much of this infrastructure was designed for a fossil-fuel-dependent economy. Future development focuses on modernizing these assets to support decarbonization, including:

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[103] Ibid. Section 2: Greenhouse Gas Emissions Inventory and Forecast, pp. 23-32.
[104] Ibid.
[105] Ibid.
[106] Ibid.

- **Electrification Infrastructure:** Expanding public and private EV charging networks, electrifying airport ground support equipment (eGSE), and exploring electric inter-island aircraft and marine vessels.
- **Sustainable Fuel Production:** Developing capabilities for local production and import of sustainable aviation fuels (SAF), renewable diesel, and green hydrogen.
- **Multimodal Integration:** Improving public transit, bicycle, and pedestrian networks to reduce reliance on single-occupancy vehicles. Honolulu's Skyline rail project is a key example of an ongoing effort to reduce road congestion and emissions.

Regulatory and Policy Environment:

Hawai'i has a proactive legislative environment supporting climate action and decarbonization. Key state statutes and policies drive the transportation sector's transition:

- **HRS § 225P-5:** Establishes statewide emissions reduction targets for 2030 and 2045.
- **HRS § 225P-7:** Mandates decarbonization of the transportation sector and state agency fleets.
- **HRS § 225P-8:** Sets a statewide goal of zero emissions across all transportation modes.
- **Act 74 (2021):** Requires 100% of the state's light-duty fleet to be zero-emission vehicles by 2035.
- **Act 100 (1999):** Requires state agencies to submit annual reports on goals, objectives, and policies for resource allocation, including for ground, air, and marine sectors.
- **HRS § 196-9(c)(6), (11) (2021):** Requires planning for EV charging stations and a 100% zero-emission light-duty state fleet.

These policies create a robust framework for HDOT's initiatives, guiding investment, infrastructure development, and stakeholder collaboration.

Challenges Unique to Hawai'i:

- **Island Geography:** The dispersed nature of the islands makes inter-island clean transportation solutions (electric aircraft, hydrogen ferries) critical but complex due to technological maturity and infrastructure requirements.
- **Import Dependence:** Hawai‘i's reliance on imported goods means that emissions from international bunkering activities and international air travel are significant but often excluded from state-level inventories as per IPCC guidelines. Addressing these "upstream" emissions indirectly through policy and collaboration remains a challenge.
- **High Cost of Living and Energy:** The higher cost of electricity and goods in Hawai‘i can impact the affordability and adoption rate of new technologies like EVs and sustainable fuels without strong incentive programs.
- **Vulnerability to Climate Impacts:** Hawai‘i's existing transportation infrastructure is highly vulnerable to climate impacts like sea-level rise, coastal erosion, and extreme weather, necessitating significant investment in climate adaptation and resilience alongside decarbonization.

5.3.3 Numbers and Targets: Current Status and Future Goals

Hawai'i has set aggressive targets for greenhouse gas (GHG) emission reductions and energy efficiency, aiming for a significant transformation of its transportation sector by 2030 and achieving net-negative emissions by 2045. These targets are legally mandated and form the backbone of the state's Climate Action Plan.

Current GHG Emissions and Energy Use:

The Hawai'i Department of Health's 2022 inventory, for instance, attributed 10.12 million metric tons of CO2e to transportation. The majority of these emissions stem from the combustion of fossil fuels across three primary modes: ground transportation, aviation, and marine transport.

Mode	Emissions (MMT COe)	Percentage of Transportation Total
Ground	3.47	34.30%
Domestic Marine	0.65	6.40%
Domestic Aviation	4.9	48.40%
Military Aviation	0.77	7.60%
Military Non-Aviation	0.32	3.20%
Total	10.12	100%

Mode-Emissions MMTCOe and Percentage of Transportation Total 2022

- Without the implementation of new strategies, transportation-related emissions are projected to decrease only marginally from 10.4 **million metric tons CO2e** to **9.7 million metric tons CO2e by 2045**, highlighting a critical gap between current trends and state mandates. This "baseline scenario" underscores the necessity of aggressive mitigation actions to achieve the decarbonization [107]

Reduction of GHG and Energy Efficiency for 2030 and 2045:

Decarbonization pathway and targets:

- **2030 Short-term Target:** Cut GHG emissions by 50% from 2005 levels. This is an ambitious near-term goal that requires immediate and substantial action across all transportation modes.
- **2045 Net-Negative Target:** Achieve **net-negative transportation emissions**, meaning Hawai'i will remove more carbon from the atmosphere than it emits. This long-term target necessitates not only deep emission reductions but also significant investments in carbon removals and sequestration technologies.

[107] Ibid.

- **Zero Emissions Goal:** Establish a statewide goal of **zero emissions across all transportation modes**, including ground, sea, and air interisland transportation, by 2045.

The Plan outlines specific strategies and their projected emission reduction totals (in million metric tons CO2e) to meet these targets. While precise quantification of future benefits for each strategy is challenging, HDOT's Plan provides its best estimate of the combination of strategies required.

Key Benchmarks and Milestones:

The Plan identifies specific benchmarks for each mode to track progress towards the 2030 and 2045 targets:

Aviation:

- **2030:** Clean Fuel Standard Program operational (SAF Policy passed by Legislature by 2027), 50% of rental cars available at airport are EVs, 50% of parking spaces have access to EV Charging.
- **2045:** Aviation achieves net-zero emissions through widespread adoption of SAF, electrification of ground operations, and the introduction of hydrogen and electric aircraft for inter-island travel. The estimated emission reduction for aviation from strategies (primarily SAF adoption) is the largest share of overall reductions.

Marine:

- **2030:** 50% reduction in overall cruise vessel calls, 75% reduction in >3,000 passenger vessel calls.
- **2035:** 75% reduction in overall cruise vessel calls, 100% reduction in >3,000 passenger vessel calls.
- **2040 and 2045:** Limit cruise vessel calls to 75% below 2023 levels.
- **Overall:** Adoption of clean fuels (biodiesel, bio-LNG, green hydrogen) for intra-state and inter-state marine vessels and commercial harbor crafts is crucial.

Ground Transportation:

- **2028:** 100% of HDOT's light-duty fleet conversion to electric vehicles.
- **2035:** Statewide fleet of light-duty vehicles must be zero-emission (Act 74).
- **2030 (Estimated):** HECO estimates approximately 3,600 public charging stations and 46,000 private charging stations will be needed. By December 2026, the full implementation of HDOT's NEVI Plan, which includes 13 stations, is on track.
- **2035 (Target):** 100% EV sales for new vehicles.
- **Long-term:** Significant increase in public transit ridership, expansion of bicycle and pedestrian infrastructure, and effective demand management strategies to reduce VMT.

5.3.4 Challenges and Innovations

The decarbonization of Hawai‘i's transportation sector is a complex undertaking, presenting unique challenges stemming from its island geography, economic reliance on tourism, and energy infrastructure. However, these challenges also drive innovative solutions tailored to the state's specific context.

Sector-Specific Challenges:

Aviation:

- **Sustainable Aviation Fuel (SAF) Supply and Cost:** The biggest challenge for aviation decarbonization is the availability and cost-effectiveness of SAF. While SAF offers significant lifecycle GHG reductions (65-80% compared to conventional jet fuel), its production capacity is currently limited, and it is more expensive. Incentivizing its import and local production requires significant policy and financial mechanisms.
- **Inter-island Aviation Electrification:** While electric aircraft are emerging, commercially viable electric aircraft for inter-island routes with sufficient range and passenger capacity are still in development. Hydrogen aircraft are a long-term prospect.
- **International Aviation Emissions:** Emissions from international flights are not typically included in state GHG inventories, as per IPCC guidelines. However, Hawai‘i's heavy reliance on international tourism means these emissions are substantial and represent an external challenge that the state can only influence through advocacy and collaboration with international bodies and airlines.
- **Airspace Modernization:** Optimizing flight paths and air traffic management can reduce fuel consumption, but these efforts require federal collaboration and significant technological upgrades.

Marine Transportation:

- **Clean Fuel Infrastructure:** Transitioning marine vessels to clean fuels like biodiesel, renewable LNG, and green hydrogen requires significant investment in bunkering infrastructure at Hawai‘i's harbors. The supply chain for these fuels is not yet fully developed.
- **Cost of New Vessels:** Replacing existing fossil-fuel-powered vessels with those capable of running on alternative fuels is capital-intensive, potentially increasing costs for cargo and passenger services, which could impact the cost of living in Hawai‘i.
- **Cruise Ship Emissions:** Reducing emissions from cruise ships involves complex negotiations with cruise lines, potentially impacting tourism revenue. Strategies include limiting the number and size of cruise ship calls.
- **International Shipping Emissions:** Similar to aviation, international shipping emissions are largely outside Hawai‘i's direct regulatory control, making it challenging to reduce their impact on local air quality and the broader climate.

Ground Transportation:

- **EV Charging Infrastructure Deployment:** While significant progress is being made, rapidly expanding public and private EV charging infrastructure statewide, especially in rural areas and multi-unit dwellings, remains a challenge. The estimated need for 3,600 public and 46,000 private charging stations by 2030 highlights the scale of this task.
- **Cost of Electric Vehicles:** Despite incentives, the upfront cost of EVs can still be a barrier for many consumers, even though lifetime costs of EVs are typically lower. Programs like tax credits, rebates, and feebate policies are crucial to accelerate adoption and equitable deployment of this money saving technology.
- **Vehicle Turnover:** Replacing the existing fleet of internal combustion engine (ICE) vehicles with EVs will take time, even with aggressive sales targets. Policies to incentivize scrappage of older, less efficient vehicles could help.
- **Public Transit Ridership and Infrastructure:** While expanding public transit, bicycle, and pedestrian networks is a priority, shifting deeply entrenched single-occupancy vehicle habits requires significant investment in infrastructure, reliable service, and cultural change.
- **Road Usage Pricing (RUC):** Implementing a road usage pricing system, while effective in reducing VMT and congestion, can face public resistance due to concerns about equity and affordability. Careful design and transparent communication are essential.

Innovations and Opportunities:

Aviation:

- **SAF Tax Credits and Coalitions:** Hawai'i is actively pursuing a Hawai'i-specific SAF tax credit to incentivize production, blending, and import. HDOT is also leading a multi-stakeholder SAF coalition to build a shared roadmap for SAF adoption, bringing together airlines, fuel producers, farmers, NGOs, and government agencies. This collaborative approach is critical for de-risking investments and accelerating market development.
- **Airfield Electrification:** Airports are implementing strategies to electrify ground service equipment (eGSE) and airfield vehicles, provide pre-conditioned air (PCA) supply and fixed electrical ground power (FEGP) to reduce aircraft auxiliary power unit (APU) usage, and transition to LED lighting for aprons, runways, and taxiways.
- **Hydrogen and Electric Aircraft Exploration:** While long-term, Hawai‘i is actively exploring the potential of hydrogen and electric aircraft for inter-island travel, positioning itself as a testbed for these emerging technologies.

Marine Transportation:

- **Clean Fuels Adoption:** The HDOT Plan champions the adoption of advanced marine fuels like biodiesel and bio-LNG in the near term, with a long-term vision for green hydrogen, for both intra-state and inter-state marine vessels and commercial harbor crafts. This phased approach allows for technological maturation and infrastructure development.

- **Cruise Ship Management:** Implementing regulations to reduce the number and size of cruise ship calls demonstrates an innovative approach to managing environmental impact while still accommodating tourism.
- **Cold Ironing/Shore Power:** While not explicitly detailed in the provided snippets, a common innovation for harbors is "cold ironing" or shore power, allowing docked vessels to turn off their auxiliary engines and plug into the grid, significantly reducing port-side emissions. This is an area for potential future exploration.

Ground Transportation:

- **Multi-faceted EV Adoption Incentives:** Hawai'i's strategy goes beyond just charging infrastructure, including financial incentives like tax credits, rebates, and feebate policies to make EVs more affordable. This comprehensive approach addresses various barriers to adoption.
- **NEVI Plan Implementation:** HDOT's aggressive implementation of the National Electric Vehicle Infrastructure (NEVI) Plan, including strategically located fast-charging stations across the islands, is crucial for building public confidence in EV travel.
- **Transit Fleet Electrification:** Converting public transit fleets to electric vehicles, such as buses, significantly reduces emissions in densely populated areas and provides a visible commitment to decarbonization.
- **Active Transportation Networks:** The planning and constructing comprehensive bicycle and pedestrian infrastructure networks, coupled with initiatives to promote active transportation, encourages healthier, affordable and lower-carbon mobility options.
- **Innovative Mobility Solutions:** Exploring and supporting innovative mobility solutions, such as micro-mobility, shared mobility services, and intelligent transportation systems, can further reduce reliance on personal vehicles and optimize traffic flow.
- **Road Usage Pricing (RUC):** While challenging to implement, the consideration of RUC is an innovative demand management strategy that can effectively reduce congestion and VMT, generating funds for transportation infrastructure improvements. The uploaded document mentions that road pricing can encourage public transit, bicycling, and walking, and promote carpooling by making peak-hour solo driving more expensive. This indicates a forward-thinking approach to managing traffic demand.

In summary, Hawai‘i's transportation sector faces substantial, multifaceted challenges in decarbonization. However, the state's proactive policy environment, coupled with a commitment to innovative technologies and collaborative approaches, positions it as a leader in forging a sustainable transportation future for island communities.

5.3.5 County-Level Variations and Actions

While the HDOT leads the overarching climate action plan for the transportation sector, significant variations exist at the county level, with each of Hawai‘i's four counties; Hawai'i County, City and County of Honolulu, Kaua'i County, and Maui County, implementing their own complementary actions and targets. These local efforts are crucial for addressing unique regional challenges and opportunities within the statewide framework.

County-Level Governance and Context:

Each county in Hawai‘i operates with its own government and planning departments that influence local transportation policies and infrastructure development.

- **City and County of Honolulu - CCH:** Encompasses the entire island of O'ahu, which is the most populous island and the economic hub of the state. CCH has the most extensive public transit system, including TheBus and the newly operational Skyline. Due to high population density and traffic congestion, CCH often leads in adopting advanced transportation solutions and demand management strategies.
- **Hawai'i County (Big Island):** The largest island geographically, characterized by a more rural landscape with expanding urban centers. Transportation challenges often involve longer distances and reliance on personal vehicles.
- **Maui County:** Includes the islands of Maui, Moloka'i, and Lāna'i. Maui is a significant tourist destination with a growing population. Transportation planning focuses on balancing tourism needs with resident mobility and environmental protection.
- **Kaua'i County:** Encompasses the island of Kaua'i, known for its natural beauty local transportation efforts often prioritize preserving natural landscapes and promoting sustainable tourism.

County-Level Actions and Targets:

The overarching state targets for GHG reduction and energy efficiency apply to all counties, but each county contributes through specific initiatives tailored to its local context. The Hawai‘i Department of Health develops county-level GHG emissions estimates as part of its ongoing inventory efforts, which will provide more granular data for future planning.

Electric Vehicle (EV) Adoption and Infrastructure:

- **Public Charging:** Counties collaborate with HDOT, Hawaiian Electric Company (HECO), and the Hawai'i State Energy Office (HSEO) to identify suitable locations for public EV charging stations on public lands and rights-of-way. For example, the HDOT NEVI Plan includes identified sites on Maui, O'ahu, Kaua'i, and Hawai'i Island, with the first two NEVI-funded stations opening on Maui and O'ahu in 2024.

- **Private Charging:** Counties may implement zoning regulations or building codes that encourage or require EV charging infrastructure in new residential and commercial developments.
- **Fleet Electrification:** Counties are also working to electrify their municipal fleets, aligning with state goals for zero-emission government vehicles. The City and County of Honolulu aims to convert all City vehicles to electric by 2035.[108]

[108] City and County of Honolulu Office of Climate Change, Sustainability and Resiliency. (n.d.). *Transportation: Greening the City Fleet*. https://www.resilientoahu.org/transportation

Public Transit Expansion and Modernization:

Counties manage and operate local public transit systems.

- **City and County of Honolulu (CCH):** CCH's Department of Transportation Services (DTS) operates TheBus and the Skyline rail. The rail project aims to reduce traffic congestion and GHG emissions on O'ahu. CCH continues to invest in modernizing its bus fleet, with 17 electric buses already in service and plans to electrify its heavy-duty vehicle fleet.[109]
- **Other Counties:** Neighbor island counties operate their own bus systems, and are exploring expanding routes, increasing frequency, and electrifying their fleets to provide more viable alternatives to personal vehicle use.
- **Intermodal Connectivity:** Counties are focused on improving connectivity between different modes of transport, such as integrating bus routes with rail stations, park-and-ride facilities, and active transportation networks.

Bicycle and Pedestrian Infrastructure:

Counties play a critical role in developing and maintaining active transportation networks.

- **Dedicated Lanes and Paths:** Counties are investing in creating safe and extensive bicycle lanes, shared-use paths, and pedestrian walkways to encourage walking and cycling for commuting and recreation. Honolulu, for example, is finalizing new protected bike lanes as part of its Complete Streets program.[110]
- **Safe Routes to School:** Many counties have programs aimed at creating safer routes for children to walk and bike to school, especially in historically marginalized communities, addressing both safety and equity concerns.
- **Urban Planning:** County-level land use planning and zoning ordinances promote compact, mixed-use, and transit-oriented development (TOD) to reduce vehicle miles traveled (VMT) and encourage walking and cycling.

Road Usage Pricing and Demand Management:

While a statewide initiative, counties are critical in the potential implementation and public acceptance of road usage pricing (RUC) mechanisms.

- **Congestion Management:** Counties with significant traffic congestion, particularly Honolulu, are keen on exploring RUC as a tool to manage demand, reduce peak-hour

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[109] City and County of Honolulu Office of Climate Change, Sustainability and Resiliency. (n.d.). *Transportation: TheBus is Driving to a Clean Energy Future*. https://www.resilientoahu.org/transportation

[110] City and County of Honolulu Office of Climate Change, Sustainability and Resiliency. (n.d.). *Climate Action Plan: Action Is Already Underway - Ward Avenue Protected Bike Lanes*. https://www.resilientoahu.org/climate-action-plan

travel, and generate revenue for transportation infrastructure. The state Plan highlights RUC's ability to encourage public transit, carpooling, and off-peak travel.

- **Local Implementation:** Any statewide RUC program would require close collaboration with counties for local enforcement, infrastructure adaptation, and public outreach to ensure equitable impacts and smooth implementation.
- **VMT Reduction Targets:** The City and County of Honolulu has set VMT reduction targets of 10%, with aspirations for 20% and 30%, to reduce emissions and congestion.[111]

Local Climate Action Plans and Initiatives:

Many counties have developed or are in the process of developing their own climate action plans that include transportation-specific strategies.

- **City and County of Honolulu Climate Action Plan (CAP):** CCH adopted its first CAP for 2020-2025, outlining 9 strategies and 47 actions to reduce GHG emissions by 45% by 2025 (relative to 2015 levels) from transportation, electricity, and waste sectors, with a long-term goal of carbon neutrality by 2045. Ground transportation accounts for approximately 19% of O'ahu's GHG emissions.[112]
- **Hawai'i County Integrated Climate Action Plan (ICAP):** Hawai'i County has an Integrated Climate Action Plan that includes clean transportation as a key area. The 2015 GHG inventory for Hawai'i County showed transportation and mobile sources as the largest emission sector, representing 53.38% of total emissions. Their ICAP aims to reduce the County's contribution to global GHG emissions and increase the resilience of county infrastructure.[113]
- **Maui County:** Transportation plans include promoting sustainable tourism transportation and expanding EV infrastructure.
- **Kaua'i County:** Focuses on resilience and sustainable tourism, with transportation initiatives often emphasizing eco-friendly options, consistent with its natural environment.

Challenges in County-Level Implementation:

- **Funding:** Counties often face budget constraints, making significant investments in new transportation infrastructure and technologies challenging without state or federal support.
- **Coordination:** Ensuring seamless coordination between state and county transportation agencies, as well as with utility companies and private sector partners, is crucial for efficient project delivery.

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[111] City and County of Honolulu. (May 25, 2024). *2024 Energy Conservation and Emissions Reduction Plan for Transportation*. p. 5. https://oahumpo.org/?wpfb_dl=3289

[112] City and County of Honolulu Office of Climate Change, Sustainability and Resiliency. (n.d.). *Climate Action Plan*. https://www.resilientoahu.org/climate-action-plan

[113] County of Hawai'i. (2023). *Integrated Climate Action Plan (ICAP)*. pp. 7-10. https://records.hawaiicounty.gov/WebLink/1/edoc/135070/County%20of%20Hawaii%20-%20Integrated%20Climate%20Action%20Plan%20(2023).pdf

- **Public Acceptance:** Implementing new policies like RUC or significant changes to existing infrastructure requires strong public engagement and buy-in, which can vary across communities within each county.
- **Data Granularity:** Improving data collection processes for more granular and focused emissions quantification at the county level is essential for better planning and tracking progress.

Despite these challenges, the decentralized approach, with strong state guidance and county-level implementation, allows for tailored solutions that best fit the unique needs and characteristics of each island and community, collectively contributing to Hawai'i's ambitious transportation decarbonization goals.

5.3.6 Measure Description and GHG reduction

Ground Transportation Measures

Vehicle Electrification
Vehicle Electrification
A host of measures are needed to support the energy transition to electric vehicles, including:

- Increasing the availability of public and private charging infrastructure;
- Offering EV registration fee incentives;
- Offering a gas-powered vehicle trade-in program;
- Incentivizing rental agencies to offer EVs; and,
- Transitioning institutional and governmental fleets to EVs.

More precise data for government and rental agency fleets is required in order to perform the calculations that would determine the emissions reduction potential from this action. Thus, this action is to be calculated at a future date, when such information is available.

Clean Fuels
As gas-powered vehicle retail sales continue and existing gas-powered vehicles will continue to operate for years to come, their emissions will persist. Addressing gas-powered vehicle emissions can be achieved through clean fuels, instead of transitioning of vehicle technology.

Ethanol is the go-to biofuel added to gasoline to reduce vehicle emissions. It is produced by fermenting organic materials like wheat, corn, sugarcane, and cellulose. Existing vehicle engines burn ethanol-gasoline mixtures similarly to gasoline on its own. With minor modifications, engines can burn mixtures with high ratios of ethanol.

Many jurisdictions in the US and internationally mandate ethanol-gasoline blends between 5% ("E5") and 20% ("E20"). Higher blends are often available as well. Hawai'i can support ethanol use through measures like:

- Supporting a clean fuel standard, carbon tax or other legislation to increase clean fuel use. This could include revisiting the ethanol blend mandate the state had between 2006-2015.
- Developing local capacity to produce ethanol, using existing crops such as sugar cane.

Ethanol blend fuels can achieve emissions reductions in the transportation sector as follows:

Assumptions

- As population and vehicle ownership increase, total vehicle miles traveled increases 0.67% annually, on average.
- Gasoline-powered vehicles phase out and are replaced by battery electric vehicles (BEV) and plug-in hybrid vehicles (PHEV). By 2050, gasoline-powered vehicles make up 5% of the total vehicle stock.
- Ethanol blend fuels affect the emissions of gasoline-powered and PHEV vehicles only.

	Baseline Emissions From BEV, PHEV, and Gasoline Vehicles (MM TCO2e)					
	2026	**2030**	**2035**	**2040**	**2045**	**2050**
Baseline	3.14	2.43	2.94	1.17	0.43	0.44

Table 17: Baseline Emissions From BEV, PHEV, and Gasoline Vehicles

	Emissions Reductions from Ethanol Blends (MM TCO2e)						
Scenario	**2026**	**2030**	**2035**	**2040**	**2045**	**2050**	**Cumulative 2026-2050**
E20	0.63	0.49	0.59	0.23	0.08	0.09	8.39
E25	0.78	0.62	0.73	0.29	0.11	0.11	10.48
E50	1.57	1.21	1.47	0.58	0.21	0.21	20.97
E85	2.67	2.06	2.49	0.98	0.36	0.36	35.64

Table 18: Emissions Reductions from Ethanol Blends (MM TCO2e)

Ethanol use is considered carbon neutral, thus the ethanol value in fuel mixes reduces emissions by roughly that percentage (e.g., E20 = 20% emissions reduction).

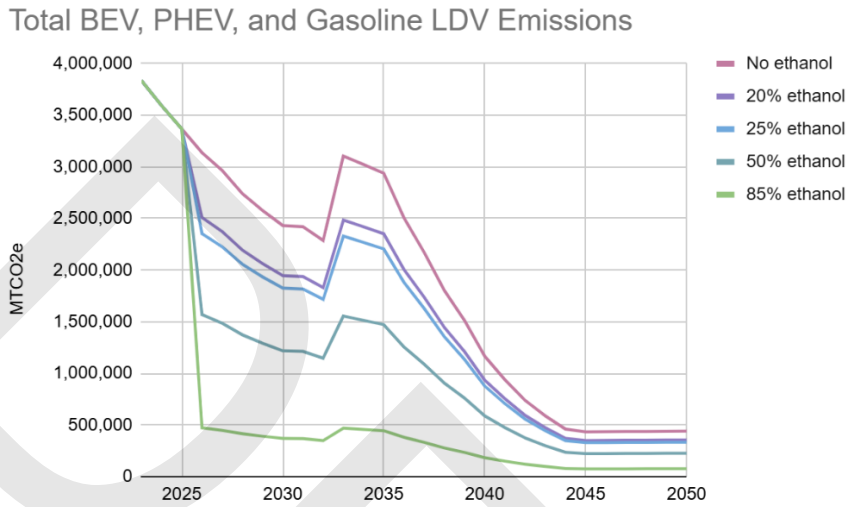

Figure 12: Light-duty Vehicle Stock Emissions Reduction Effects of Blending Ethanol into Gasoline.

Mode Shift

As mentioned, although per vehicle VMT is projected to remain consistent in the future, increased vehicle ownership accompanying population growth will result in an increase in total VMT. This creates continue challenges with vehicle emissions and traffic congestion. VMT reduction measures can help shift trips made by personal vehicle to those made by active transportation or transit.

This action considers four elements:

- Switching vehicle trips to walking, biking, and rolling trips.
- Switching trips made using personal vehicles trips to trips made using transit;
- Assessing and implementing road use pricing programs (after multimodal infrastructure built out); and,
- Complete, compact community land use planning to focus new building development in built-up areas to increase population density, which encourages the co-location of housing, employment, and services, which encourages making trips via active transportation and transit.

This combination of elements targets a 20% reduction in total VMT by 2050.

Shifting from vehicle trips to walking, biking, and rolling trips is supported by actions like:

- Implementing a 5-Yr priority multimodal network;
- Implementing bicycling & walking initiatives/pilots (e.g., county transit free for youth, dedicated lanes/streets, rebates, etc.); and
- Continuing the expansion of bicycling and pedestrian infrastructure & maintenance programs.

Shifting from vehicle trips to transit trips is supported by actions like:

- Implementing a unified payment app for transit on all islands;
- Creating transit initiatives/pilots (e.g., county transit free for youth); and
- Continuing improvements to intra-city public transit service network and infrastructure.

Road pricing program implementation is supported by actions like:

- Assessing which urban areas suffer from traffic congestion and determining what the options are for road pricing geographic boundaries and how mode shift can be supported by accompanying improvements in transit services and active transportation infrastructure;
- Determining road pricing fees; and
- Implementing financing programs for transit and active transportation, funded by road pricing fees.

Complete, compact communities land use planning approaches include:

- Site development potential analyses to determine infill strategies;
- Affordable housing needs assessments and development strategies;
- Transit-oriented development potential assessments; and
- Parking minimums reduction and EV charging requirements in new building developments.

Transportation sector emissions reductions from these four elements can be achieved as follows:

Assumptions

- All mode shift occurs from LDV trips to other modes. LDVs use gasoline, electricity, or a combination.
- Assume transit fuel is carbon neutral. Shifting trips to transit reduces those trip emissions to zero.
- As population and vehicle ownership increase, total vehicle miles traveled increases 0.67% annually, on average.
- Gasoline-powered vehicles phase out and are replaced by battery electric vehicles (BEV) and plug-in hybrid vehicles (PHEV). By 2050, gasoline-powered vehicles make up 5% of the total vehicle stock.
- Each element is able to achieve roughly the same share of target VMT reduction (i.e., 5%).

	Baseline Emissions From BEV, PHEV, and Gasoline Vehicles (MM TCO2e)					
	2026	**2030**	**2035**	**2040**	**2045**	**2050**
Baseline	3.14	2.43	2.94	1.17	0.43	0.44

Table 19: Baseline Light-duty Vehicle Emissions.

	Emissions Reductions from Mode Shift (MM TCO2e)						
Mechanism	**2026**	**2030**	**2035**	**2040**	**2045**	**2050**	**Cumulative 2026-2050**
Active transportation	0.006	0.024	0.059	0.035	0.017	0.022	0.75
Compact communities	0.006	0.024	0.059	0.035	0.017	0.022	0.75
Transit	0.006	0.024	0.059	0.035	0.017	0.022	0.75
Road pricing	0.006	0.024	0.059	0.035	0.017	0.022	0.75
Total	0.024	0.096	0.236	0.140	0.068	0.088	3.00

Table 20: Light-duty Vehicle Emissions Reductions from Mode Shifting Measures.

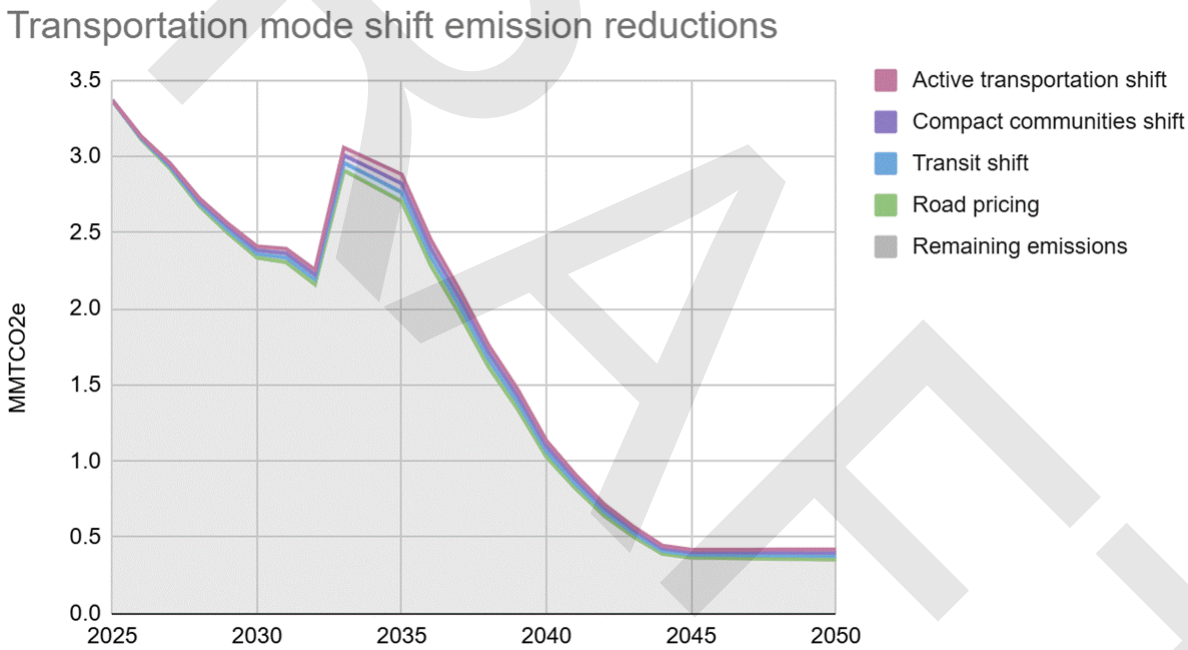

Figure 13: Light-duty Vehicle Emission Reductions from Mode Shift Measures.

The emissions reduction from mode shift measures in any given year is minor, as the target of a 20% reduction in current VMT levels by 2050 is roughly balanced by the VMT added by population and vehicle use growth by that year.

Aviation Transportation Measures

Aviation emissions (domestic and military) are excluded from Hawai‘i’s GHG emissions reduction goal established in Act 234 of 2007; however, Act 238 of 2022 introduced a GHG emissions

reduction target including aviation emissions.[114] Domestic aviation makes up almost 50% of transportation emissions in 2021. Adding military flights, aviation makes up 55% of transportation emissions. Hence, the importance to consider emission reduction measures from this source.

Similarly to ground transportation emissions, addressing aviation emissions can be achieved through clean fuels. Sustainable aviation fuel (SAF) has a lower carbon intensity than regular jet fuel, since it is made from renewable biomass and waste resources. It is expected that SAF will make up 2% of U.S. jet fuel consumption in 2026 (EIA, 2025). This action targets 20% SAF content in aviation fuels by 2040.

Adopting a higher share of SAF considers the following supporting actions:

- Developing necessary policies, such as clean fuel standards, tax credit, carbon tax or other legislation to increase SAF affordability and use.
- Advising and participating in an SAF industry working group that meets quarterly and addresses barriers to meeting SAF goals and targets.
- Incentivizing locally grown SAF farmers & producers.
- Assessing existing infrastructure, Supply Chain and Distribution Pathways for SAF.
- Monitoring developments in scale-up of zero carbon fuels such as eSAF and green hydrogen.
- Engaging with airlines regarding use of aircraft powered by zero carbon fuels for intra-island flights, such as green hydrogen.

Other measures to reduce aviation emissions include reducing fuel consumption in airplanes and electrifying airplanes, as well as ground operations. These were not quantified due to lack of data, but supporting actions can be described as:

- Reducing fuel consumption by:
    - Revising airline scheduling to stagger departures and arrivals to reduce idling.
    - Optimizing aircraft ramp movements to prevent congestion and delays.
    - Completing and implementing an airspace modernization strategy.
    - Expanding the number of gates to reduce aircraft idling time following landing.
- Electrification, including:
    - Converting airfield vehicles and ground support to electric models.
    - Installing/expanding EV charging infrastructure.
    - Engaging with airlines regarding use of aircraft powered by electricity for intra-island flights.
    - Converting all mobile equipment to electric.

The following table illustrates baseline emissions from aviation. These were projected in the latest inventory and are expected to increase 9% from current levels by 2050.

[114] By 2030 the level of statewide GHG emissions should be at least 50 percent below 2005 levels.

Baseline Emissions from Domestic Aviation (MM TCO2e)					
2026	**2030**	**2035**	**2040**	**2045**	**2050**
5.51	5.65	5.75	5.82	5.89	5.96

Table 21: Baseline Projected Emissions from Aviation.

Emission reductions are shown in the table below. We can see that the adoption of SAF contributes to a reduction of 3.4% from projected emissions in 2050.

	Emissions Reductions from SAF Use (MM TCO2e)						
Action	**2026**	**2030**	**2035**	**2040**	**2045**	**2050**	**Cumulative 2026-2050**
SAF	0.02	0.07	0.13	0.20	0.20	0.20	20.6

Table 22: Emission Reductions from Sustainable Airline Fuel Use.

Figure 14: Emissions Reductions Using Sustainable Aviation Fuels.

Marine Transportation Measures

Domestic marine transportation emissions were 5.4% of total transportation emissions in 2021. These emissions can be reduced by using cleaner fuels (target: 15% by 2050) as well as decreasing fossil fuel consumption with more efficient use of energy in cruise ships.

In the near term, use of renewable fuels in marine vessels can occur via adopting biodiesel in intra-island vessels, using bio-LNG in interstate vessels, and using biodiesel in harbor crafts. In the long term, e-methanol, e-ammonia, and green hydrogen - once all are produced at scale - can be used as sustainable marine fuels.

The following table illustrates baseline emissions of domestic and international marine transportation. Domestic emissions are projected in the latest inventory and are expected to increase 34% from current levels by 2050. International bunker fuel use emissions for marine transportation are not projected in the inventory and are assumed to be constant.

	Baseline Emissions from Marine Transportation (MM TCO2e)					
Source	**2026**	**2030**	**2035**	**2040**	**2045**	**2050**
Domestic	0.65	0.69	0.75	0.80	0.86	0.86
International	0.08	0.08	0.08	0.08	0.08	0.08

Table 23: Marine Vessel Baseline Emissions.

Emission reductions for each measure are shown in the table below, where the adoption of SMF contributes to decreasing 15% of marine emissions in 2050, as expected from the action's goal. Replacing 15% of vessel fuel with SMF would however contribute to a reduction of almost 8% of baseline emissions over the 2026-2050 period. Similarly, decreasing 10% of cruise fuel consumption by 2035 would have an 8% of reduction of 2026-2050 baseline emissions.

	Emissions Reductions from Sustainable Marine Fuel Use (MM TCO2e)						Cumulative 2026-2050
Action	**2026**	**2030**	**2035**	**2040**	**2045**	**2050**	
SMF	0.00	0.02	0.04	0.07	0.10	0.13	1.5
Cruise efficiency	0.001	0.004	0.008	0.008	0.008	0.008	0.16

Table 24: Marine Vessel Emission Reductions from Sustainable Marine Fuel Use.

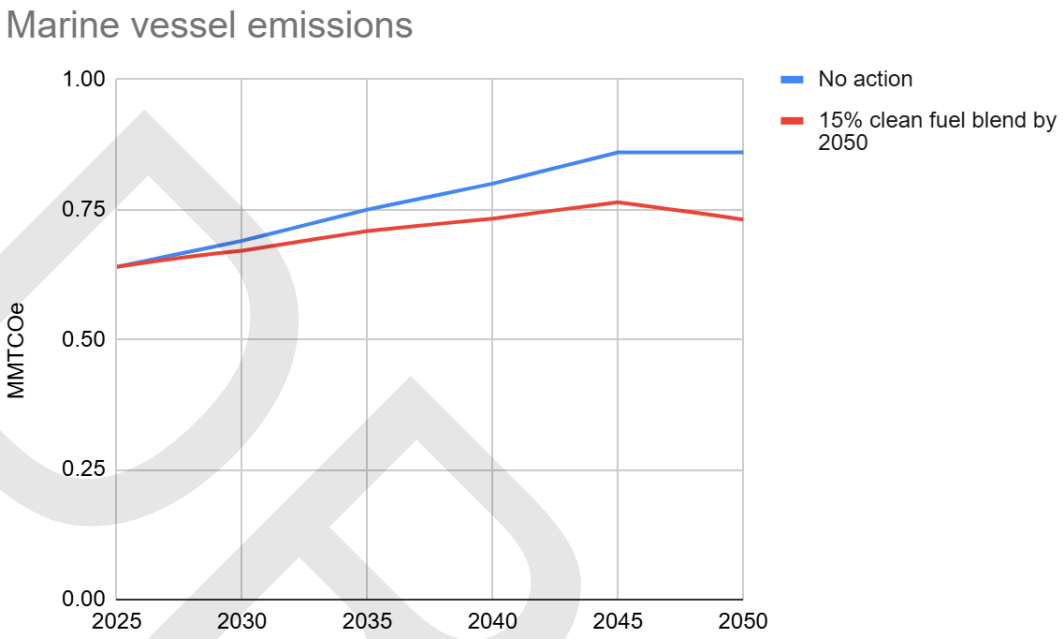

Figure 15: Marine Vessel Emission Reductions Using Sustainable Marine Fuels.

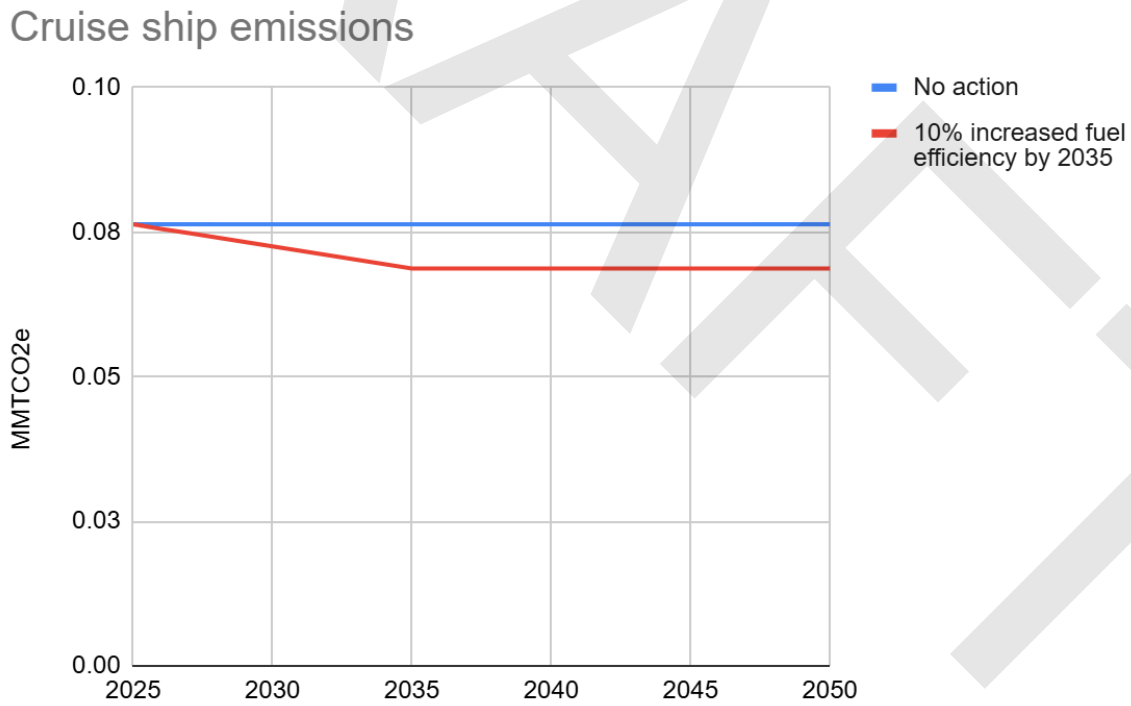

Figure 16: Emissions Reductions from More Efficient Cruise Ship Operations.

5.3.7 Key agencies

HDOT's foundational mission statement articulates a broad and integrated responsibility: "To provide a safe, efficient, accessible, and sustainable inter-modal transportation system that ensures the mobility of people and goods, and enhances and/or preserves economic prosperity and the quality of life". This mission explicitly recognizes HDOT's obligation to preserve Hawai'i's clean and healthful environment, reflecting a holistic approach to transportation that extends beyond traditional operational metrics like traffic flow or infrastructure maintenance. The inclusion of "sustainable" within the mission, implicitly defined as a system "largely powered by clean and locally sourced power," directly links decarbonization to the core function of HDOT. This signifies that decarbonization is not an ancillary environmental initiative but an intrinsic part of HDOT's fundamental responsibility to provide a functional and beneficial transportation system, suggesting a deeper institutional commitment to environmental stewardship.

In 2009, the Hawai'i legislature amended state statutes to require HDOT and Hawai'i's four county transportation departments to adopt complete streets policies that accommodate all users of the roadways, including pedestrians, bicyclists, transit users, motorists and persons of all ages and abilities.

5.3.8 Implementation schedule and milestones and Metrics for tracking progress

GROUND TRANSPORTATION		
Action	**Schedule**	**Metrics**
7. VEHICLES ELECTRIFICATION	2035: All new vehicles sales are ZEVs. 2050: gasoline-powered vehicles make up 5% of the total vehicle stock, due to their replacement with battery electric vehicles (BEV) and plug-in hybrid vehicles (PHEV).	Number of battery electric vehicles (BEV) and plug-in hybrid vehicles (PHEV) as percentages of total vehicle stocks. Number and location of EV charging infrastructure.
8. FUEL DECARBONIZATION	Using an ethanol blend for remaining gasoline consumption of LDVs starting at 10% in 2026. Ethanol blend levels increase 10%-15% every 5 years until the maximum practical ethanol content is reached (85%).	Ethanol content of LDV fuels.
9. MODE SHIFT	By 2050 reach a 20% reduction in total VMT. Increase transit service hours by 2% each year, starting in 2026 until 2050. Add 10 miles of bike lane infrastructure to each urban center annually.	Mode split, total VMT, per capita VMT, transit ridership and service hours, total miles of bike lanes.

AIR TRANSPORTATION		
10. FUEL DECARBONIZATION	2026: Mandate airports to supply SAF, at minimum 5% of total fuel use. Increase SAF requirements 5% every 5 years. By 2040: 20% of jet fuel is sustainable aviation fuel (SAF).	Aviation fuel use by type, including SAF.
11. REDUCE FUEL CONSUMPTION IN AIR TRANSPORTATION	Mandate efficient ground travel airplane engine use (e.g., single engine taxiing, no idling) effective by the end of 2026 at all airfields.	Fuel consumption of aircrafts during idle time.
12. AIRPOT GROUND TRANSPORTATION ELECTRIFICATION	2026: Develop an electrification plan and create a technical working group for cooperation and following the state of the art in electrifying airport ground transportation. 2035: All ground transportation is electrified.	Fuel use in and rate of electrification of airport ground operations vehicles.
MARINE TRANSPORTATION		
13. FUEL DECARBONIZATION	2026: Mandate marina fuel sales contain at minimum 5% SMF. Increase SMF mix by 5% every 10 years or fewer. 2040: 15% of vessel fuel is sustainable marine fuel (SMF).	Vessel fuel use by type, including SMF.
14. ENERGY EFFICIENCY IN CRUISE SHIPS	2027: Mandate best practices in marine vessel fuel consumption in Hawai'i ports. 2035: 10% of cruise fuel consumption is avoided.	Cruise ship fuel consumption volumes. Number of cruise ships docked.

Table 25: Transportation Sector Measures Implementation Schedule and Milestones.

5.3.9 Cost estimates for implementation

Decarbonizing vehicle fuel would have a net present value cost of $143 million. These costs were calculated using projected E85 (a fuel blend consisting of 85% ethanol and 15% gasoline) and gasoline projected costs, assuming they have a price difference[115] of 10% but after 2034 E85 is progressively cheaper than gasoline. On the other hand, decarbonizing jet fuels would cost more than $2 billion. This is because currently SAF is a bit more than 2 times more expensive than jet fuel[116]. This difference in price was projected to decrease, similarly than with E85; however, SAF will remain more expensive than jet fuel.

[115] Clean Cities And Communities Alternative Fuel Price Report, 2024, https://afdc.energy.gov/files/u/publication/alternative_fuel_price_report_july_2024.pdf

[116] IATA, Jet Fuel Price Monitor, accessed August 1, https://www.iata.org/en/publications/economics/fuel-monitor/

Action	Emission reductions MMT CO2e (2026-2050)	Costs (M$) - Net Present Value
Decarbonizing vehicle fuels	35.6	$ 143
Decarbonizing jet fuels	20.6	$ 2,293

5.3.10 Funding source

Hawai‘i’s Climate Action Plan (CAP) outlines major projects across sectors that depend on sustained federal support and supplemental funding sources:

- FTA 5307 formula and discretionary funds
- Safe Streets and Roads for All (SS4A)
- DOT Charging and Fueling Infrastructure Grants
- State Transportation Improvement Program (STIP)
- County user fees

5.4 AFOLU (Sources and Sinks)

5.4.1 Overview: Transforming AFOLU for Regenerative Impact

Hawai‘i’s **Agriculture, Forestry, and Other Land Use** (AFOLU) sector holds immense potential to mitigate climate change through carbon sequestration while strengthening local food systems, community resilience, and environmental stewardship. This strategy advances a vision rooted in aloha ‘āina (love for the land), circularity, and self-sufficiency, where waste becomes nutrient, degraded lands are healed, and the economy thrives by honoring ecological boundaries. This chapter outlines integrated measures, actions and commitments focused on soil health, nutrient cycling, ecosystem restoration, fire prevention, and capacity-building, all of which contribute to carbon capture, improving equity, and securing long-term prosperity for the people and lands of Hawai‘i.

Overarching goals activities and plans for the AFOLU sector in Hawai’i could be largely framed through a *Regenerative and Just Transition* values system. Regenerative agriculture through soil health infrastructure, eco-cultural and Indigenous Traditional Ecological Knowledge (ITEK) guidance for best practices for the islands is increasingly featured and valued.

Regenerative agriculture, including agroforestry and the application of local and Indigenous TEK for food forests and stewardship of ecosystems through hybridized adaptive traditional practices, strongly supports improvement of soil health, carbon sequestration, localized food systems and recovery of ecosystems, all of which translate to improved climate resilience. Agroforestry, silvopasture, organic and other regenerative land management strategies are finding support through a suite of County and State programs on both State-owned and managed land, and community or private land management initiatives.

With a residential population of over 1.4 million and at least 10 million annual visitors, Hawai‘i has one of the most food importation-dependent populations in the world. Importing over 90% of its food and fertilizer, the Hawaiian Islands are uniquely vulnerable to statewide and community food insecurity in the face of anthropogenic climate change, fuel price fluctuations and other economic or natural disturbances.[117] [118] [119] [120] Given 41% of Hawai‘i’s agricultural lands are

[117] "Increased Food Security And Food Self Sufficiency Strategy" (2012), https://files.hawaii.gov/dbedt/op/spb/INCREASED_FOOD_SECURITY_AND_FOOD_SELF_SUFFICIENCY_STRATEGY.pdf.
[118] Leung, PingSun & Loke, Matthew. (2008). Economic Impacts of Improving Hawaii's Food Self-sufficiency.
[119] Suryanata, Krisnawati. "Diversified Agriculture, Land Use, And Agrofood Networks In Hawaii". Economic Geography, vol 78, no. 1, 2009, pp. 71-86.
[120] Kent, George. "Food Security In Hawai'i" (2016), http://www2.hawaii.edu/~kent/FOODSECURITYINHAWAII.pdf.

currently unfarmed,[121] there is a huge opportunity to lower the state's food importation rates while mitigating climate change and protecting native ecosystems and cultural/traditional practices.

Central to carbon drawdown is the protection of existing native forests, restoration of historically forested areas and the revitalization of Hawai'i's soils. Healthy soils act as living carbon banks, offering not only climate benefits but also enhancing biodiversity, water retention, and productivity. In 2022 Hawai'i's forested areas were the primary carbon sink in the state contributing the majority of the 2.48 MMT CO2 Eq sequestered. Healthy native forests are essential to stabilizing soil organic carbon which accounts for over half of the carbon stored in Hawai'i's terrestrial ecosystems (approximately 158.9 Tg C of the total 232.9 Tg C where one Tg = 1 billion kilograms). Protecting forest watersheds is the most cost effective and efficient way to replenish our aquifers and reduce impacts from climate change by absorbing GHGs and reducing flooding, erosion, and siltation of reefs and fisheries. Additionally, forests sustain irreplaceable cultural and natural values and facilitate social and cultural connections to place. Forests and agroforests are an essential part of the solution to tackle climate change and biodiversity collapse. Healthy forests and agroforests provide jobs and sustainable livelihoods through forest products, conservation, and restoration.

5.4.2 Key Features

Fire resilience, invasive species control, forest management, and watershed protection:
For Hawai'i's regenerative transition to take root, land stewards must have access to tools, land security, and infrastructure that support sustainable practices. Actionable proposals include bolstering local and community-based efforts to advance Nature-based Solutions (NbS); implementation of the Strategic Plan for Hawai'i Wetlands to restore 20 wetland and loko'ia (traditional Hawaiian fishpond aquaculture) sites across Hawai'i; electrifying farming equipment and product transportation; DLNR's 30x30 watershed initiative; increase and acceleration of urban forestry and increasing carbon storage through climate smart farming and ranching.

As Hawai'i's primary carbon sink, watershed and existing forest protection programs that maintain healthy resilient forest systems must be prioritized. Resilient forest systems must include those with diverse age classes, healthy regeneration and a mix of species. Ungulate and invasive species control, and pathogen management programs must aggressively deal with these threats to forests. Climate change is amplifying wildfire threats across Hawai'i, particularly in areas of unmanaged lands and invasive species overgrowth. A proactive AFOLU fire resilience strategy is essential. This includes invasive species removal, particularly fire-prone species, and applying spacing typology and maintenance fire risk management methodologies for a replanting process of native and other appropriate plant species. It also involves restoring fire-adapted lands to conditions that retain more moisture and reduce soil and water runoff. Programs are needed to place abandoned agricultural lands back into agricultural or ecosystem restoration active management with potential for biofuel feedstock production incorporated.

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[121] Melrose, Jeffrey et al. "Statewide Agricultural Land Use Baseline 2015" (2015), http://hdoa.hawaii.gov/wp-content/uploads/2016/02/StateAgLandUseBaseline2015.pdf.

Urban Forestry
Trees are a critical component of cities. Research indicates that healthy trees can lessen impacts associated with the built environment by reducing stormwater runoff, energy consumption, and air pollutants.[122] *City of Honolulu, Hawai'i Municiple Forest Resource Analysis* found that annual benefits of urban trees in Honolulu total $3.9 million and average $90 per tree.[123] Urban forest initiatives are essential in keeping urban areas cooler, supporting flood control and sequestering carbon. The State's Tree Canopy Viewer is a visualization of where Hawai'i's tree canopy located, if the distribution of tree canopy in Hawai'i is equitable and where best to prioritize tree planting and maintenance so it may create the most positive impact for communities--especially those disproportionately burdened by eco-social risks that urban tree cover may help ameliorate. The high maintenance cost of urban trees, limited incorporation of landscaping in urban planning and challenges in recruitment has hampered efforts to increase urban forestry goals.

Technical Assistance, Monitoring, and Knowledge Infrastructure:
Scaling climate-smart practices requires more than funding. Farmers, ranchers, and land managers need access to science-based tools, data, and hands-on direct technical support. Support systems must include the development of a consortium of State agencies, local universities, and non-profits to provide technical assistance and educational materials on best farming practices that improve carbon sequestration potential and increase soil quality.

Reporting standards to measure carbon sequestration of agricultural and conservation land, as appropriate to the conditions, ecocultures, and needs of Hawai'i, must be established. A formal assessment on the impact of development and land use upon carbon sequestration across Hawai'i is needed, along with a rigorous collection of baseline data on food importation. In order to understand Hawai'i's vulnerability to climate shocks, stressors and supply chain disruptions, we need to have a clear and rigorously informed understanding of the precise conditions. This understanding will aid in strategically co-creating viable pathways to build food security and localized climate resilience.

Food System Equity and Localized Agricultural Support:
A regenerative food system must be inclusive, accessible, and rooted in local production. Increasing food sovereignty simultaneously supports carbon sequestration by shortening supply chains and revitalizing working lands. To ensure food equity and carbon alignment, measures, it is essential to deepen and continue partnerships with state and federal agencies to expand programs such as "Da Bux" which support low-income access to healthy local and organic foods,[124] and the 'Āina Pono/Farm-to-School Initiative. As unique programs like "Da Bux" intentionally are linked into federally funded Supplemental Nutrition Assistance Program (SNAP) program in order to make healthy local organic and climate considered foods accessible to marginalized and most-

[122] City Of Honolulu, Hawai'i Municipal Forest Resource Analysis, (2007), https://www.honolulu.gov/tod/wp-content/uploads/sites/73/2025/02/Municipal_Forest_Resource_Analysis.pdf
[123] Ibid.
[124] Da Bux, https://dabux.org/

vulnerable populations, these too must be reassessed as SNAP experiences significant budget cuts in 2025. An audit of food services procurement processes across State of Hawai‘i departments is needed to provide specific recommendations on procurement code amendments that will increase purchasing of locally produced food. Tax credits for agriculture producers that grow food for local consumption and food manufacturers who produce value-added products with locally grown crops would support acceleration of local food production and market webs. A plan for the development of a hatchery to enhance stock at loko i‘a (traditional fishponds) across Hawai‘i is also crucially needed.

Wetlands and Loko i’a

Wetlands are the final line of defense to capture sediment, nutrients, and pollutants, and absorb flood events and coastal surges[125,126]. Flash flooding, severe weather, and extreme storm surges cause catastrophic impacts to community access and safety. Damage to reefs also impacts food supply. In 2017, Hawai‘i’s aquatic resources supplied more than 7 million local meals, and the non-commercial value of catch was estimated between 7–12 million USD[127]. Sedimentation adversely affects coral and reduces overall reef productivity[128]. Wetland habitat includes culturally important Indigenous agriculture lo‘i kalo (wetland taro patches) and loko i‘a (fishponds) historically created a mosaic of wetland habitat along the coast which was highly suitable for waterbirds and provided sustainable food sources for a large population.[129]

Regulatory and Policy Environment:

The State regulatory and policy environment reflect concern across Hawai’i regarding biosecurity, biodiversity and ecosystems recovery, and investment in conservation-rooted agriculture and carbon-smart land management. A fuller picture of the values and commitments of communities can be found at the counties level (5.4.5 County Level Variations and Actions). Highlighted below are key legislative and policy commitments in the State that strive to address the threat of invasive species to the local endemic and ‘canoe plant’ (traditional Hawaiian Indigenous ecosystems and food systems management) recovery, as well as some piloted learning steps towards direct support to local land managers for carbon sequestration through local food and ecosystems regeneration.

HRS 155–4 identifies the Department of Agriculture and Biosecurity (DAB) as the agency responsible for biosecurity and

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[125] NOAA (2014), Sea Level Rise and Coastal Flooding Impacts Viewer, https://coast.noaa.gov/slr/
[126] Hovis, M., Hollinger, J. C., Cubbage, F., Shear, T., Doll, B., Kurki-Fox, J. J., Line, D., Fox, A., Baldwin, M., Klondike, T., Lovejoy, M., Evans, B., West, J., & Potter, T. (2021). “Natural Infrastructure Practices as Potential Flood Storage and Reduction for Farms and Rural Communities in the North Carolina Coastal Plain. Sustainability”. 13(16):9309.
[127] Grafeld, S., Oleson, K. L., Teneva, L., & Kittinger, J. N. (2017). Follow that Fish: Uncovering the Hidden Blue Economy in Coral Reef Fisheries. PloS one, 12(8), e0182104.
[128]Pacific Birds, “Strategic Plan for Hawai‘i Wetlands 2024”, (2024), PB-Hawaii-Plan-FINAL-2.27.24.pdf
[129] Ibid.

Invasive species and biosecurity are regulated under DAB) through HRS 150A – the "Hawai‘i Plant Quarantine Law" and Hawai‘i Administrative Rules Chapters 4-70 – Plant Import Rules, 4-71 – Non-Domestic Animal Import Rules, 4-71A – Microorganism Import Rules, 4-72 – Plant Intrastate Rules, and 4-73 – Plant Export Rules.

ACT 185 / Section 171-6 Hawai‘i Revised Statutes: established the Hawai‘i Carbon Smart Land Management Assistance Pilot Program. This program, within the Department of Land and Natural Resources, incentivizes carbon sequestration activities on farms and forests through compensation contracts for eligible practices. The program aims to promote keeping forests and farmlands intact and sequestering additional carbon on the lands.

In 2022, Hawai'i enacted HB1992 HD3 SD1 CD1 (Act 131) to allow composting in agricultural districts by designating it as a permissible land use. The Act also establishes and funds new staff capacity to help eliminate permitting barriers for small-scale compost operations. The purpose of the Act is to encourage the production of local compost and the diversion of certain materials from the State's waste streams.

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ACT 144 -RELATING TO AGRICULTURE. Requires the department of education, department of health, department of public safety, department of defense, and University of Hawai‘i system to ensure that a certain percentage of food purchased for public schools, youth campuses, public hospitals, public prisons, and University of Hawai‘i system academic programs consists of fresh, local agricultural products or local value-added, processed, agricultural, or food products. Requires each of those departments and the University of Hawai‘i system to annually report to the legislature on progress made toward meeting these benchmarks and clarifies the information to be reported.

ACT 197--RELATING TO SPECIAL PURPOSE REVENUE BONDS TO ASSIST THE HAWAIIAN LEGACY REFORESTATION INITIATIVE TO RESTORE HAWAII'S FORESTS AND NATURAL RESOURCES. Authorizes the Department of Budget and Finance to issue special purpose revenue bonds to assist Hawaiian Legacy Reforestation Initiative, LLC, in its mission to proliferate a sustainable model of endemic reforestation, ecosystem revitalization, endangered species recovery, and carbon credit sequestering.

ACT 238 --RELATING TO CLIMATE MITIGATION. Establishes a goal for the statewide greenhouse gas emissions limit to be at least fifty per cent below 2005 levels by 2030. Requires the Hawai‘i state energy office to conduct a study to determine Hawai‘i’s pathway to decarbonization and identify challenges, opportunities, and actions that will be needed to achieve those goals. Appropriates funds out of the energy security special fund for the study.

ACT 302-RELATING TO COMPOSTING. Establishes and appropriates funds for a compost reimbursement program within the Department of Agriculture and for one full-time permanent compost reimbursement program manager position. Requires an annual progress report to the Legislature prior to each regular session.

ACT 175 --RELATING TO THE FARM TO SCHOOL PROGRAM Moves the Hawai‘i farm to school program from the Department of Agriculture to the Department of Education. Establishes a programmatic goal for the Department of Education that at least 30% of food served in public schools shall consist of locally sourced products by 2030. Creates an annual reporting requirement.

ACT 151 - RELATING TO AGRICULTURE Requires the Department of Agriculture, in cooperation with the Office of the Governor, to develop a strategic plan to double local food production and increase food exports by 2030. Requires the Department of Agriculture to submit the strategic plan to the Legislature. Appropriates funds.

ACT 015 - RELATING TO ENVIRONMENTAL PROTECTION Renames the Carbon Farming Task Force established by Act 33, Session Laws of Hawai‘i 2017, as the Greenhouse Gas Sequestration Task Force and makes the task force and Hawai‘i Climate Change Mitigation and Adaptation Initiative permanent. Aligns the State’s clean energy and carbon sequestration efforts with climate initiative goals. Amends membership and duties of the Task Force. Establishes a zero emissions clean economy target for the State. Makes an appropriation.

ACT 181 - RELATING TO JOB CORPS PROGRAM Allows the governor to designate the department of land and natural resources to administer or enter into agreements for the administration of a green job youth corps program that provides temporary work and training opportunities to help address the unemployment impacts of the COVID-19 pandemic and support economic diversification. Requires a report to the legislature. Appropriates American Rescue Plan Act funds.

ACT 045 - RELATING TO THE OFFICE OF PLANNING Establishes a statewide sustainability branch within the Office of Planning. Updates and reaffirms the role of the office to coordinate among state agencies regarding climate change adaptation and sustainability.

ACT 146 - RELATING TO SUSTAINABILITY Requires the Office of Planning to update the Hawai‘i 2050 Sustainability Plan and submit the updated plan to the Legislature prior to the Regular Session of 2021 and every tenth session, thereafter, using the goals and priority guidelines of the Hawai‘i State Planning Act and the Hawai‘i Climate Change Mitigation and Adaptation Initiative as guiding principles. Appropriates funds.

ACT 016 - RELATING TO THE ENVIRONMENT Requires the Office of Planning in partnership with the Greenhouse Gas Sequestration Task Force to establish a framework for a carbon offset program and report to the Legislature. Appropriates funds.

ACT 101 - RELATING TO GREEN JOB YOUTH CORPS. Appropriates funds to the Department of Land and Natural Resources to continue the Green Jobs Youth Corps Program.

ACT 33 RELATING TO THE HAWAII YOUTH CONSERVATION CORPS.
Authorizes the Governor to designate the Department of Land and Natural Resources to administer or enter into an agreement for the administration of a green jobs youth corps to provide temporary work and training opportunities in the fields of natural resource management, agriculture, or other sustainability-related professions to young adults ages thirty-eight and younger. Requires the Department to partner with an organization that has received accreditation from the Corps Center of Excellence Accreditation Program or has at least ten years of experience providing similar programming statewide in the State, or both

Food Hub - Pursuant to Section 16 of Article Ill of the State Constitution, SB2218 SD1 HDI CD2, entitled "RELATING TO A FOOD HUB PILOT PROGRAM" became law as ACT 313, Session Laws of Hawai‘i 2022, on July 13, 2022, for a period of five years and was assigned to the HDOA. This program established food hubs, which are centrally located facilities having a business management structure that facilitates aggregation, storage, processing, distribution, and marketing of locally produced food products. By actively coordinating these activities along the value chain, food hubs may provide wider access to institutional and retail markets for small- to mid-sized producers and increase consumer access to fresh healthy food, including those consumers in underserved areas and food deserts.

Further to the regulation and policy environment, the Hawai'i Department of Agriculture (HDOA) supports initiatives like the Healthy Soils Program and works with partners to promote best management practices (BMPs) for improving soil health and increasing carbon sequestration in agricultural and natural environments. BMPs include practices such as using cover crops, agroforestry, composting, and reduced tillage.

The HDOA was appropriated $1,500,000 for the establishment of a five-year program to support local farmers and localized markets. Grants-In-Aid (GIA): The legislature makes appropriations for grants in accordance with Chapter 42F of the Hawai‘i Revised Statutes (HRS). There are two types of grants: Operating and Capital Improvement Project (CIP) grants. The legislature decides who is awarded a grant, the type of grant, the award amount, what the funds can be used for, and which state department will administer said award. HDOA does not participate in the application process as the House Finance Committee and the Senate Ways and Means Committee does the process. The HDOA was assigned 11 operating awardees for a total of $2,085,000.

Carbon Sequestration: The HDOA is involved in projects and policies aimed at enhancing carbon sequestration in agricultural and natural lands. This includes participation in the Greenhouse Gas Sequestration Task Force and support for initiatives like the Carbon Smart Program, which provides grants to land managers for regenerative practices including carbon sequestration.

Agroforestry: The HDOA recognizes and supports the use of agroforestry, which involves integrating woody plants and crops to revitalize agriculture, enhance biodiversity, and promote carbon sequestration on fallow agricultural lands.

5.4.3 Numbers and Targets: Current Status and Future Goals

The *Hawai'i Greenhouse Gas Emissions Report for 2022* listed total emissions from the AFOLU sector at 1.11 MMT CO2 Eq., accounting for 5.5 percent of total Hawai'i emissions.[130] Carbon removals by sinks were 2.48 MMT CO2 Eq. in 2022. The AFOLU sector resulted in a net increase in carbon stocks (i.e., net CO2 removals) of 1.37 MMT CO2 Eq. in 2022. Forest carbon accounted for the largest carbon sink, followed by urban trees, and landfilled yard trimmings and food scraps. Relative to 1990, emissions from AFOLU sources in 2022 were lower by roughly 24.0 percent. Carbon removals from AFOLU sinks in 2022 decreased by roughly 3.6 percent relative to 1990 sinks. As a result, net removals (including sources and sinks) from AFOLU increased by 47.2 percent in 2022 compared to 1990 (i.e., this sector "removes" more carbon than it did in 1990).[131]

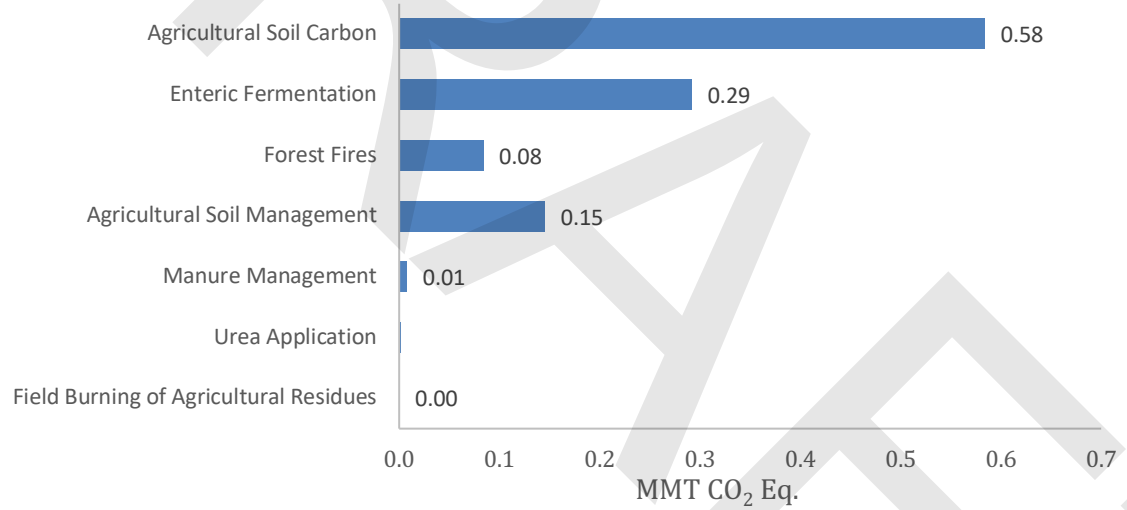

Figure 17: 2022 AFOLU Emissions by Source Excluding Sinks (MMT CO2 Eq.)[132]

[130] Hawai'i Department of Health. (2025, April). *Hawai'i Greenhouse Gas Emissions Report for 2022*. https://health.hawaii.gov/cab/files/2025/04/Final-2022-GHG-Emissions-Report.pdf
[131] Ibid.
[132] Ibid.

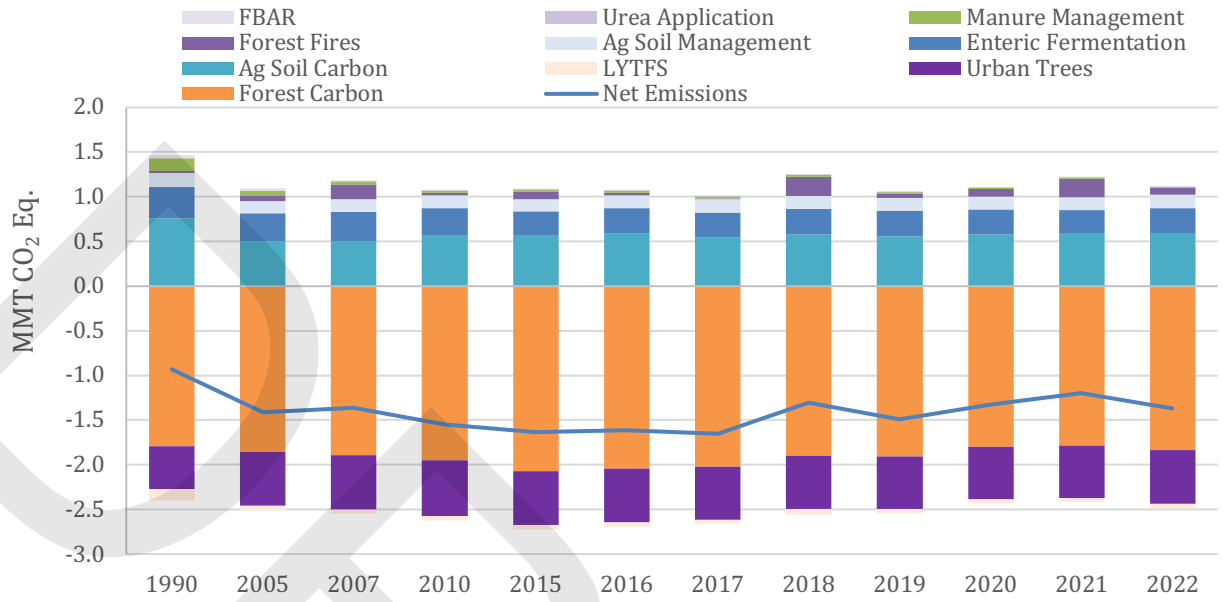

Figure 18: AFOLU Emissions and Removals by Source and Sink Category and Year (MMT CO2 Eq.)[133]

While at present there are no explicitly State-mandated targets, there *are* goals and commitments to which State and County departments have committed, such as 30X30 Watershed Initiative[134] to protect 30% of Hawai'i's priority watershed forests by the year 2030, and the State's pledge to the international One Trillion Trees (1TT) initiative [135] to protect, conserve, and restore 100,000,000 by 2030. DLNR's 30x30 watershed initiative has successfully protected 22% of watersheds and is on the path to meet the goal or protecting 843,000 acres. [136]

5.4.4 Challenges and Innovations

The challenges and opportunities for AFOLU in Hawai'i tend to be deeply interconnected, with many solutions embedded in the difficulties faced.

- **Reliance upon food imports** creates deep climate disruption vulnerability and also an opportunity to grow traditional nature-based and localized land management practices which would support local food security alongside creating carbon sequestration and adaptive resilience for our island communities.

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[133] Ibid.
[134] 30x30 Watershed Initiative, https://dlnr.hawaii.gov/dofaw/30x30/#:~:text=These%20forests%20are%20the%20foundation,reduce%20the%20risk%20of%20wildfires.&text=The%20Division%27s%2030%C3%9730,forest%20protection%20and%20recreation%20opportunities.
[135] One Trillion Trees Pledge, https://us.1t.org/pledge/state-of-hawaii/
[136] Aloha+ Challenge, https://alohachallenge.hawaii.gov/pages/natural-resource-management

- **The recent 2025 federal funding cuts and freezes** for AFOLU sectors has stopped vital projects on agriculture, forestry and ranch lands, as well as support to localized food markets and access to healthy local foods (via Da Bux and SNAP) for Most Vulnerable Communities (MVCs). Continued cuts to staffing and technical service providers will impede needed support for increasing efforts for food and water security as well as protecting and increasing carbon sinks.
- **Invasive species and wildfire are part of a feedback loop that continues to threaten agriculture, native ecosystems and lives.** Species such as deer, goats, ants, fountain grass, coqui frogs, and Albizia cause soil erosion, prevents the growth of other plants, munch on agricultural goods, lead to lost crops, spread disease and injured pets.[137] The frequency of wildfires in the Hawaiian Islands has increased by 400% over the last century. The combination of less rainfall and severe drought from climate change, along with the introduction and unmanaged growth of non-native grasses, have contributed to the increased frequency and intensity of wildfires across the State.[138]
- **Disruption to Indigenous food and management systems** and island vulnerabilities that exist due to isolation, globalized and extractive economies, that have deforested more than half of all of Hawai‘i’s forests and eroded soils in important agricultural lands. Diversion of water resources and fracturing of the ahupua‘a system and native food system practices have left it challenging for many small farmers to find healthy spaces to grow foods.
- Gaps in Data: federal cuts put an end to the research and the programs. The data sets and methodologies developed on ‘mainland’ U.S. states do not include Hawai’i, and are not appropriate for Hawai’i’s context. While some global tropical research may help frame a focus for learning in Hawai’i, their contexts are not identical, and the research around carbon capture numbers have not been consistent nor precise. A 2022 report on emissions noted data weaknesses and gaps in the AFOLU sector, particularly as far as soil amelioration and carbon-smart agriculture and ecosystems regeneration is concerned. Efforts have been underway to close this research and data gap, particularly through the Climate Smart Commodities partnership and the University of Hawai’i Manoa’s S(HEE)R lab; however, in 2025 both programs were shut done through funding cuts. A commitment to recover and reinvigorate the essence of these programs and capabilities is essential if Hawai’i is to have a fully informed strategy to maximize carbon sequestration and increase overall resilience to the impacts of climate change.

The answers reside in the recovery of that which has been lost or harmed, alongside respect and deference paid to those who carry the lineages of that wisdom.

- **Locally owned and facilitated ecotourism alongside a higher prioritization upon the protection and restoration of land and agricultural systems** (particular Carbon-Smart and agroforestry strategies) will help shift a balance towards wellbeing for Hawai‘i.
- The newly passed **Hawai’i** ‘***Green Fee***’ will commence on January 1, 2026, and it is hoped that accrued resources will be well-allocated for the support of a climate-and-carbon considered agriculture, forest, and ecosystems recovery actions- of utmost priority for Hawai‘i’s survival and wellbeing.

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[137] DLNR, Invasive Species, Hawaii Invasive Species Council | Invasive Species
[138] DLNR, Invasive Species, Hawaii Invasive Species Council | Invasive Grasses in Hawaii and their Impacts

- **Hawai‘i strives to recover and protect its native food systems and ecosystems (particularly through promotion and support of Hawaiian Indigenous Traditional Ecological Knowledge** ‘I-TEK’ and traditional practices), and to learn from a past isolation that understood the necessity of careful water and land management from Mauka to Makai (from the mountains to the sea).

5.4.5 County-Level Variations and Actions

Hawai‘i County (Hawai‘i Island)

- The County’s **Agriculture and Food Systems Program** leads planning and provides **grants**, policy coordination, advocacy, and extension services to farmers, foresters, aquaculture operations, and natural-resource users. The county allocated roughly **$419,000** to support these efforts Kaua'i SWCD+2Kauai Government+2Kauai Government+2rd.hawaiicounty.gov.

- A **County Agriculture Advisory Commission** offers formal recommendations to the Mayor regarding agricultural infrastructure, marketing, research, education, and outreach tied to the County's Agriculture & Food System Plan Hawaii County.

- The county has a **Native Forest Dedication** property-tax program (draft benefits table updated July 2024) incentivizing reforestation and forest farming with reduced assessed values for forestry-designated land Maui County+15hawaiipropertytax.com+15cms.ctahr.hawaii.edu+15.

Maui County

- **Department of Agriculture** established via charter in **July 2022**, explicitly tasked with developing a diversified, resilient agricultural system to support local food security, ecosystem regeneration, and agro-economic development. A 2024–28 Strategic Plan guides those goals Maui County+4Maui County+4Maui County+4.

- Maui County annually holds **grant-readiness workshops** and offers **agricultural and farm expansion grants** (e.g. FY2026 currently pending release) to local producers. Grant readiness events are held regularly and full applications expected in August 2025 Hawaii County+4Maui County+4Kauai Government+4.

- The county maintains close **partnerships** with Maui County Farm Bureau and Maui Flower Growers' Association to promote farming development and industry advocacy Maui County.

- Created a **Food & Nutrition Security Plan**, overseen by county staff, food producers, and community leaders to assess vulnerabilities and coordinate long-term strategies Maui County+1Maui County+1.

- Public infrastructure investments include expanding **Kula Agricultural Park** and planning additional county agricultural parks—including one on Lānaʻi—to increase land access for local growers Maui County Council.

Kauaʻi County

- Kauaʻi County's **Office of Economic Development (OED)** administers a competitive **Agriculture Farm Expansion Grant** program (FY 2024–25), funding local projects that expand agricultural capacity across the island. Awards announced in early 2025 Kauai Government+4kauaiforward.com+4Kauai Government+4.

- Through its **Agricultural Dedication Program**, the county offers property-tax relief to land used for active farming or livestock. A recent ordinance expanded benefits and reduced administrative burdens for participants Kauai Government+1Kauai Now+1.

- Kauaʻi County collaborates with nonprofit groups and industry stakeholders (Farm Bureau, Tropical Flower & Foliage Assn, aquaculture groups) to develop grant programs and technical assistance offerings — though grants are structured for organizations, not individual farmers Kauai Government.

- The county leverages **NRCS and SWCD programs** like EQIP, CSP, and AMA to provide farmers/forest landowners with **technical and financial support** for soil conservation, water management, and habitat restoration under local planning frameworks Kaua'i SWCD+1Kaua'i SWCD+1.

City & County of Honolulu (Oʻahu)

- The county's **Division of Urban Forestry** (within DPR) manages urban forestry, including tree acquisition programs, botanical gardens, and oversight of public tree plantings and canopy monitoring honolulu.gov+2honolulu.gov+2smarttreespacific.org+2.

- Under the **Kaulunani Community Forestry Program**, City & County staff lead **tree-planting**, **education**, and volunteer **Citizen Forester** programs (e.g. Hoʻolāʻau pilot), funded in part via the County to expand urban canopy across neighborhoods smarttreespacific.org+3smarttreespacific.org+3cms.ctahr.hawaii.edu+3.

- The county spearheaded a **$3M agricultural grant program** (funded via ARPA/Federal recovery funds), disbursing $1M annually in 2022–24 to support farmers, ranchers, and growers on Oʻahu; it supports local food production and pandemic recovery efforts revitalizeoahu.org.

- Related forestry/urban forestry policy includes the **"100,000 Trees by 2025"** campaign, inviting residents to count and report trees planted to build canopy data and community stewardship honolulu.gov.

5.4.6 Measure Description and GHG reduction

Emission reduction actions were evaluated. These actions include implementing Nature-based Solutions (NbS) through ecosystems restoration and agroforestry, and promoting agricultural soil amendments.

Calculations of GHG sinks, emissions and reductions are extremely challenging due to significant data gaps in the AFOLU sector. The data sets and methodologies developed on 'mainland' U.S. states often do not include Hawai'i's soil types, forestry types or do not include Hawai'i at all. The Climate Smart Commodities partnership which was terminated by the federal administration was working to develop appropriate indicators and categories to better understand the carbon sink data from the carbon smart land management programs. This shows an unfortunate carry-over from a data challenge reported in the 2022 Hawai'i Greenhouse Gas Emission Report and the AFOLU numbers thereby impact overall numbers. This potentially misses opportunities to demonstrate lower net emissions due to ecosystems recovery and carbon smart farming practices.

Agricultural Soil Amendment

According to the HDOH GHG inventory, the AFOLU sector is the second largest contributor to total emissions in Hawai'i (7.5%) when excluding sinks. This measure seeks to capture carbon in agricultural soils through soil amendments from local waste streams and agricultural practices that decrease GHG emissions. The following supporting actions are considered:

- Integrate waste and land management systems to recapture nutrients and generate soil carbon amendments using a Circular Economy (CE) approach, integrating 'āina stewards, local meat processors, and agricultural producers.
- Incentivize the use of biochar through pyrolysis of dead or dying invasive tree species, which will be applied to soil (implemented at a pilot level through projects across the state).
- Infrastructure investments in regenerative agriculture through soil health
- Invest in infrastructure that facilitates climate-smart implementation practices and increase access to resources for land stewardship and agricultural production, for example state-funded and implemented removal of Albizia and other invasive species on private lands; state subsidies and support for the creation of local composting businesses across the islands, and facilitated support for composting agencies to access larger markets and to have support to meet standard regulations; state funding for transitioning to or establishing carbon-smart land management practices such as agroforestry, silviculture and silvopasture, and for more local farmers to get started within the agricultural sector, and education and support to thrive as part of an essential local food economy.

Carbon capture from organics waste streams is possible through composting schemes. Given that compost is used to amend agricultural soils, we can assume that 10% of synthetic fertilizer use will be reduced.

Nature-based Solutions (forests and wetlands)

According to the inventory, carbon removals from AFOLU sinks have been decreasing since 1990 by roughly 1.6% between 1990 and 2021. According to the baseline projected, these sinks are expected to keep decreasing. Actions to increase carbon sinks through Nature-based Solutions (NbS) include restoration of forest ecosystems and wetlands.

Goals for restoring forest ecosystems are to plant 11 million native trees and plants, preserving 23,000 acres of forested lands and protecting 30% of priority watersheds by 2030 (843,000 acres). Priority areas for planting trees include:

- Degraded lands, to revitalize abandoned agricultural land and reduce wildfire risk.
- County-owned undeveloped or vacant lands that can be reforested.
- Mauka areas that benefit watershed capacity and quality.
- Urban areas, to improve the health, resilience, and ecosystems, and to mitigate the impacts of heat.

Protecting and restoring wetlands follows from the Strategic Plan for Hawai‘i Wetlands, which targets restoring 20 wetland and loko‘ia sites across Hawai‘i. A supporting action for this is to provide State and County budgets for infrastructure investments in aloha ‘āina projects. A plan for the development of a hatchery to enhance stock at loko i‘a (traditional fishponds) across Hawai‘i is also crucially needed.

GHG Emission Reductions

The following table shows baseline emissions of the relevant sources within the AFOLU sector.

	AFOLU Baseline Emissions (MM TCO2e)					
Source	**2026**	**2030**	**2035**	**2040**	**2045**	**2050**
Agricultural Soil Management	0.14	0.14	0.14	0.13	0.13	0.13
Forest Carbon (sink)	-1.69	-1.63	-1.63	-1.63	-1.63	-1.63

Table 26: AFOLU Baseline Emissions.

The table below illustrates emission reductions of the two actions calculated. Avoiding fertilizer use is reflected in the agricultural soil amendment action; planting 11 million trees falls within the forest actions category. The latter increases carbon capture, which is why results are negative. Planting 11 million trees would increase the current projected capture from forests from 0.18 MM TCO2e/year to 0.90 MM TCO2e.

	Emissions Reductions from AFOLU Actions (MM TCO2e)						Cumulative 2026-2050
Action	**2026**	**2030**	**2035**	**2040**	**2045**	**2050**	
Agricultural Soil Amendment	0.01	0.01	0.01	0.01	0.01	0.01	0.3

Forests	-0.18	-0.90	-0.90	-0.90	-0.90	-0.90	-20.8

Table 27: Emissions Reductions from AFOLU Actions (MM TCO2e).

5.4.7 Key implementing agency (or agencies)

- Department of Land and Natural Resources
  - Division of Forestry and Wildlife
    - Forestry, NEPM Native Ecosystems Protection & Management Program *including Watershed Partnerships, Natural Area Partnership Program, Legacy Land Conservation Program and Plant Extinction Prevention Program.
    - Kaulunani Urban and Community Forestry
    - Forestry Stewardship Program
    - NAPP-Natural Area Partnership Program
    - Carbon Smart Land Management Assistance

- Department of Transportation
- HIARNG (Hawai'i Army National Guard / Department of Defense)
- Department of Agriculture and Biosecurity

5.4.8 Implementation schedule and milestones and Metrics for tracking progress

AGRICULTURAL SOIL AMENDMENT		
Action	**Schedule**	**Metrics**
Plant 11 million native trees and plants, preserving 23,000 acres of forested lands and protecting 30% of priority watersheds (843,000 acres).	Action to be completed by the end of 2030, requiring: • Planting ~2 million trees annually • Designating ~4.6 thousand acres of forested lands as protected annually • Protecting 6% of priority watersheds as protected annually	Annual acres of planted and acres of protected lands.

Table 28: AFLOU Sector Measures Implementation Schedule and Milestones.

5.4.9 Cost estimates for implementation

Implementing the tree planting action would cost in total $49 million. These costs were calculated using funding referenced in the PCAP, assuming $5 per tree planted.

Action	Emission reductions MMT CO2e (2026-2050)	Costs (M$) - Net Present Value
Tree planting	20.8	$ 49

5.4.10 Funding sources

Hawai‘i’s Climate Action Plan (CAP) outlines major projects across sectors that depend on sustained federal support and supplemental funding sources:

- NOAA Coastal Resilience and Habitat Restoration grants
- NSF Biodiversity on a Changing Planet
- USDA Forest Resilience Programs
- Department of Agriculture
- Department of Land and Natural Resources
- Local initiatives like the Maui County Green Grants Program

5.5 Waste and Material Management

5.5.1 Overview:

The State of Hawai‘i’s waste management sector operates under the oversight of the Office of Solid Waste Management (OSWM), which is a component of the Hawai‘i Department of Health’s (DOH) Solid and Hazardous Waste Branch (SHWB).[139] The OSWM is tasked with providing annual reports to the Hawai‘i State Legislature, detailing the progress made toward the state’s waste reduction objectives. Integral to these efforts are three primary programs administered by the OSWM: the Deposit Beverage Container (DBC) Program, the Electronic Waste and Television Recycling and Recovery Program, and the Glass Advance Disposal Fee (ADF) Program. These programs are fundamental to achieving the state’s overarching waste reduction goals.

Hawai‘i Revised Statutes (HRS) Section 342G-2 establishes a foundational hierarchy for solid waste management practices that guides both state and county strategies. This hierarchy prioritizes: 1) Source Reduction, 2) Recycling (inclusive of bioconversion), and 3) Landfilling and/or Incineration. This statutory framework underscores a commitment to minimizing waste generation and maximizing resource recovery before resorting to disposal methods. The successful implementation of the initial two practices in this hierarchy is designed to reduce the volume of waste requiring landfilling or incineration.[140]

Beyond solid waste, the Hawai‘i Department of Health’s Wastewater Branch plays a crucial role in environmental protection and public health. This branch administers statewide engineering functions related to water pollution control, overseeing municipal and private wastewater treatment facilities, individual wastewater systems (including efforts to address substandard cesspools), and the Clean Water State Revolving Fund. A significant initiative within this branch is the Recycled Water Program, which has gained increasing importance due to Hawai‘i’s growing population, finite potable water resources, and challenges associated with wastewater disposal.[141]

Hawai‘i’s distinctive island geography and its relatively small economy present inherent and persistent challenges for effective waste management. The limited local market and the high operational costs associated with land values, labor, utilities, and specialized equipment mean that nearly all recyclable materials collected within the state must be shipped to larger processing

[139] Office of Solid Waste Management Annual Report to the thirty-second Legislature State of Hawai’i, p.2, accessed June 10, 2025, https://health.hawaii.gov/opppd/files/2024/03/27_2024-OSWM-Legislative-Report.pdf
[140] Ibid.
[141] Wastewater Branch - Hawai‘i State Department of Health, accessed June 10, 2025, https://health.hawaii.gov/wastewater/

facilities on the U.S. mainland or in Asia.[142] This reliance on external markets introduces significant logistical complexities and economic vulnerabilities.

To build true circularity and resilience in Hawai‘i’s waste sector, substantial investment in local processing capabilities or the development of innovative, high-value end-uses for recycled materials is necessary. Such initiatives could help offset the high internal costs and reduce the current dependency on export markets. This implies a strategic need for policies that actively attract and support on-island recycling businesses, potentially through targeted subsidies or tax incentives, to foster a more resilient and self-sufficient local waste economy. Without such measures, the state will continue to face an uphill battle in consistently meeting its ambitious waste reduction targets.

5.5.2 Key Features

Solid Waste Management Practices:

Hawai‘i’s approach to solid waste management is guided by a statutory hierarchy, emphasizing waste prevention and resource recovery.

Source Reduction:
As the highest priority in the state’s waste management hierarchy, source reduction is defined by HRS Chapter 342G-1 as the design, manufacture, and use of materials to minimize both the quantity and toxicity of waste produced.[143] This also encompasses efforts to reduce waste creation through product redesign or by fundamentally altering societal consumption patterns. While conceptually the most impactful strategy for waste prevention, quantifying source reduction remains inherently difficult. Its effectiveness is often assessed through estimates rather than precise measurements, as it involves reducing waste that is never generated in the first place either because of product redesign of through the reduced consumption of products by the public.

Recycling (including Bioconversion):
Recycling is statutorily defined as "the collection, separation, recovery, and sale or reuse of secondary resources that would otherwise be disposed of as municipal solid waste, and is an integral part of a manufacturing process aimed at producing a marketable product made of postconsumer material".[144] This process of collecting and reprocessing materials into new products is the most easily quantifiable waste diversion activity, with data regularly collected from recycling facilities by both the State and counties.[145] Bioconversion, primarily exemplified in Hawai‘i by the composting of green waste (such as tree trimmings and grass clippings), is considered a recycling activity and its reported weights are included within overall recycling figures.

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[142] Office of Solid Waste Management Annual Report to the thirty-second Legislature State of Hawai’i, accessed June 10, 2025, https://health.hawaii.gov/opppd/files/2024/03/27_2024-OSWM-Legislative-Report.pdf
[143] Ibid.
[144] Ibid.
[145] Ibid.

Reuse:
Although not explicitly identified as a statutory priority within the waste management hierarchy, the OSWM actively promotes reuse activities.[146] Reuse involves utilizing a product again without the need for reprocessing, whether for its original purpose or a different application. Similar to source reduction, quantifying reuse is challenging and often impractical. This is due to its widespread and unregulated nature, as it occurs at many levels, from individuals reusing plastic food containers or glass jars to larger-scale material exchanges. The difficulty in measuring these activities means that their contribution to overall waste reduction and environmental benefits may not be fully captured in official statistics.

The inherent difficulty in quantifying source reduction and reuse, despite their high priority in Hawai‘i’s waste management hierarchy, presents a notable challenge for comprehensive climate action reporting. While recycling rates are readily measurable and often the focus of public reporting and policy, the true impact of the state’s efforts in preventing waste at its origin may be significantly understated. For future reporting, Hawai‘i could explore innovative proxy metrics or qualitative indicators for source reduction and reuse activities to better convey their environmental benefits, even in the absence of direct quantification. This might involve tracking the implementation of relevant policies (e.g., plastic bans), public participation rates in reuse initiatives, or shifts in industry practices towards reduced packaging.

Wastewater Management:
The Hawai‘i Department of Health’s Wastewater Branch is responsible for protecting public health and the environment through the administration of statewide engineering functions related to water pollution control.[147] Its purview includes municipal and private wastewater treatment works, individual wastewater systems, and the management of the Clean Water State Revolving Fund. A key area of focus for the branch is addressing substandard cesspools, which are noted for merely disposing of wastewater rather than treating it, posing significant environmental and public health risks.

The Wastewater Branch also manages a Recycled Water Program, which is increasingly vital given Hawai‘i’s growing population and limited potable water resources.[148] This program recognizes the importance of treated domestic wastewater for reuse applications, addressing critical water scarcity issues that are exacerbated by climate change.

The Recycled Water Program represents an important innovation that contributes not only to climate adaptation by enhancing water security but also potentially to climate mitigation by reducing the energy demands of alternative water sources like desalination or long-distance water transport. This indicates a broader need for integrated planning across both solid waste and wastewater sectors to ensure a holistic and effective approach to climate action.

[146] Ibid.
[147] Ibid.
[148] Ibid.

Cesspools:
One significant issue in Hawai'i is the large number of households which use cesspools. About 83,000 residential cesspools still operate statewide, discharging around 50 million gallons of raw sewage every day to groundwater, streams and coastal reefs.[149] All cesspools are now legally classified as sub-standard systems that endanger public health and marine ecosystems. Beyond nutrient and pathogen loading, anaerobic sewage decomposition inside cesspools releases methane (CH_4) and nitrous oxide (N_2O), two potent greenhouse-gases. Eliminating all cesspools would remove one of the state's largest diffuse CH_4 sources and advance Hawai'i's 2045 carbon-neutral goal. Act 125 (2017) has as its goal to convert all cesspools by 2050.[150] Yet replacement costs range from $880 million to > $5.3 billion (average around $23,000 per home). At that price 97% of cesspool households would pay more than 2% of annual income; even a hypothetical $10,000 rebate still leaves 85% cost-burdened. Counties and DOH currently lack the engineering, permitting, outreach and loan-servicing staff needed to process thousands of upgrades per year. Existing federal and state loan/grant channels (CWSRF, USDA RD, WIFIA, etc.) generally fund public entities, not individual homeowners; most programs also require owners to pre-pay and wait for reimbursement.[151] By coupling an accelerated conversion schedule with layered financing, Hawai'i can simultaneously protect drinking water, revive coral reefs and achieve a measurable slice of its statewide greenhouse-gas reduction commitment.

Cesspools in Numbers[152]

- Cesspools by Island: Hawai'i 48,596; Kaua'i 14,300; Maui 11,038; O'ahu 7,491; Moloka'i 1,400.
- Wastewater load: 49.9 mgd effluent; around 30 mgd on Hawai'i Island alone.
- GHG footprint: Each cesspool emits around 0.34 metric tons CO_2-e of CH_4 per year (DOH estimate); statewide conversion would avoid around 28,000 t CO_2-e annually - comparable to taking around 6,000 cars off the road.
- Unit costs: Low-complexity septic + leach field around $10k; advanced aerobic/UV + seepage pit up to $60k; median modeled monthly cost around $210.
- Financing gap: After plausible loans, grants and $10k rebates, at least $1.1 billion remains unfunded.

5.5.3 Numbers and Targets: Current Status and Future Goals

On O'ahu, emissions from waste and wastewater disposal and management contribute approximately 3% and 0.2% of the island's total Greenhouse Gas (GHG) emissions, respectively.[153] While these percentages may appear modest, this is largely attributable to the significant diversion of waste to H-POWER for electricity generation. H-POWER functions as a

[149] Cesspool Conversion Working Group Final Report (2023), https://health.hawaii.gov/wastewater/files/2022/11/ccwg_final_report.pdf
[150] Ibid.
[151] Ibid.
[152] Ibid.
[153] One Climate One O'ahu Climate Action Plan 2020-2025, accessed June 10, 2025, https://alohachallenge.hawaii.gov/pages/spotlight-one-climate-one-oahu-climate-action-plan

waste-to-energy facility, capable of processing 730,000 -750,000 tons of trash annually, supplying approximately 10% of O‘ahu's electricity needs, or 70 megawatts of power, sufficient for about 60,000 homes.[154]

Waste Sources	2022
	MMTCO2Eq
Landfills	0.32
Wastewater Treatment	0.05
Composting	0.03
Total Emissions	0.40
Non-Waste Emissions	19.9

Table 29: Hawai‘i GHG Emissions in Waste Sector 2022 (MMT CO2 Eq.), figures taken from Hawai‘i Energy Office, Hawai‘i Pathways to Decarbonization.

The majority of waste stream GHG emissions on O‘ahu originate from H-POWER which is considered less GHG-intensive than direct fossil-fuel burning or traditional landfilling. Projections indicate that GHG emissions from landfills are expected to decline, while emissions from composting and wastewater treatment are anticipated to increase slightly, based on assumptions related to population growth.[155] Beyond direct emissions within the state, Hawai‘i’s waste stream reduction efforts contribute to a broader reduction in global GHG emissions, underscoring the interconnected nature of climate pollution.

In Fiscal Year 2023, the State of Hawai‘i achieved a total waste diversion rate of 24.1%, with 544,399 tons diverted out of a total of 2,263,227 tons generated.[156] When the tonnage from incineration, specifically from Honolulu's H-POWER facility, is included, the combined diversion and incineration rate for the State rises to 54.6%.[157]

The following table provides a clear, concise summary of current waste management performance across all counties and the state. By including both "Diversion Rate" and "Diversion + Incineration Rate," it acknowledges the specific role of waste-to-energy (H-POWER) in Honolulu, which significantly impacts overall waste management but is not strictly "recycling" by state definition.

County	Total Waste Generated (tons)	Total Waste Diverted (tons)	Diversion Rate (%)	Incinerated (tons)	Diversion + Incineration Rate (%)
Hawai‘i County	296,155	90,874	30.7	N/A	30.7

[154] City and County of Honolulu, Department of Environmental Services, https://www.honolulu.gov/env/h-power-continues-to-record-high-landfill-diversion-rates/
[155] One Climate One O‘ahu Climate Action Plan 2020-2025, accessed June 10, 2025, https://alohachallenge.hawaii.gov/pages/spotlight-one-climate-one-oahu-climate-action-plan
[156] Office Of Solid Waste Management Annual Report To The Thirty-Second Legislature State Of Hawai’i, accessed June 10, 2025, https://health.hawaii.gov/opppd/files/2024/03/27_2024-OSWM-Legislative-Report.pdf
[157] Ibid.

Maui County	332,355	43,181	13.0	N/A	13.0
Honolulu County	1,507,445	371,280	24.6	690,534	70.4
Kaua‘i County	127,272	39,064	30.7	N/A	30.7
State Total	**2,263,227**	**544,399**	**24.1**	**690,534**	**54.6**

Table 30: State Solid Waste Diversion and Diversion + Incineration Rates (FY2023)

State-Level Targets:
The State Legislature had initially set an ambitious waste diversion goal of 25% by 1995, which was subsequently increased to 50% by 2000, both of these targets are met if .[158] Both of these targets are met, with the percentage of waste diversion for the state staying around the 25% mark and rising to a total of 50% if incinerated waste is included. Proposals to amendment to HRS Chapter 342G-003 to expand the State's waste diversion goal to 70% by 2035 has been proposed and is supported by DOH but has not yet been passed.

Honolulu County Targets:
The City and County of Honolulu's Climate Action Plan (CAP) outlines a strategy to reduce Greenhouse Gas (GHG) emissions by 45% over the next five years (from its 2020-2025 CAP, with an update planned for 2025-2030) and to achieve carbon neutrality by 2045.[159] The waste sector is one of the key areas targeted for these reductions. The City's 2019 Integrated Solid Waste Management Plan (ISWMP) established a goal of 25% per capita waste reduction by 2030, with the primary implications of this goal being realized through H-POWER operations.[160] Projections indicate that waste sector GHG emissions for O‘ahu are estimated to be approximately 0.15 MMTC02 Eq. in 2045 (and .20 MMTCO2 Eq in 2030), representing a 66% reduction from 2015 levels.[161] The city anticipates continued increases in landfill diversion through enhanced public participation in recycling and optimized H-POWER operations in 2024 and 2025.[162] For the City and County are also exploring options to extending the O‘ahu Island "Transfer Station Reusable Material Collection Site" to support waste diversion.

[158] Office of Solid Waste Management Annual Report to the thirty-second Legislature State of Hawai’i, accessed June 10, 2025, https://health.hawaii.gov/opppd/files/2024/03/27_2024-OSWM-Legislative-Report.pdf
[159] Climate Action Plan — Resilience Office - City and County of Honolulu Office of Climate Change, Sustainability and Resiliency, accessed June 10, 2025, https://www.resilientoahu.org/climate-action-plan
[160] Ibid.
[161] City and County of Honolulu Climate Action Plan 2020 - 2025, https://static1.squarespace.com/static/5e3885654a153a6ef84e6c9c/t/5fed27185abd827cad03a859/1609377638945/Climate+Action+Plan.pdf

[162] Res Rates and Data | Department of Environmental Services, accessed June 10, 2025, https://www8.honolulu.gov/env/ref/res-rates-and-data/

Kaua‘i County Targets:
Kaua‘i County's 2011 Zero Waste Resolution and its 2018 General Plan established a 70% waste diversion goal by 2023.[163] As of Fiscal Year 2019, the county had achieved a 30.4% diversion rate, indicating a significant gap between the target and actual performance.[164]

Maui County Targets:
Maui County's 2009 Integrated Solid Waste Management Plan (ISWMP) set a goal of 60% waste diversion from its landfills.[165] Efforts to achieve this objective, including increased recycling and the utilization of WasteTEC (waste-to-energy) technology, are projected to extend the capacity of the Central Maui Landfill until 2042.

A significant gap exists between Hawai‘i’s ambitious waste diversion targets and current performance across most counties. While clear goals are established, achieving them necessitates substantial systemic changes, including adequate funding, robust infrastructure development, sufficient staffing, and strong legislative support. The current diversion rates suggest that the state is not on track to meet its proposed 2030 goals without accelerated and concerted efforts. It is essential to candidly address these performance gaps and outline specific, funded initiatives and policy changes required to bridge the difference between current rates and future targets. This may involve advocating for stronger state-level mandates, increased county funding, and expanded public-private partnerships to scale up recycling and bioconversion infrastructure.

5.5.4 Challenges and Innovations

Economic and Geographic Constraints:
The state’s small population and limited local economy mean that nearly all recyclable materials must be shipped to processing facilities on the continent or in Asia. This dependence on external markets exposes Hawai‘i to significant volatility in global recycled materials markets. For instance, the 2018 ban on most recyclable plastics by China had a disproportionate impact on Hawai‘i’s recyclers, who already operate with thinner profit margins due to high land values, labor costs, utilities, and specialized equipment expenses.[166] This reliance on external markets means that when the economics of export become unfavorable, local recycling infrastructure and programs suffer, as evidenced by redemption center closures on Hawai‘i Island due to labor market issues and a lack of bids for county subsidies. This highlights a fundamental weakness in achieving

[163] Kaua'i Integrated Solid Waste Management Plan - Kauai.gov, accessed June 10, 2025, https://www.kauai.gov/files/assets/public/v/1/public-works/documents/proof-v2__kauaico_iswmp_update_draft5_final-211103.pdf
[164] Office of Solid Waste Management Annual Report to the thirty-second Legislature State of Hawai’i, accessed June 10, 2025, https://health.hawaii.gov/opppd/files/2024/03/27_2024-OSWM-Legislative-Report.pdf
[165] Integrated Solid Waste Management Overview - Maui County, accessed June 10, 2025, https://www.mauicounty.gov/DocumentCenter/View/4502/Overview-of-final-ISWMP?bidId=
[166] Office of Solid Waste Management Annual Report to the thirty-second Legislature State of Hawai’i, accessed June 10, 2025, https://health.hawaii.gov/opppd/files/2024/03/27_2024-OSWM-Legislative-Report.pdf

consistent waste diversion, as the current market-driven approach creates inherent instability for the state's efforts.

Landfill Capacity Crisis:
A critical and immediate challenge across several counties is the looming shortage of landfill capacity. The Kekaha Landfill on Kaua'i is projected to reach its capacity by June 2027, or November 2030 with a vertical expansion.[167] Similarly, the Central Maui Landfill's capacity is projected to be reached by 2026.[168] On O'ahu, the Waimanalo Gulch Sanitary Landfill (WGSL), the city's only active municipal solid waste landfill, is mandated to cease operations by March 2, 2028.[169] The process of siting, permitting, and constructing new landfills typically requires approximately 10 years, creating a severe timeline challenge for the state. This impending landfill crisis is not merely a waste disposal problem but a direct impetus for accelerating waste diversion efforts and exploring alternative technologies.

Program-Specific Operational Issues:
The Deposit Beverage Container (DBC) Program has experienced a declining redemption rate, falling from 63.08% in FY2021 to 56.02% in FY2023.[170] This decline is partly attributed to macroeconomic issues and, more recently, to the closure of redemption centers on Hawai'i Island due to labor shortages and a lack of bids for county subsidies. Additionally, the current "segregated rate" used for counting containers, which was developed in 2007 based on thicker plastic carbonated beverage containers, negatively impacts the reported redemption rate as consumer trends have shifted to thinner, lighter plastic water bottles that weigh less per container.[171]

Despite the significant challenges, Hawai'i is actively pursuing various innovations and strategic approaches to enhance its waste management sector and achieve climate goals.

Integrated Planning:
A key strategic approach is the ongoing update to the 2000 State Integrated Solid Waste Management (ISWM) Plan. This update, being led by the OSWM and Tetra Tech BAS, Inc., involves a dedicated Task Force comprising diverse stakeholders from county government, solid waste management and recycling businesses, and environmental groups.[172] This comprehensive planning effort aims to identify and implement solutions for a wide array of waste streams, including tires, batteries, photovoltaic panels, organic waste, construction waste, packaging,

[167] Kaua'i Integrated Solid Waste Management Plan - Kauai.gov, accessed June 10, 2025, https://www.kauai.gov/files/assets/public/v/1/public-works/documents/proof-v2__kauaico_iswmp_update_draft5_final-211103.pdf
[168] Maui Island Plan 07-28-2014, accessed June 10, 2025, https://mauicounty.legistar.com/View.ashx?M=F&ID=4804406&GUID=8F903AE3-41A3-4521-B7A6-91CCACE7C106
[169] New Landfill Siting | Department of Environmental Services - Honolulu.gov, accessed June 10, 2025, https://www.honolulu.gov/env/ref/new-landfill-siting/
[170] Office of Solid Waste Management Annual Report to the thirty-second Legislature State of Hawai'i, accessed June 10, 2025, https://health.hawaii.gov/opppd/files/2024/03/27_2024-OSWM-Legislative-Report.pdf
[171] Ibid.
[172] Ibid.

carpet, and mattresses. This modernized approach signals a strong commitment to improving the state's waste management infrastructure and practices.

Policy and Regulatory Refinements:
Legislative actions are playing a crucial role in strengthening waste management programs. Act 012 (2022) for the DBC Program aims to improve accountability by ensuring distributors properly account for imported or manufactured containers, addressing previous audit findings and revenue discrepancies.[173]

Act 151 (2022) concerning Crucially, beginning January 1, 2023, manufacturers are now required to fully fund their recycling programs, covering collection, transportation to certified mainland recyclers, and the actual recycling processes. The act also established a 50% recycling goal for manufacturers, based on sales from two years prior, with a $1.50 per pound penalty for non-compliance, aiming to significantly increase electronics recycling rates. Act 162 expands the types of electronic devices subject to the Electronic Device Recycling and Recovery Act to include electronic device peripherals and certain legacy devices.174 Excludes manufacturers of only electronic device peripherals and no other electronic devices. Allows, rather than requires, the Department of Health to determine additional penalties. Requires manufacturers' recycling plans to describe communication efforts wit the State and counties to facilitate consumer education efforts. Repeals the requirement that recycling plans be implemented and fully operational by 1/1/2023 in order for manufacturer collaboration authority to apply. Establishes additional manufacturer recycling goals beginning on 1/1/2026 and 1/1/2027. Requires additional information to be included in manufacturers' reports containing information for calendar years 2025, 2026, and 2027. Requires collectors to report certain information regarding recyclers and refurbishers and allows the Department of Health to require submission of bills of lading and recycler receiving reports. Requires a report to the Legislature.

At the local level, Honolulu's Disposable Food Ware Ordinance (Ordinance 19-30) phases out single-use polystyrene and plastic service ware, directly promoting source reduction and mitigating plastic pollution.[175]

Waste-to-Energy and Resource Recovery:
Efforts are continuously underway to optimize H-POWER's contribution by redirecting additional waste streams, such as sewage sludge, bulky waste, auto shredder residue, and wastewater treatment plant screenings, from landfills to the facility.[176] Furthermore, the city is actively pursuing initiatives to reuse H-POWER ash and residue, maximizing resource utilization and further minimizing reliance on landfills.

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[173] Ibid.
[174]ACT 162 (2025), The Hawaii Electronic Device Recycling and Recovery Law, https://health.hawaii.gov/ewaste/files/2025/06/GM1262_-ACT-162.pdf
[175] Waste - Resilience Office - City and County of Honolulu Office of Climate Change, Sustainability and Resiliency, accessed June 10, 2025, https://www.resilientoahu.org/waste
[176] Future Plans | Department of Environmental Services - Honolulu.gov, accessed June 10, 2025, https://www8.honolulu.gov/env/ref/future-plans/

County-Level Innovations:
Individual counties are also implementing innovative programs tailored to their specific needs. Kauaʻi County's "Pay As You Throw" (PAYT) program incentivizes residents to reduce waste by charging variable rates based on cart size.[177] The county has also enacted plastic ordinances and actively promotes green waste diversion.

Maui County has initiated a Fiscal Year 2026 Recycling Grants Program, offering funding for projects focused on landfill diversion. These projects can include material collection, processing, recycling equipment, and broader waste reduction initiatives.[178]

Honolulu's Source Reduction Working Group (SRWG) exemplifies a collaborative innovation. This group actively engages with diverse stakeholders to identify effective source reduction strategies, with a focus on critical topics such as construction and demolition (C&D) waste, product packaging, food waste/organics, and solar photovoltaic (PV) panel waste.[179]

To build resilience and ensure consistent progress towards climate goals, Hawaiʻi may need to transition towards a more publicly supported or regulated recycling system that is less susceptible to global market forces. This could involve direct government investment in local processing facilities, guaranteed minimum prices for recycled materials, or stronger Extended Producer Responsibility (EPR) laws that internalize the costs of recycling within product pricing, thereby stabilizing the local recycling economy. Funding that supports significant increases in diversion infrastructure (e.g., Materials Recovery Facilities, composting facilities, advanced processing technologies) directly addresses both the immediate waste crisis and long-term GHG reduction targets. Policies that incentivize diversion are no longer merely environmental preferences but have become economic and logistical necessities for the state.

5.5.6 Measure Description and GHG reduction

Measures to reduce emissions in the waste sector are summarized into three overarching actions.

Waste Diversion

This measure combines complying with State targets on diverting 70% of generated waste from final disposal in the short term (2030), aiming to reach 90% by 2050. The goal behind waste diversion is to reduce the waste stream, which includes avoiding the generation of waste (source

[177] Kaua'i Integrated Solid Waste Management Plan - Kauai.gov, accessed June 10, 2025, https://www.kauai.gov/files/assets/public/v/1/public-works/documents/proof-v2__kauaico_iswmp_update_draft5_final-211103.pdf
[178] Applicants invited to County FY26 Recycling Grants Program information session May 7, accessed June 10, 2025, http://www.mauinuistrong.info/news/applicants-invited-to-county-fy26-recycling-grants-program-information-session-may-7
[179] Source Reduction | Department of Environmental Services - Honolulu.gov, accessed June 10, 2025, https://www8.honolulu.gov/env/ref/source-reduction/

reduction), reusing or recycling and composting. In this action, we calculate emission reductions due to recycling paper and cardboard, since composting is covered in a separate action. In 2023, waste diversion reached 24.1% of the total waste stream indicating significant efforts are needed to reach upcoming goals.

In order to implement this measure, infrastructure investments in regional material recovery hubs are required, including advanced sorting facilities, remanufacturing centers, and repair and reuse marketplaces. Also, the project for extending the O‘ahu Island "Transfer Station Reusable Material Collection Site" is considered relevant to facilitate implementation of this measure.
Waste Avoidance

Composting

Diversion of organic waste both encourages the production of local compost and the diversion of certain materials from the State’s waste streams. Local composting opportunities have expanded with Act 131 (2022) to allow composting in agricultural districts and providing capacity to help eliminate permitting barriers for small-scale compost operations. Composting targets are set to reach a diversion rate of 70% by 2030 and 90% by 2050. Achieving this will be though both municipal programs and decentralized, community-based compost networks.

Waste Reduction

This action reduces the amount of waste generated in packaging, supported by legislation that redefines producer accountability for imported goods. A 10% reduction in paper, cardboard and plastic waste is targeted by avoiding its existence in the first place. There are several programs to promote waste generation avoidance, such as installing dishwashers and mobile washing stations to reduce food waste and reliance on single-use materials in schools, as well as reusing and refilling programs for food and beverage packaging (collection, washing, and logistics infrastructure to support the circulation of reusable items) as well as Extended Producer Responsibility legislation.

GHG Emissions Reductions

The table below shows baseline emissions trajectories for selected years 2026 and 2050. These emissions are differentiated between category: landfill and incineration.

	Baseline Emissions from Solid Waste (MM TCO2e)					
Category	**2026**	**2030**	**2035**	**2040**	**2045**	**2050**
Landfill	0.33	0.32	0.32	0.32	0.33	0.33
Incineration	0.26	0.26	0.27	0.27	0.28	0.28

Table 31: Baseline Emissions from Solid Waste.

Emission reductions from waste actions are detailed in the following table. In 2050, the three actions together reduce 73% of the total baseline emissions. The actions with more reduction are diverting waste and composting.

Action	Emissions Reductions from Waste Actions (MM TCO2e)						Cumulative 2026-2050
	2026	2030	2035	2040	2045	2050	
Waste diversion	0.08	0.17	0.19	0.20	0.22	0.23	4.7
Composting	0.10	0.15	0.17	0.18	0.19	0.21	4.3
Waste reduction	0.002	0.005	0.010	0.012	0.010	0.007	0.21

Table 32: Emissions Reductions from Waste Diversion, Composting, and Reduction Actions (MM TCO2e).

It is important to note that composting emission reductions include the avoided landfill emissions and offsets due to increase in soil carbon storage and avoiding the use of synthetic fertilizer. These reductions are included in this sector, which is why reductions are higher than the baseline, reaching negative numbers after 2037 (see figure below).

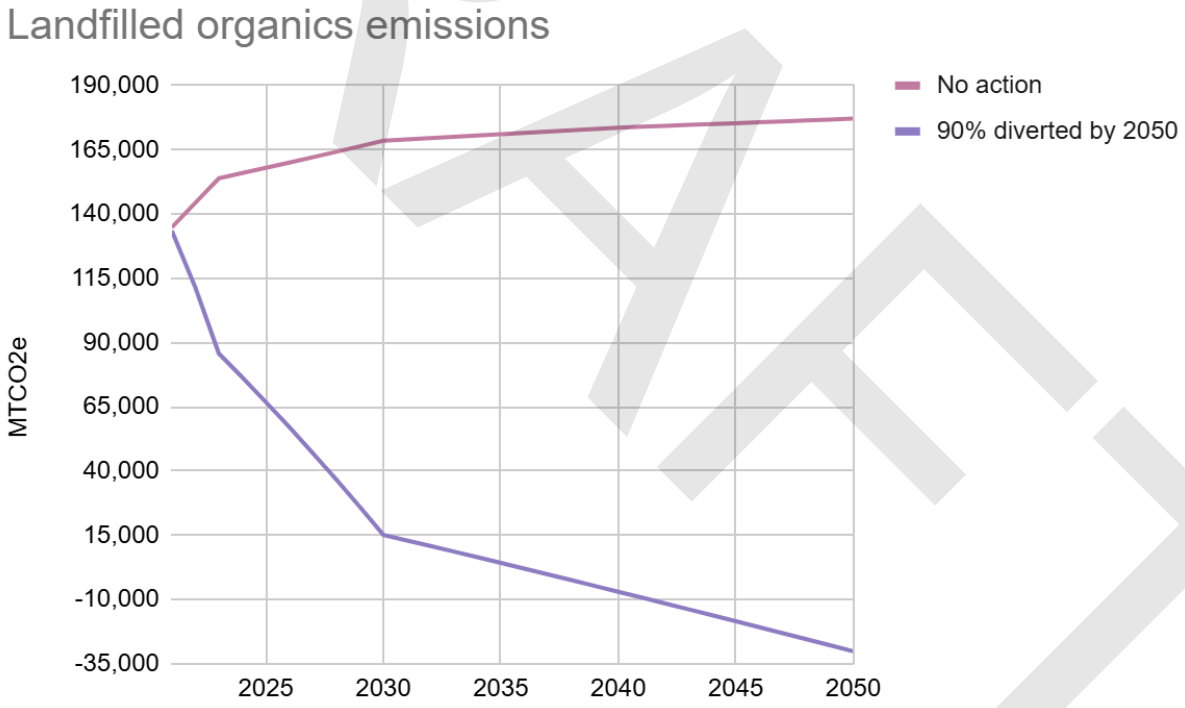

Figure 19: Waste Stream Emissions Reductions from Diversion, Composting, and Reduction Actions.

5.5.7 Key implementing agency (or agencies)

Authority to Implement Composting.
The Hawai‘i Department of Health’s Office of Solid Waste offers permits for green waste composting facilities. The proposer is prepared to abide by Hawai‘i Administrative Rules Title 11 DOH Chapter 58.1 Solid Waste Management Control Subchapter 4 (§11-58.1-41) to obtain permit approvals.

Authority to Implement Waste Diversion.
The proposer is prepared to abide by Hawai‘i Administrative Rules Title 11 DOH Chapter 58.1 Solid Waste Management Control Subchapter 4 (§11-58.1-41) to obtain permit approvals.

Authority to Implement Waste Reduction.
The County of Hawai‘i Department of Environmental Management has authority to implement a reusable food ware programs under its Administrative Rule 2-10 Relating to Polystyrene Foam Food Container and Food Service Ware Reduction.[180] In addition, in December 2007, the County Council adopted Resolution 356-07 to “embrace and adopt the principles of zero waste as a long-term goal for Hawai‘i County.”[181]

5.5.8 Implementation schedule and milestones and Metrics for tracking progress

WASTE		
1. WASTE DIVERSION	2026: Plan enhancements and expansions to waste collection and diversion services. Increase diversion of total waste by 10% every 5 years. Waste being diverted from final disposal or treatment to reach: - 70% by 2030 - 90% by 2050	Tonnes of recycled and composted materials/tons of solid waste generated
2. COMPOSTING	Starting with 34% of composting in 2023, the organic fraction being composted reaches: - 70% by 2030 - 90% by 2050	Quantity of organic waste going to composting plants. Number of composting plants and capacity.

[180] County of Hawai‘i Department of Environmental Management (2023). Rules of Practice and Procedure, https://records.hawaiicounty.gov/weblink/1/edoc/122975/23-04-19%20Env%20Mgt%20Rules%20of%20Practice%20and%20Procedure%20-%20Final.pdf

[181] County of Hawai‘i (2019). Integrated Waste Solid Waste Management Plan Update, https://records.hawaiicounty.gov/weblink/1/edoc/120882/County_of_Hawaii_Integrated_Solid_Waste_Management_Plan_2019_Update_Final.pdf

3. AVOIDING WASTE GENERATION	10% reduction in waste generation by 2040.	Per capita waste generation rates.

Table 33: Waste Management Sector Implementation Schedule and Milestones

5.5.9 Cost estimates for implementation

Implementing waste actions would cost in total 163 million USD. These costs were estimated using funding referenced in the PCAP, assuming $195 per tonne of waste being diverted and composted. This calculation does not include savings from solid waste final disposition in landfills.

Action	Emission reductions MMT CO2e (2026-2050)	Costs (M$) - Net Present Value
Waste diversion	3.92	$ 73
Composting	0.99	$ 89

5.5.10 Funding source

Hawai‘i’s Climate Action Plan (CAP) outlines major projects across sectors that depend on sustained federal support and supplemental funding sources:

- EPA Solid Waste Infrastructure for Recycling (SWIFR)
- EPA Pollution Prevention and Environmental Justice Grants
- USDA Fertilizer Expansion and Climate-Smart Commodities
- Private foundations (e.g., Bezos Earth Fund—though some commitments have been reallocated due to disasters like the Maui wildfires)

5.6 Circular and Wellbeing Economy for All

5.6.1 Overview:

Hawai‘i and the world are at a crucial juncture of crises and opportunities. The exacerbated impacts of climate change are felt in ever more acute ways in rising sea levels and temperatures, in increased storms and flooding as well as drought and fire risk, leading to an increasing spread of invasive species, including vectors for disease. These climate impacts lead to increasing health risks and exacerbate the cost of living crisis rising costs for insurance, food and fuel, which have triggered a troubling exodus of Native Hawaiians. This needed transition is not merely an environmental imperative but an economic and cultural necessity for Hawai‘i, where the interconnected crises of climate change, socioeconomic inequality, and resource dependency have accelerated loss of local talent and expertise. Hawai‘i has lost a net total of 22,000 residents - approximately 20 people daily from 2019-2022 and another 4,000 in 2023 alone. with many citing unaffordable housing and limited economic opportunities as primary factors.[182] This outmigration represents an unprecedented demographic shift with a majority of Native Hawaiians now living outside their ancestral islands. The “brain drain” phenomenon disproportionately affects younger generations, particularly college-educated millennials who find themselves caught in what has been described as “one nasty high-cost-of-living-no-economic-opportunities sandwich”.[183] Beyond statistics lies a profound cultural fracturing, as intergenerational family bonds, the foundation of Hawaiian social structures, become stretched across thousands of miles. This separation particularly impacts kūpuna (elders), who lose access to the care and connection traditionally provided by younger family members. Daily economic realities for those who remain reflect a state trapped between paradise and precarity.

At the same time, Hawai‘i’s remote location and history present it with a myriad of unique opportunities for transforming the climate crisis into opportunities for increasing its resilience and self-sufficiency, for caring for the 'āina and transforming the economy to be able to weather the growing impacts of climate change whilst strengthening the capacity of these islands and its community to flourish (Beamer et.al, 2023).[184] A profound paradigm shift is needed to put into place any of these opportunities. It is imperative to shift away from the extractive model underpinning the traditional growth-oriented linear and extractive economy to one that is founded on values and practices that emphasize interdependency, reciprocity, and stewardship.

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[182] “The *Hawai‘i We Deserve*: State of Hawai‘i’s Report to the People 2024.” Honolulu, HI: State of Hawai‘i Office of the Governor. Available from: https://governor.hawaii.gov/wp-content/uploads/2024/03/2024-Green-Admin-Policy-Briefing-Report-1.pdf

[183] Aki, Zuri (2024, January 15). "Stopping Hawaii’s Millennial Brain Drain Is Complicated". Civil Beat. https://www.civilbeat.org/2019/03/stopping-hawaiis-millennial-brain-drain-is-complicated/

[184] Beamer, K., Elkington, K., Souza, P., Tuma, A., Thorenz, A., Köhler, S., Kukea-Shultz, K., Kotubetey, K., & Winter, K. (2023). Island and Indigenous systems of circularity: How Hawai‘i can inform the development of universal circular economy policy goals. Ecology and Society, 28(1), art9. https://doi.org/10.5751/ES-13656-280109

This new paradigm brings together ancient wisdom and the best of modern knowledge and practices, centers a circular and wellbeing economy. That is, an economy that centers restoration and regeneration of culture and nature, the wellbeing of and solidarity between people, and circularity of production and consumption to reduce negative impacts and enhance efficiency. A circular and wellbeing economy offers pathways to address these interconnected challenges by reimagining how value is created, distributed, and regenerated within island ecosystems. Rather than treating economic, social, and environmental concerns as separate domains, this model recognizes their fundamental interdependence—much like traditional ahupua‘a and looks at affordability, safety, health, housing, food and transportation accessibility and other factors in addition to healthy economies. By localizing production cycles, emphasizing repair and reuse, and prioritizing indigenous practices of resource stewardship, a circular economy could significantly reduce dependence on unstable imports while creating meaningful employment opportunities rooted in place-based knowledge and skills.

Housing crises are addressed through adaptive reuse of existing structures, locally-sourced and renewable building materials, and community land trusts could increase affordability while reducing ecological footprints.[185] Circular food systems reduce waste and increase food security by expanding regenerative agriculture which improves self-sufficiency, reduces shipping costs, and creates meaningful employment in a field which also brings cultural connections. Workforce development plays a critical role by investing in circular skills training - from repair technologies to materials innovation – in land conservation, energy and circular entrepreneurship provides career pathways that allow young people to remain in Hawai‘i while participating in its ecological and cultural restoration.

Reclaiming Regenerative and Equitable Economic Systems

Through reclaiming economic systems based on aloha ‘āina principles, Hawai‘i can address not just symptoms, but root causes of its interconnected crises, creating opportunities for residents to thrive rather than merely survive. In doing so, Indigenous knowledge systems and governance are re-prioritized, cultural continuity is strengthened, and measures of prosperity remain grounded in community wellbeing rather than extraction and accumulation.

While contemporary views of prosperity and wealth are often tied to capital and production, a Hawaiian understanding views wealth not as an economic quantity, but as a social ideal rooted in relational health and overall collective well-being. Indigenous economies and resource management systems, such as those that once thrived in Hawai‘i, offer early blueprints of circular economy models. The Hawaiian Ancestral Circular Economy (ACE) achieved balance and systemic sustainability through robust institutions that emphasized an equitable distribution of resources. Beamer, Souza, and Elkington describe this system as follows: “Resource and material management within the Hawaiian ACE varied from place to place. Communities worked to ensure

[185] Different models of collective and community ownership keep prices down and create incentives for long-term stewardship.

that resources were continuously cycled through a process of gathering, distributing, and recycling back into the environment. These practices ensured continuity over decades of management" .[186]

Key principles of the Hawaiian ACE are: 1) prioritization of relationship-building; 2) balanced governance structures; 3) systematic and regular redistributions of wealth and power; 4) promoting regenerative socio-ecological processes; and 5) environmental kinship.[187] In the context of the current climate crisis and social inequalities, embracing the ACE framework allows Hawai‘i to shift its relationship to resource use and rebuild self-sufficiency. As we face urgent global challenges, the return toward a circular, wellbeing economy led by Hawaiian ACE principles becomes not only an environmental necessity but also a profound cultural and economic imperative.

Circular and Wellbeing Economy Framework

The circular and wellbeing economy framework is centered in holistic, place-based values and practices that aims to transform Hawai‘i's economic systems to be regenerative, equitable, and aligned with *aloha 'āina*. It combines principles of material and energy circularity with a deep commitment to indigenous Hawaiian values, community wellbeing, and solidarity economy practices. Key elements of this definition include:

- ***Aloha 'Āina:*** A foundational Hawaiian philosophy grounded in the kinship between people and environment, consisting of core values that include the commitment to act as protectors of land, natural resources, and the overall health of the natural world. This also entails seeking cultural and ecological justice in Hawai‘i and the integration of ancestral knowledge and practices into contemporary social-ecological management efforts.
- ***Wellbeing:*** Measuring success beyond gross domestic product (GDP), to include indicators of environmental health, social wellbeing, cultural vitality, and the overall thriving of Hawai'i's people and communities.
- ***Circularity:*** Designing out waste and pollution, keeping products and materials in use through reuse, repair, and recycling, and regenerating natural systems. This involves tracking and optimizing material and energy flows through the economy as well as being aware of boundaries and limits of resource and energy use which can cause irreparable harm to our ecology and the systems and cycles that hold it in balance.
- ***Solidarity Economy:*** Prioritizing community-based, cooperative, and reciprocal economic models that foster mutual aid, equitable distribution, and collective ownership and stewardship.

Hawai'i's unique geographic isolation and fragile ecosystems make the transition to a circular economy not just an ecological imperative but a socioeconomic necessity. Building on a foundation of principles, this policy encompasses a transformative strategy across diverse sectors.

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[186] Beamer, K., Souza, P., Elkington, K. (2025). Wai and the Ancestral Circular Economy. In K. Beamer (Ed.), Waiwai: Water and the future of Hawaii (pp. 44-60). University of Hawaii Press.
[187] Ibid.

5.6.2 Funding source

Multi-Stakeholder Financing Model

- **Producer Fees**: Generate $85 million annually from EPR program participants
- **General Obligation Bonds**: $200 million for hub construction, repayable through material sales
- **Federal Grants**: Leveraging USDA and EPA programs targeting island sustainability

5.7 Tourism

5.7.1 Overview of the Tourism Sector

The State of Hawai‘i’s tourism sector, a cornerstone of its economy, faces the dual imperative of economic recovery following COVID’s impact on the sector and robust climate action. This chapter details the significant climate and environmental footprint of Hawai'i's tourism, from substantial greenhouse gas (GHG) emissions primarily associated with air travel to the strain on vital natural resources and socio-cultural well-being. A pivotal innovation, the “Green Fee”, enacted through Act 96, in 2025, which directly links tourism revenue to climate resilience and environmental stewardship, projecting approximately $100 million annually for these critical initiatives. This policy, alongside the strategic shift towards a “regenerative tourism” model, signifies a profound re-evaluation of tourism's purpose, prioritizing the sustainability of natural, cultural, and community resources.

Economic Significance and Contribution to the State Economy

In 2022, the tourism sector generated $19.29 billion in total visitor spending, an 8.9% increase from 2019, and contributed $2.24 billion in state tax revenue, an 8.2% increase from 2019. These economic gains were made despite an 11% decrease in 2022 from the visitors recorded in 2019 indicating a reduction in visitors can also mean sustained economic inputs.[188] Prior to the pandemic, in 2019, tourism supported a substantial 216,000 jobs statewide. Projections indicate.[189]

The devastating 2023 Maui wild fires further underscored that the state susceptible to external shocks, including pandemics, natural disasters, and global economic shifts. Consequently, strategies within the CAP must not only focus on mitigating environmental impacts but also on enhancing economic resilience through diversification and a strategic shift towards a more stable, less volume-dependent tourism model that can better withstand future disruptions, including those exacerbated by climate change.

The implementation of the “Green Fee” (Act 96, 2025) explicitly recognizes the intrinsic connection between ecological health and economic prosperity.[190] This measure, particularly in the aftermath of the Maui wildfires, signals a re-evaluation of tourism’s purpose beyond mere economic output to include direct contributions to environmental and community well-being. This policy direction, alongside the projected decline in international air seats, suggests a potential strategic pivot towards attracting a higher-value, more environmentally conscious visitor segment, rather than solely pursuing volume-based growth. This indicates a maturing understanding of the interconnectedness of economic prosperity and environmental health, as the state moves towards

[188] Fact Sheet: Benefits of Hawai'i's Tourism Economy, accessed July 17, 2025, https://www.hawaiitourismauthority.org/media/11276/tourism-econ-impact-fact-sheet-june-2023.pdf
[189] DBEDT Economists Lower Hawaii Economic Growth Projections, accessed July 17, 2025, https://dbedt.hawaii.gov/blog/25-20/
[190] Ibid.

internalizing the environmental costs of tourism and setting a precedent for other tourism-dependent economies.

Visitor Trends and Industry Landscape

The Hawai'i Tourism Authority (HTA) functions as the state's primary agency for managing tourism, operating under a framework guided by four foundational pillars: natural resources, Hawaiian culture, community, and brand marketing. The HTA's overarching mission is to strategically manage tourism in a sustainable manner, ensuring alignment with economic objectives, cultural values, the preservation of natural resources, community aspirations, and the needs of the visitor industry.[191]

HTA's 2020-2025 Strategic Plan places a strong emphasis on the development of sustainable and regenerative tourism practices. This strategic direction is explicitly aligned with global sustainability frameworks, specifically supporting the United Nations' 17 Sustainable Development Goals (SDGs) and the UN 2030 Agenda for Sustainable Development.[192] This explicit support for global sustainability frameworks demonstrates Hawai'i is actively positioning itself as a leader in sustainable tourism, which could attract environmentally conscious travelers and stimulate investments in green technologies and practices.

A significant evolution within the industry is the deliberate shift towards a "regenerative tourism" model. This approach is designed to prioritize the sustainability of natural, cultural, and community resources, moving beyond sustainability to actively restore and enhance the destination. Regenerative tourism recognizes the interconnectedness of environmental, social, and economic factors, with the aim of fostering thriving communities and providing meaningful visitor experiences while simultaneously improving the well-being of the environment, residents, and indigenous communities for future generations.[193] This redefinition of success moves beyond traditional metrics like visitor arrivals and expenditures to include resident sentiment, cultural preservation, and environmental health as core performance indicators. This is crucial for gaining community support for the industry and ensuring its long-term viability in the face of climate change, as it implies that future growth will be measured not just by economic output but by its positive contribution to the islands' ecological and social well-being.

5.7.2 Climate and Environmental Impacts of Tourism

General Environmental Pressures and Resource Strain

The visitor industry in Hawai'i exerts substantial impacts across various facets of the islands, including its physical infrastructure, natural resources, and the socio-cultural fabric of its

[191] Who We Are - Hawaii Tourism Authority, accessed July 17, 2025, https://www.hawaiitourismauthority.org/who-we-are/
[192] 2024 HTA Annual Report to the Legislature - Hawaii Tourism Authority, accessed July 17, 2025, https://www.hawaiitourismauthority.org/media/13946/2024-hta-annual-report-to-the-legislature_rev_ada.pdf
[193] Ibid.

communities.[194] Historically, a significant shift from an agrarian economy to one dominated by tourism has driven extensive land development throughout the islands. Hawai'i, despite comprising only 0.2% of the nation's land area, disproportionately accounts for 75% of its extinctions and more 30% of its rare or endangered species. Tourism-related development has contributed significantly to this ecological vulnerability. The continuous urban expansion required to accommodate the growing number of visitors has imposed a considerable toll on the islands' fragile environment.[195]

In the post-pandemic period, residents have increasingly vocalized concerns regarding "overtourism". These concerns extend beyond mere crowding to encompass issues such as congested parking lots, severe trail erosion, and a palpable strain on local natural and grey infrastructure. "[196] This indicates a fundamental misalignment between the current tourism model and community well-being. Addressing "overtourism" therefore requires a shift from simply managing visitor numbers to managing the *impact* of tourism, prioritizing quality over quantity, and ensuring a more equitable distribution of benefits and burdens. This necessitates robust destination management plans with clear, measurable benchmarks and accountability, moving beyond superficial initiatives. It also highlights that resident sentiment is a critical indicator of sustainability and must be central to any climate action plan.

Specific Impacts on Natural Ecosystems (e.g., Coral Reefs, Biodiversity, Land Use)

Hawai'i is home to over 400,000 acres of coral reefs, which are highly sensitive and vital ecosystems. These reefs are particularly vulnerable to changes in ocean temperature and acidity.[197] Rising sea surface temperatures and marine heatwaves are increasing the frequency and severity of coral bleaching events, a phenomenon where stressed corals expel the algae that provide their food, leading to whitening and increased susceptibility to disease. A notable example occurred in 2014, when 80% of the dominant corals in Kaneohe Bay, O'ahu, experienced bleaching.[198] Beyond climate change, direct human impacts from tourism, such as sunscreen chemicals and heavy foot traffic, also contribute to reef degradation.

Research provides compelling evidence that human presence significantly alters the community structure of marine ecosystems. A study conducted in the Molokini Marine Life Conservation District (MLCD) observed that key reef predators, such as 'ōmilu, were displaced from shallow, preferred waters into deeper, less optimal habitats when tourism activities resumed post-pandemic. This directly demonstrates the impact of high-density marine tourism on sensitive ecological

[194] Visitor Statistics | Overview - Department of Business, Economic Development & Tourism, accessed July 17, 2025, https://dbedt.hawaii.gov/visitor/sustainable-tourism-project/overview/
[195] DLNR Hawaii Statewide Assessment of Forest Conditions and Resource Strategy (2010), https://dlnr.hawaii.gov/forestry/files/2013/09/SWARS-Issue-6.pdf
[196] Big Plan To Fix Hawaii Tourism Just Got A Brutal Reality Check, accessed July 17, 2025, https://beatofhawaii.com/big-plan-to-fix-hawaii-tourism-just-got-a-brutal-reality-check/
[197] Climate Change Connections: Hawai'i (Coral Reefs) | US EPA, accessed July 17, 2025, https://www.epa.gov/climateimpacts/climate-change-connections-hawaii-coral-reefs
[198] Ibid.

balances.[199] Similarly, coral bleaching is a direct, visible consequence of climate change exacerbated by human activity. These are clear feedback loops where tourism's activities directly degrade the very natural assets that attract visitors. This highlights the urgent need for targeted destination management, strict environmental regulations, and effective visitor education programs, such as "Travel Pono", to mitigate these direct, observable impacts. It reinforces that protecting natural resources is not just an environmental goal but an economic necessity for the long-term viability of Hawai'i's tourism industry.[200]

Land development for tourism has led to severe impacts on Hawai'i's fragile coastal and conservation areas. For instance, a large hotel project on the Hawai‘i Island destroyed 70% of unique anchialine ponds during its construction, illustrating the direct ecological damage caused by unchecked development.[201] A systemic challenge to effective climate adaptation and sustainable land use in Hawai'i is the continued reliance on outdated land classification studies, some dating back to the 1930s. These legacy classifications, which predate Hawai'i's statehood, continue to influence critical land use decisions across the islands, including on agricultural lands. A 2024 state report warned that these classifications "obscure the true potential of Hawai'i's lands" and complicate efforts to adapt to modern agricultural and land development needs, representing a "dramatic departure from the holistic resource management principles of the ahupua‘a system".[202]

Overcoming these entrenched planning legacies is crucial requires comprehensive, culturally informed land-use reform that integrates contemporary climate science and ecological carrying capacities. Without addressing these underlying systemic issues, even well-intentioned climate actions may be hampered by an outdated regulatory environment.

Socio-Cultural Dimensions and Community Well-being

The expansion of the tourism industry in Hawai‘i has contributed to a degradation of cultural values, compromised cultural integrity, diminished the presence of Native Hawaiians in visitor centers, and devalued sacred places, known as "wahi-pana".[203] Many Native Hawaiians express a

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[199] Division of Aquatic Resources | 4/24/23 – Measuring the impacts of tourism on marine ecosystems - Hawaii.gov, accessed July 17, 2025, https://dlnr.hawaii.gov/dar/measuring-the-impacts-of-tourism-on-marine-ecosystems/

[200] Sustainable Tourism Association of Hawaii | Hawaii STAH Tours & Education, accessed July 17, 2025, https://www.sustainabletourismhawaii.org/

[201] Matsuoka, J., & Kelly, T. (1988). The environmental, economic, and social impacts of resort development and tourism on native Hawaiians. *J. Soc. & Soc. Welfare*, *15*, 29. https://scholarworks.wmich.edu/context/jssw/article/1868/viewcontent/JSSW_15.4_2_MATSUOKA.pdf

[202] "Soil Classification Systems & Use In Regulating Agricultural Lands Study" DBEDT 2024, https://data.capitol.hawaii.gov/sessions/session2025/bills/DC174_.pdf

[203] Socio-Cultural Impacts of Tourism in Hawai`i – Impacts on Native Hawiians - Hawaii.gov, accessed July 17, 2025, https://files.hawaii.gov/dbedt/visitor/sustainable-tourism-project/drafts/Native-Hawaiian-Impact-Report.pdf

profound sense of alienation from their ancestral lands due to the imposition of Western economic systems, including tourism, which has historically proceeded without their explicit consent.[204]

Incorporating social equity, cultural preservation, and community well-being metrics is needed. The State needs to actively restore and enhance, rather than just mitigate impacts to natural, cultural and community resources to reflect a deeper commitment to the islands' overall well-being. The success of addressing cultural fracturing will depend heavily on the effective and widespread implementation of regenerative tourism principles. This involves fostering genuine collaboration, empowering local communities, and investing in initiatives that not only reduce environmental footprint but also actively contribute to cultural revitalization and community resilience. This approach transforms tourism from a potential burden into a force for positive change.

5.7.3 Numbers and Targets: GHG Emissions, Energy Use, and Waste Management

Greenhouse Gas Emissions from the Tourism Sector

Air Travel Emissions

The "average" visitor's round-trip flight to Hawai'i in 2019 contributed approximately 1.8 tons CO2e. It is important to note a significant discrepancy: Hawai'i's official 2019 Greenhouse Gas Inventory reported "Domestic Air Transport" emissions as 3.2 million tons CO2e. This category typically includes inter-island flights and flights departing from Hawai'i to the U.S. mainland but *excludes* U.S. mainland arrivals and international flights (both arrivals and departures). Furthermore, this official inventory often does not account for "non-CO2 emissions" such as water vapor, ice crystals (contrails), and nitrogen oxides from flights above 9,000 meters, which can have up to twice the global warming potential of CO2 alone and comprise 90% of the flight time to and from Hawai'i.[205]

The stark contrast between the estimated 18 million tons (accounting for the total number of visitors) CO2e from visitor air travel and the 3.2 million tons reported in Hawai'i's official GHG inventory for "Domestic Air Transport" highlights a critical data and accountability gap. The official figure significantly underrepresents the true carbon footprint of tourism by excluding mainland arrivals, international flights, and non-CO2 radiative forcing effects. This situation demands that Hawai'i's Climate Action Plan explicitly acknowledge and address these "imported" emissions, even if direct control over international aviation is limited. It strengthens the ethical and financial justification for policies like the "Green Fee" to fund mitigation and adaptation efforts, framing tourism as a global climate responsibility. This also suggests a need for a shift in

[204] 2024 HTA Annual Report to the Legislature - Hawaii Tourism Authority, accessed July 17, 2025, https://www.hawaiitourismauthority.org/media/13946/2024-hta-annual-report-to-the-legislature_rev_ada.pdf
[205] Ibid.

tourism strategy to prioritize visitors who are willing to offset their travel impact or choose lower-carbon travel options, moving towards a more conscious and equitable tourism model.

On-Island Operational Emissions (Accommodation, Transportation, etc.)

Beyond air travel, tourism operations on the islands also contribute to GHG emissions. A study focusing on Hawai'i Island estimated that tourism sectors, including accommodations, food and beverages, golf courses, tourism services, and rental cars, collectively account for 21.7% of the island's total energy consumption.[206] This study indicated that visitors generated over 22% of the state's total emissions through their expenditure patterns.

While statewide GHG reduction targets are clearly articulated (50% by 2030, zero emissions by 2045), the available data on tourism's specific contribution to on-island emissions is not aggregated into a comprehensive, statewide tourism-specific GHG inventory with explicit sector-specific reduction targets. County-level plans address general emissions from transportation, electricity, and waste but do not disaggregate these for the tourism sector. This indicates a significant data and reporting gap for effectively managing tourism's on-island carbon footprint. To ensure accountability and targeted policy implementation within the sector, the development of a more granular, tourism-specific GHG inventory and establish clear, measurable reduction targets for the industry's on-island operations is needed.

Waste Generation and Reduction Initiatives

The tourism sector contributes measurably to waste generation in Hawai'i. On Hawai'i Island, it is estimated that tourism sectors collectively account for 10.7% of the island's total waste generation.[207] More specifically, accommodation facilities on Hawai'i Island produced 5.9 kg of Municipal Solid Waste (MSW) per guest, while restaurants generated 2 kg per guest.[208] When considering waste generation per employee, the accommodation sector produced 2.4 kg of MSW daily, and the Food & Beverage (F&B) sector generated 9.8 kg daily, assuming F&B waste is primarily from tourists in the accommodation sector. An analysis of the total tourism-related waste on Hawai'i Island revealed that 62% originated from restaurants, 27% from accommodation, and 7% from golf courses.

The observation that "waste from tourism systematically remains hidden behind residential waste flows" indicates a significant challenge in accurately attributing and managing waste generated by the sector.[209] This lack of precise information can lead to municipal fees being set without proper consideration of producers' contributions, potentially causing budget imbalances and cross-subsidies between residential and economic activities. This situation highlights a critical need for

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[206] Saito, O. (2013). Resource use and waste generation by the tourism industry on the big island of Hawaii. *Journal of Industrial Ecology*, *17*(4), 578-589. https://kohalacenter.org/archive/pdf/Research_BI_ResourceUseWasteGenerationTourism.pdf

[207] Ibid.

[208] Ibid.

[209] Ibid.

enhanced data collection and reporting on tourism-specific waste streams to ensure equitable waste management policies and to reinforce the principle of extended producer responsibility.

Resource/Waste Category	Percentage of Island's Total
Energy Consumption	21.7%
Water Consumption	44.7%
Waste Generation	10.7%

Table 34: Table Estimated Tourism Sector Resource Consumption and Waste Generation (Hawai'i Island) [210]

5.7.4 Policy and Governance Innovations

A landmark policy innovation is the "Green Fee", officially enacted as Act 96. This legislation increases the state's transient accommodations tax (TAT) by 0.75% (raising the overall TAT to 11% starting January 1, 2026, and projected to rise to 12% in 2027), and for the first time, includes cruise ship accommodations.[211] This levy is projected to raise approximately $100 million annually, with a dedicated portion of the revenue directed towards climate resilience, environmental stewardship, and sustainable tourism programs. The "Green Fee" serves as a model for climate finance, directly internalizing the environmental externalities of tourism and creating a dedicated funding stream for mitigation and adaptation efforts. It sets a precedent for other tourism-dependent economies by explicitly linking visitor contributions to the protection of the very natural resources that attract them.

Industry-Led Initiatives and Technologies

Globally, hotel chains are increasingly focusing their waste reduction efforts on single-use plastics and food waste, recognizing these as primary waste streams within the industry.[212] Specific waste reduction strategies implemented within the hotel industry include: purchasing in bulk, requesting suppliers to minimize packaging, reusing incoming packaging materials, utilizing washable and reusable plates, cups, and utensils, employing rechargeable batteries, repairing equipment instead of replacing it, donating obsolete items to charities, using liquid soap and shampoo dispensers in guest rooms, providing daily newspapers only upon request, and repurposing torn linens into smaller usable items.[213]

The emphasis on waste prevention, reuse, and recycling across various county plans and hotel-specific initiatives highlights a growing recognition of the need for a more circular economy within the tourism sector. The detailed strategies, such as bulk purchasing and repurposing linens, move beyond simple waste disposal to address waste at its source and throughout its lifecycle. This

[210] Ibid.
[211] "Historic Green Fee Launched To Combat Climate Change In Hawai'i", accessed July 17, 2025, https://governor.hawaii.gov/main/historic-green-fee-launched-to-combat-climate-change-in-hawai'i/
[212] Ibid.
[213] Waste Prevention | Department of Environmental Services - Honolulu.gov, accessed July 17, 2025, https://www8.honolulu.gov/env/ref/waste-prevention/

approach offers significant opportunities not only for environmental benefits but also for economic savings through reduced material consumption and waste management costs. By focusing on these operational and systemic changes, Hawai‘i’s tourism industry can significantly reduce its environmental footprint and contribute to the state's broader climate goals.

The Sustainable Tourism Association of Hawai‘i (STAH) plays a crucial role in promoting responsible travel and linking the tourism sector with local conservation initiatives. STAH offers educational programs for residents, businesses, and visitors, and operates a certification program for tour operators, encouraging the adoption of a “Triple Bottom Line” approach that prioritizes community involvement, environmental protection, and employee management. The “Travel Pono” program, meaning “to do what is right”, encourages visitors to explore Hawai‘i respectfully of Native Hawaiian culture, wildlife, and the environment.[214] This focus on industry collaboration and certification, exemplified by STAH’s efforts, helps to standardize and elevate best practices across the sector, driving collective responsibility and improving visitor behavior.

Individual hotels and resorts are also implementing comprehensive sustainability programs. Mauna Kea Resort, for example, has established the “Moku Pūlama Fund” to support initiatives such as reforestation, Hawaiian culture and landmark sustainability, and coral reef protection. The resort has introduced electric car rental amenities, installed LED lighting and occupancy sensors, uses energy-efficient appliances, and operates its golf course with recycled water for irrigation. It also prioritizes sustainable local sourcing, investing over $1.3 million in local agricultural businesses and harvesting honey from on-property apiaries.[215] Prince Waikiki engages in “voluntourism” programs, cultural preservation partnerships (e.g., supporting Hawaiian language immersion schools), and workforce development initiatives.[216] The American Hotel & Lodging Association (AHLA) has launched “Responsible Stay”, a broad industry initiative focused on waste reduction, water conservation, responsible sourcing, and energy efficiency across properties.[217] These technological and operational efficiencies, ranging from smart HVAC systems and LED lighting to on-site composting and water-efficient fixtures, not only reduce environmental impact but also yield significant financial benefits through utility savings.

Recommendations

To address climatic impacts in the tourism industry several key areas warrant continued focus:

1. **Comprehensive Data Integration:** Develop a more granular, tourism-specific GHG inventory that accounts for all relevant emission sources, including a more complete

[214] Sustainable Tourism Association of Hawaii | Hawaii STAH Tours & Education, accessed July 17, 2025, https://www.sustainabletourismhawaii.org/
[215] Sustainability | Mauna Kea Resort, accessed July 17, 2025, https://www.maunakearesort.com/culture/sustainability
[216] Regenerative Tourism - Prince Waikiki, accessed July 17, 2025, https://www.princewaikiki.com/regenerative-tourism/
[217] Hotel Industry Launches Environmental Sustainability Initiative To Provide A ‘Responsible Stay’, Accessed July 17, 2025, https://www.ahla.com/news/hotel-industry-launches-environmental-sustainability-initiative-provide-responsible-stay

assessment of visitor air travel's total climate impact. This will enable more targeted interventions and transparent reporting of the sector's progress.

2. **Policy Cohesion and Enforcement:** Ensure consistent implementation and rigorous enforcement of state and county climate policies, particularly those related to land use reform, building performance standards, and waste management. Bridging the gap between policy intent and measurable outcomes is crucial.
3. **Investment in Regenerative Practices:** Channel resources, including those generated by the "Green Fee", into initiatives that actively restore natural ecosystems, support cultural preservation, and enhance community well-being, moving beyond mere mitigation to truly regenerative outcomes.
4. **Visitor Education and Behavior Change:** Intensify efforts to educate visitors on responsible travel practices ("Travel Pono") and the unique ecological and cultural sensitivities of the islands. This can foster a more mindful visitor experience and reduce negative impacts.
5. **Economic Diversification and Resilience:** Continue to support the diversification of Hawai'i's economy to reduce over-reliance on tourism, while simultaneously building resilience within the tourism sector itself to withstand future climate-related disruptions and economic shocks.

By systematically addressing these areas, Hawai'i can solidify its position as a global leader in sustainable and regenerative tourism, demonstrating a viable pathway for other island economies to align prosperity with profound environmental and cultural stewardship.

6. Benefits Analysis

The implementation of the measures included in this CAP is anticipated to have a broad range of benefits. This section details the co-pollutant reductions associated with implementation of the measures identified in this CAP.

Inventory for Co-Pollutants

Emissions data from EPA's National Emissions Inventory were obtained for the year 2017.[218] Table 19 presents nitrogen oxides (NOx), fine particulate matter ($PM_{2.5}$), sulfur dioxide (SO_2) and volatile organic compounds (VOC) for the State of Hawaii in 2017.

Pollutant	NOx (tons)	$PM_{2.5}$ (tons)	SO_2 (tons)	VOC (tons)
Total Emissions	41,031	7,497	18,667	161,284

Table 35: Hawai'i State criteria pollutants emissions inventory.

Co-pollutants Emission Changes from Measures

Measures that reduce GHG often result in improvements in local air quality that impact human health and the environment. For selected measures emission reductions of co-pollutants were calculated. These are fine particulate matter (PM2.5) nitrous oxides (NOx) and sulfur oxides.

According to the latest Integrated Science Assessment from US EPA, particulate matter[219] is associated with premature death and other serious health effects such as nonfatal heart attacks, irregular heartbeat, aggravated asthma, decreased lung function. Nitrous oxides exposure is linked several adverse human health effects, most notably on the respiratory system[220]. Emissions of NOx also contribute to the formation of PM2.5 and ground-level ozone. Ground level ozone[221] causes effects in human health, such as respiratory and cardiovascular diseases. It has also effects on vegetation, ecosystems and climate. Lastly, sulfur dioxide is linked with a number of adverse effects on the respiratory system, particularly for exercising asthmatic individuals.

The table below shows cumulative emission reductions between 2026 and 2050 in co-pollutants for each measure that was calculated.

[218] https://gispub.epa.gov/neireport/2017/ accessed on 07/07/2025.
[219] https://www.epa.gov/isa/integrated-science-assessment-isa-particulate-matter
[220] https://www.epa.gov/isa/integrated-science-assessment-isa-oxides-nitrogen-health-criteria
[221] https://www.epa.gov/isa/integrated-science-assessment-isa-ozone-and-related-photochemical-oxidants

Measure	SO_2 (tons)	NOx (tons)	$PM_{2.5}$ (tons)
Reducing Energy Consumption in Buildings	4,855	2,943	294
New Building Codes and Solar Water Heaters	1,280	776	78
Solar Panels	37,658	22,823	2,282
Tree planting	10,831	897	1,926
Vehicle Fuel Decarbonization		8,564	366
Active Transportation		20,219	512
Total	54,624	56,222	5,458

Table 36: Cumulative (2026-2050) co-pollutant emissions reductions from implementation of CAP measures

Projected Future Year Co-Pollutant Emissions Reductions

The following tables list projected future years co-pollutant emissions reductions for each evaluated measure.

	Emissions Reductions from Reducing Energy Consumption in Buildings (MT)					
Co-Pollutant	**2026**	**2030**	**2035**	**2040**	**2045**	**2050**
SO2	229.4	239.9	133.4	143.5	233.3	237.9
NOX	139.1	145.4	80.8	87.0	141.4	144.2
PM2.5	13.9	14.5	8.1	8.7	14.1	14.4

Table 37: Future-year co-pollutant emission reductions for buildings measure: reducing energy consumption.

	Emissions Reductions from New Building Codes and Solar Water Heaters (MT)					
Co-Pollutant	**2026**	**2030**	**2035**	**2040**	**2045**	**2050**
SO2	52.1	48.2	127.9	54.0	34.6	34.6
NOX	31.6	29.2	77.5	32.7	21.0	21.0
PM2.5	3.2	2.9	7.8	3.3	2.1	2.1

Table:38 Future-year co-pollutant emission reductions for buildings measure: new building codes and solar water heaters.

	Emissions Reductions from Solar Panels (MT)					
Co-Pollutant	**2026**	**2030**	**2035**	**2040**	**2045**	**2050**
SO2	1,576	1,376	1,500	1,757	2,101	721
NOX	955	834	909	1,065	1,273	437
PM2.5	95	83	91	106	127	44

Table:39 Future-year co-pollutant emission reductions for buildings measure: solar panels.

Co-Pollutant	Emissions Reductions from Planting Trees (MT)					
	2026	2030	2035	2040	2045	2050
SO2	94	471	471	471	471	471
NOX	8	39	39	39	39	39
PM2.5	17	84	84	84	84	84

Table:40 Future-year co-pollutant emission reductions for the tree planting measure.

Co-Pollutant	Emissions Reductions from Vehicle Fuel Decarbonization (MT)					
	2026	2030	2035	2040	2045	2050
NOX	826.3	470.6	569.1	224.3	81.9	83.0
PM2.5	27.3	21.1	25.6	10.1	3.7	3.7

Table:41 Future-year co-pollutant emission reductions for ground transportation measure: vehicle fuel decarbonization.

Co-Pollutant	Emissions Reductions from Active Transportation (MT)					
	2026	2030	2035	2040	2045	2050
NOX	5.8	16.6	40.2	23.7	11.6	14.7
PM2.5	0.2	0.7	1.8	1.1	0.5	0.7

Table:42 Future-year co-pollutant emission reductions for ground transportation measure: active transportation.

7. Low-Income and Disadvantaged Community Analysis

Low-income households often contribute the least to greenhouse gas emissions, yet they disproportionately bear the impacts of climate change. This represents an important climate justice consideration in the design of mitigation and adaptation policies. National-level data offers a stark illustration: a 2023 study published in *PLOS Climate* found that the top 10% of U.S. earners are responsible for approximately 40% of total U.S. greenhouse gas emissions, while the top 1% alone account for 15 to 17%. Notably, a significant portion of these emissions is not linked to consumption but to investment-based activities, such as stakes in fossil fuel-intensive industries. For the top 1%, an estimated 38–43% of emissions derive from investments rather than day-to-day consumption—highlighting the structural role of capital in driving climate change.[222]

Globally, the disparity is even more extreme. The bottom 50% of the world's population contributes just 12% of emissions, while the top 10% is responsible for nearly half (48%). The wealthiest 1% emit more than the bottom five billion combined.[223] These figures underscore the degree to which wealth is inextricably linked to carbon intensity. As income increases, so too does an individual's carbon footprint, due not only to greater consumption of goods and services but also to the carbon embedded in financial assets and luxury lifestyles. It is clear that increased income carries an associated carbon cost.

These insights have implications for Hawai‘i's LIDAC communities, where low-income households not only emit minimally but also shoulder some of the highest energy burdens in the nation. Wealthier households tend to contribute significantly more to greenhouse gas emissions through channels such as frequent airline travel, large single-family homes, increased vehicle ownership, and extensive home cooling and heavy air-conditioning use. In Hawai‘i's tropical climate, higher-income families often maintain large, energy-intensive homes with multiple air-conditioning units running for hours daily, which increases electricity demand and drives emissions beyond what is captured by per-capita averages. Meanwhile, low-income households face unique hardships in this same environment. According to the Hawai‘i State Department of Business, Economic Development & Tourism (DBEDT), and corroborated by American Council for an Energy-Efficient Economy (ACEEE) analysis, Hawai‘i has among the highest electricity rates in the country, roughly double the national average.[224]

For LIDAC households in Hawai‘i, the combination of low emissions, high costs, and rising vulnerability to heat and storms demands an intentional and equity-centered response. Mitigation

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[222] Oswald, Y., Owen, A., & Steinberger, J. K. (2023). *The US income-emissions inequality nexus: A multi-dimensional analysis*. *PLOS Climate*, 2(6). https://doi.org/10.1371/journal.pclm.0000190

[223] Chancel, L. (2022). *Global Carbon Inequality Over 1990–2019*. *Nature Sustainability*, 5, 931–938. https://doi.org/10.1038/s41893-022-00955-z

[224] Hawai‘i State Department of Business, Economic Development & Tourism (DBEDT). (2023). Electricity Burdens on Hawai‘i Households. Honolulu, HI: Research & Economic Analysis Division. Retrieved from https://files.hawaii.gov/dbedt/economic/data_reports/reports-studies/Electricity_Burdens_on_Hawai%E2%80%99i_Households_Jan_2025.pdfSierra Club Hawai‘i. (2021). *Energy Justice in Hawai‘i*. https://sierraclubhawaii.org/blog/ej-heco-july2021

and adaptation strategies must acknowledge that the wealthiest households not only contribute disproportionately to emissions but also often have the resources to insulate themselves from the consequences of climate change and that low-income households are left exposed and overburdened, with few options to adapt. These dynamics make it clear that policies that improve resilience infrastructure and reduce energy burdens and climate impacts in LIDAC communities need to be prioritized to ensure that progress toward Hawai‘i’s climate goals is carried out equitably.

The implementation of the measures included in this CAP will significantly benefit low-income and disadvantaged communities. This chapter outlines how Hawai‘i identified LIDACs for the purposes of this plan, why a Hawai‘i-specific methodology was necessary, and how our state intends to ensure that the benefits of our CAP measures flow equitably to these communities.

Context for Hawai‘i’s LIDAC Methodology

Hawai‘i's unique geographic, economic, and social context necessitates a localized approach for identifying low-income and disadvantaged communities (LIDACs). National-level screening tools such as the Climate and Economic Justice Screening Tool (CEJST) and EPA’s EJScreen IRA Disadvantaged Communities Layer often do not adequately characterize the specific vulnerabilities and needs of Hawai‘i's communities. This is due to limitations such as broad census tract groupings that mask intra-island disparities, skewed federal income thresholds, and lack of coverage for climate-specific hazards experienced in the islands.

Given these constraints, Hawai‘i has adopted a customized methodology rooted in local data sources that more accurately reflect the socioeconomic and environmental realities faced by our frontline communities. Our approach sought to identify LIDACs using more granular, high-resolution data than national-level screening tools provide, in order to more accurately capture the localized conditions and diverse characteristics of Hawai‘i’s communities.

Methodology for Identifying LIDACs

To conduct a meaningful LIDAC Benefits Analysis for our CAP, we first developed a list of communities throughout the state that we consider to be low-income and disadvantaged. This identification process varied by county due to the availability and quality of local data.

Kaua‘i County
For Kaua‘i, we used the SVI mapping and vulnerability analysis provided in the Kaua‘i CAP Vulnerability and Equity Analysis. Communities with a Social Vulnerability Index score above the 0.6 percentile were designated as LIDACs.

- Source: https://kauaiadaptation.com/impacts/
- Reference: Kaua‘i CAP Vulnerability and Equity Analysis

Honolulu County (O‘ahu)
We used the O‘ahu Social Vulnerability Index developed by the Honolulu City and County Office of Climate Change, Sustainability, and Resilience. This index was created as part of the O‘ahu

Climate Change Resilience Strategy and incorporates socioeconomic and climate vulnerability indicators. Communities categorized as "High" or "Very High" vulnerability were classified as LIDACs for this analysis.

- Source: Oʻahu Social Vulnerability Index Webmap
- Reference: Ola: Oʻahu Resilience Strategy

Maui and Hawai'i Counties
In the absence of comprehensive local social vulnerability indexes for these counties, we utilized census data from United for ALICE (Asset Limited, Income Constrained, Employed) to identify vulnerable communities. Communities where more than 50% of households were either below the federal poverty line or classified as ALICE were designated as LIDACs.

- Source: United for ALICE - Hawaiʻi

Hawaiian Home Lands
All Hawaiian Home Lands tracts across the state were automatically included in our LIDAC definition. These lands are designated for Native Hawaiian beneficiaries and represent communities with unique socio-cultural and economic considerations.

Wherever possible, we identified communities down to the level of Census Designated Places (CDPs) to enhance the resolution of our analysis. This granularity will also allow for targeted outreach in the future, enabling meaningful engagement with each community about their climate priorities and the ways in which CAP measures may be implemented.

We recognize that for the quantitative portion of the LIDAC Benefits Analysis, our consultants may operate at a broader resolution than CDPs due to data and modeling limitations. However, our list will serve as the foundational community inventory for that work and for ongoing outreach.

Impact of CAP Implementation on LIDACs

This section discusses anticipated broader societal impacts of GHG mitigation measures, such as potential positive (co-benefits) or negative (co-harms) impacts. These are not equally distributed and are often difficult to clearly determine and assess, as their relevance encompasses different areas of concern, such as technology, income distribution, economic market, energy, health, environment, climate adaptation and resilience.

The Intergovernmental Panel on Climate Change (IPCC) defines co-benefits as “the positive effects that a policy or measure aimed at one objective might have on other objectives, irrespective of the net effect on overall social welfare.” In this analysis, co-benefits are assumed to be any potential or anticipated benefits of the measure in addition to its impact on GHG emissions. Examples of co-benefits of reducing GHG emissions are shown in the following figure.

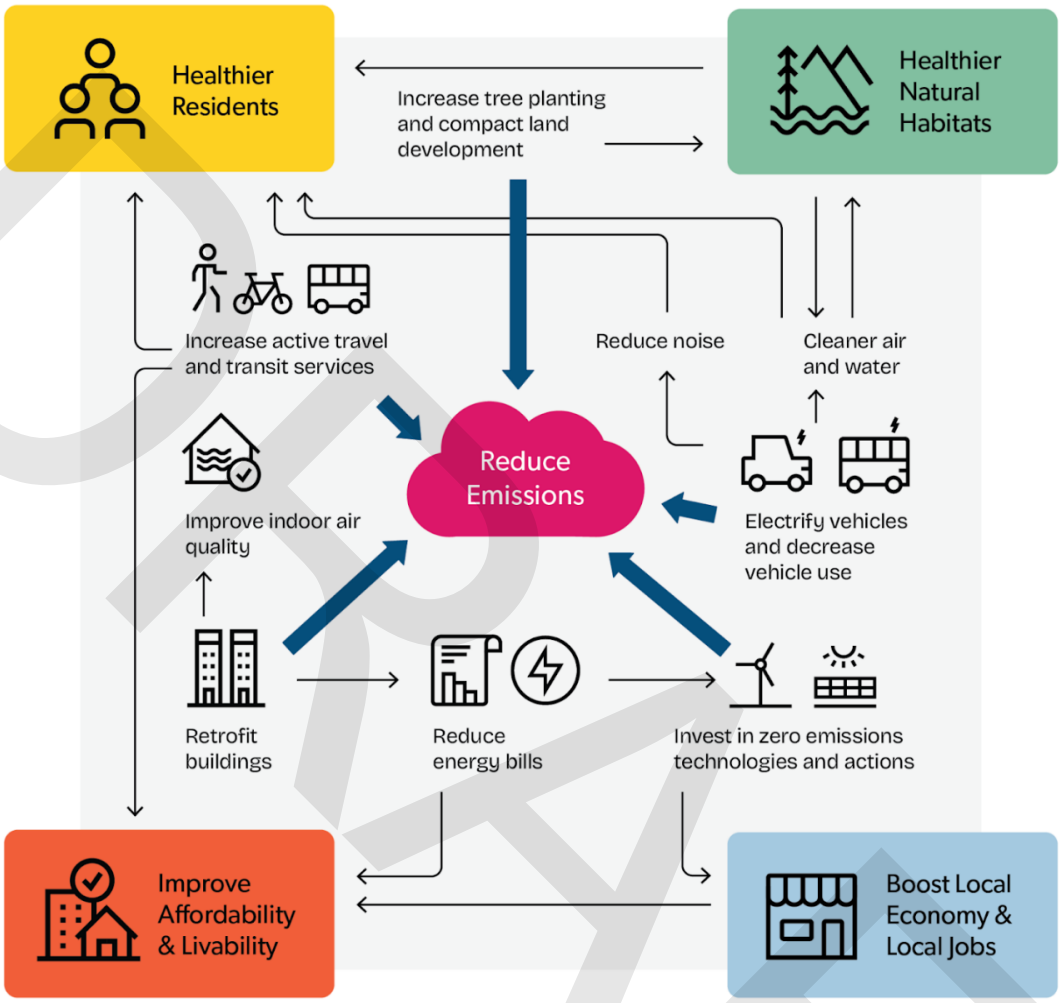

Figure 20: Depiction of how emissions reductions have various co-benefits

While many GHG reduction measures have positive effects, there is also potential for co-harms and the creation of negative feedback cycles. For example:

- Compact urban development reduces emissions, but without careful design, there is a risk that people, including children and the elderly, will be exposed to elevated levels of air pollutants as they walk or cycle in close proximity to traffic increasing the need for faster adoption of electric vehicles.
- Infrastructure to reduce emissions requires major investments, and the income distributional effects of those investments may impact those households with lower incomes without guardrails to protect them.
- Increased costs in urban centers may result in increased lower-cost housing at the edge of cities or outside of their boundaries, leading to an increase in transportation emissions and congestion.

- An increase in transportation electrification may lead to a displacement of increased emissions, particularly in the absence of policies related to renewable electricity generation. This may cause negative impacts to those households residing in the vicinity of electricity-generating facilities.

The positive, or negative, effects are often unintentional and specific to local contexts, but measures that reduce emissions can be implemented in ways that increase positive co-benefits and mitigate or avoid negative ones. This can be achieved through careful policy design that considers and prioritizes GHG emissions alongside other impacts.

Co-benefits and co-harms were assessed broadly and qualitatively, considering economic prosperity, energy poverty, employment opportunities, indoor air pollution and physical and emotional wellbeing.

In terms of economic prosperity, an important impact is the household energy expenditures. Technologies and energy sources can increase or decrease household energy expenditures, which particularly impacts households with a high energy burden. A household faces a high energy burden when it spends more than 6% of its income on energy and a severe energy burden when it spends more than 10% of its income on energy, as defined by the U.S. Department of Energy.

According to the 2022 Update of Electricity Burdens on Hawai'i Households report[225], households in Hawai'i have, on average, the highest electricity costs, compared to the rest of the US. While the average household electricity burden in Hawai'i was 2.1% (the 5th highest in the country), extremely low-income households, who earn less than 30% of Area Median Income (AMI), spent 13.9% of their income on electricity bills. This worsens in households with incomes below the Federal Poverty Level (FPL), who spent 19.5% of their income on electricity costs. These households experiencing high and sever energy burdens comprise almost a quarter of the households in Hawai'i.

Implementing GHG emission reduction measures in buildings can also help reducing energy poverty. For instance, by using solar power, homeowners can partly offset their electricity costs. Also, by reducing energy consumption through retrofitting homes, installing solar water heaters and changing equipment, amongst others, can decrease energy consumption in households, decreasing the energy burden in low-income households in Hawai'i. Together with GHG measures in buildings, energy and transportation actions, such as transitioning to clean energy, switching transportation modes (encouraging active transportation), electrifying vehicles and decarbonizing fuels, may help reduce energy poverty.

When implementing these types of measures, many of the savings occur as a result of investments, such as building weatherization, but not all, such as shifting short trips from a vehicle to walking

[225] https://files.hawaii.gov/dbedt/economic/data_reports/reports-studies/Electricity_Burdens_on_Hawai%E2%80%99i_Households_Jan_2025.pdf

or cycling. This investment can be inaccessible to some households, so that they are unable to access the cost savings that can result. It is important to set up the right policies and programs so low-income households can implement measures that require investments in order to access their savings and hence improve their energy burden.

In terms of employment opportunities, transitioning to a low-carbon economy is expected to have four categories of impacts on labor markets:

- Additional jobs will be created in emerging sectors, such as electric vehicles and energy management systems (EMS).
- Some employment will be shifted, for example, from fossil fuel production and distribution to renewables.
- Certain jobs will no longer be relevant or necessary, such as vehicle mechanics who specialize in gasoline engines. Many existing jobs will be transformed and redefined, with some employment opportunities emerging that are not yet possible to anticipate.

Policy and implementation design can maximize the benefits of new job creation during the implementation of low-carbon measures, while also mitigating the negative effects of job losses in certain sectors. As industries that are gradually phased out leave some workers vulnerable, tools and resources can be provided to help with the transition into high-quality jobs. This support could take the form of financial assistance, targeted workforce training, and economic development initiatives to foster resilience.

Investments in GHG emission reduction measures represent opportunities for existing and new businesses in Hawai'i. These include businesses directly implementing elements of the measures, such as contractors, HVAC suppliers, construction companies, appliance manufacturers, renewable energy developers, car dealerships, arborists and bike shops, as well as businesses supporting them, such as banks and credit unions, engineering firms, architects and designers, and insurance companies.

Air pollution co-benefits were discussed in the previous section. However, implementing measures to reduce carbon emissions occurring at residential and commercial buildings may improve indoor air quality and may reduce the incremental health burdens associated with the co-pollutant emissions. Measures that reduce the combustion of fuels in the home such as stoves, water heaters, and furnaces can reduce indoor air pollution. Transitioning to electric systems, particularly by incentivizing and requiring heat pumps, eliminates these combustion-related emissions.

Decarbonizing vehicle fuels through the use of E85 fuel bring lower GHG emissions as well as harmful toxic pollutants such as benzene, which is a known carcinogen. An identified co-harm

though are acetaldehyde emissions of this fuel, under certain engine conditions[226] (sold engine start), also a carcinogen and a moderate contributor to the formation of ground level ozone.[227]

Low-carbon actions can also have impacts in people's physical and emotional wellbeing. For instance, promoting a transition from personal vehicle use to public transportation or other active modes of transportation can lead to increased physical activity and a healthier lifestyle, reducing the relative risk of premature mortality by 30 - 40%.[228] Also, studies have consistently shown that regular physical activity improves overall health, mental health and fitness, reduces many chronic diseases and contributes to happiness and decreased anxiety.[229] [230]

[226] Comparison of Emissions of Conventional and Flexible fuel Vehicles Operating on Gasoline and E85 Fuels. https://gaftp.epa.gov/Air/emismod/SPECIATE_supportingdata/v4_2/E-85%20and%20gasoline%20fuels%20exhaust%20comparison%2005-39%20FFV%20Report%20-%20Final.pdf
[227] https://afdc.energy.gov/vehicles/flexible-fuel-emissions
[228] U.S. Department of Transportation. *Active Transportation and Health*. https://www.transportation.gov/mission/health/active-transportation-and-health.
[229] World Health Organization. *Physical Activity*. https://www.who.int/news-room/fact-sheets/detail/physical-activity.
[230] Mayo Clinic Staff. *Exercise: 7 Benefits of Regular Physical Activity*. Mayo Clinic. https://www.mayoclinic.org/healthy-lifestyle/fitness/in-depth/exercise/art-20048389.

8. Workforce Planning Analysis

Implementation of this CAP will create high-quality jobs for Hawai‘i. Workforce development will be a critical component of ensuring that jobs are provided to kama‘aina. Developing a skilled workforce at home will aloow the State to meet our climate goals, and can also create pathways to sustainable careers for residents across the islands. This workforce should be developed in an equitable and inclusive manner and address barriers to accessing workforce opportunities for disadvantaged communities. This section details strategies and commitments to strengthen workforce partnerships, address anticipated labor changes, build sector-specific technical skills, overcome equity challenges, and ensure targeted funding and effective messaging.

8.1 Workforce Partnerships

Hawai‘i’s existing workforce partnerships provide a strong platform for future growth but require expanded coordination and support across sectors and parties to meet the demands of our future climate-ready workforces. A number of agencies across the state are already active in workforce development and may serve as valuable collaborators in these efforts. The following is a list of some key organizations currently involved in this space:

Nonprofit Organizations:

- Affordable Hawai‘i Foundation
- Aloha ‘Āina Economic Futures (AAEF)
- American Job Centers
    - Workforce Innovation and Opportunities Act (WIOA)
- Chamber of Commerce Hawai‘i
    - Education & Workforce Development Team
    - Engineering Sector Partnership
    - Future of Work Annual Conference
    - Healthcare Sector Partnership
    - Kama‘āina Come Home Initiative
    - Technology Sector Partnership
- Council for Native Hawaiian Advancement (CNHA)
    - Hawaiian Trades Academy
    - Kāko‘o Maui Workforce Development Program
- Elemental Impact
- ‘Ewalu Industries
    - CREATE Hawai‘i
    - Lead for Hawai‘i Fellowship
    - ‘Ōpio Internship Program
    - Workforce Advancement Initiative (WAI)
- Hawai‘i Farmers Union United
    - Farm Apprentice Mentoring Program
- Hawaii International Science Experience
- Hawai’i Workforce Funders Collaborative
    - Hawai‘i Worker Equity Lab

- Hawai‘i Workforce Pipeline
    - Career and Technical Education (CTE) Work-Based Learning: Networking & Showcase Conference
- Jobs for the Future
- Kupu
    - Conservation Leadership Development Program (CLDP)
    - Kupu ‘Āina Corps
    - Kupu Community Program
    - Natural Resources Sector Partnership
- Maui Economic Opportunities
    - Business Development Center
    - Community Services Department
    - Transportation Department
    - Youth Services Department
- Purple Mai‘a
    - Hiapo Workforce Development
    - Mālama Design Studio
    - Pākōlea Small Business Pilot Program
- Vibrant Hawai‘i
    - ‘Iliahikū Work-Based Learning Initiative
    - KōCreate Initiative
    - Kuhikuhi Work-Based Learning Program
- Wastewater Alternatives and Innovations (WAI)
    - Work-4-Water Program

Public Agencies:

- County Economic Development Boards
- Department of Business, Economic Development & Tourism (DBEDT)
    - Creative Industries Division
        - Creative Industries Sector Partnership
    - Hawai‘i State Energy Office (HSEO)
        - Clean Energy Wayfinders
        - Clean Energy Sector Partnership
- Department of Education (DOE):
    - Career and Technical Education (CTE) Pathways
    - Workforce Development Branch
- Department of Labor and Industrial Relations (DLIR)
    - Workforce Development Council (WDC)
        - Workforce Synergy Summit
    - Workforce Development Division (WDD)
- Natural Energy Laboratory of Hawai‘i Authority (NELHA)
    - Hawaii Ocean Science and Technology (HOST) Park
    - NELHA Internship Program

Academic Institutions:

- College of Tropical Agriculture and Human Resources (CTAHR)

- GoFarm Hawai‘i
- National Disaster Preparedness Training Center (NDTPC)
- University of Hawai’i and Community Colleges
- University of Hawai‘i Sea Grant
    - Aquaculture Sector Partnership

Partnerships:

- Hawai‘i P-20
    - Education Data Initiative
    - GEAR UP Hawai‘i
    - Hawai‘i Graduates for Hawai‘i’s Future
    - Hawai‘i P-3 Initiative
    - Ke Ala Na‘auao
- Good Jobs Hawai‘i

Private Sector:

- AE Consulting
    - Sector Partnerships Support
- Harold K.L. Castle Foundation
    - Hawai‘i Youth Apprenticeship Network (HYAN)
- Hawai‘i Community Foundation
    - ALICE Initiative Cohort
    - House Maui Initiative
    - Social Impact Investment Fund
    - THINK Fund
- Ma‘o Farms
    - Farm Expansion Experience (FE‘E)

A diverse ecosystem of partners across the state including public agencies, nonprofits, educational institutions, and industry leaders is actively contributing to Hawai‘i’s workforce development landscape. State agencies such as the Department of Labor and Industrial Relations (DLIR), the Department of Education (DOE), and the Department of Business, Economic Development & Tourism (DBEDT) are playing a growing role in shaping a more coordinated and climate-responsive workforce development system. DLIR advances workforce readiness through initiatives like the Workforce Development Council and the Hawai‘i Green Jobs Initiative, which identifies employment opportunities in renewable energy, conservation, and other sustainability-related fields while aligning labor market data with education and training systems. DOE contributes through its Career and Technical Education (CTE) pathways in areas like clean energy, STEM, and sustainable agriculture, and oversees a Workforce Development Branch that supports career readiness throughout the K–12 system. However, capacity remains limited, and additional resources are needed to strengthen climate-related offerings. DBEDT contributes through its leadership in innovation and economic development, including efforts led by the Hawai‘i State Energy Office (HSEO) such as the Clean Energy Wayfinders and the Clean Energy Sector Partnership, which aim to improve energy equity and access in vulnerable communities.

A key strategy for cross-sector coordination is the use of industry-specific sector partnerships. Funded by DLIR and convened by the Chamber of Commerce Hawai‘i, with logistical support

from AE Consulting, these partnerships bring together employers, educators, and workforce organizations to identify shared needs and co-design training programs. Active sector partnerships in industries such as healthcare, clean energy, technology, engineering, aquaculture, and the creative economy are aligning education with real workforce demand and building shared goals for recruitment, training, and job placement. For example, the Engineering and Technology Sector Partnerships facilitate collaboration between employers and educators to ensure curriculum reflects current industry needs.

The Natural Energy Laboratory of Hawai‘i Authority (NELHA) also supports green workforce development through its work in aquaculture, clean energy, and sustainable technology sectors. Through its HOST Park and partnership initiatives, NELHA offers hands-on training, internships, and career pathways for local residents in emerging green industries.

As a participant in the U.S. Climate Alliance's Climate-Ready Workforce Initiative, the State is contributing to a national effort to accelerate the development of a diverse, equitable, and inclusive climate-ready workforce, with a particular focus on establishing new climate-ready pre-apprenticeship and Registered Apprenticeship programs. This initiative supports the creation of new pathways into good-paying, high-quality jobs in climate mitigation, adaptation, and resilience, particularly for workers from underrepresented communities. More information about the initiative is available at www.usclimatealliance.org

Alongside state agencies, nonprofits and community-based organizations are advancing innovative models rooted in local knowledge and cultural grounding. Organizations such as ‘Ewalu Industries, Kupu, Purple Mai‘a, Work-4-Water, and Vibrant Hawai‘i that offer strong models for career exposure, work-based learning, and leadership development. Their initiatives exemplify values-driven, community-rooted workforce development aligned with climate resilience. ‘Ewalu Industries operates four integrated programs (CREATE Hawai‘i, the Lead for Hawai‘i Fellowship, the ‘Ōpio Internship Program, and the Workforce Advancement Initiative (WAI)) that provide hands-on learning, paid fellowships, and employer engagement strategies. The Council for Native Hawaiian Advancement (CNHA) advances workforce development through initiatives like the Hawaiian Trades Academy, which offers training programs in skilled trades such as construction, CDL licensing, and clean energy, with a focus on uplifting Native Hawaiian and underserved communities. Additionally, CNHA's Kāko‘o Maui initiative supports economic recovery and resilience on Maui by funding job training, small business support, and employment opportunities in response to recent disasters, helping to build long-term community capacity and workforce readiness.

The Hawai‘i Workforce Funders Collaborative (HFWC) is a non-profit that brings together philanthropy, government, education, business, and nonprofit leaders to strengthen workforce systems across the state. HFWC focuses on aligning investments, coordinating strategies, and scaling high-impact solutions that connect residents to quality jobs and economic mobility. As part of this work, HFWC launched the Hawai‘i Worker Equity Lab to help ensure that equity remains central to workforce planning. The Lab addresses systemic barriers faced by marginalized communities including Native Hawaiians, immigrants, and low-income workers through policy research, advocacy, and coalition-building. Together, these efforts help expand access to quality jobs, elevate worker voices, and promote economic security rooted in justice and community empowerment.

The ʻĀina Aloha Economic Futures (AAEF) framework is a Native Hawaiian-led vision for a just and sustainable economy in Hawaiʻi that centers the values of kuleana (responsibility), mālama ʻāina (care for the land), and collective well-being. Developed through broad-based community engagement, AAEF calls for a shift away from extractive and externally dependent economic models, and toward locally grounded systems that restore and sustain ʻāina, uplift Indigenous knowledge, and promote self-determination.[244] In the context of workforce development, this means investing in career pathways that are not only economically productive, but that also reinforce cultural identity, foster environmental stewardship, and serve community-defined goals. The AAEF framework supports the growth of industries aligned with regenerative practices such as sustainable agriculture, renewable energy, and ecosystem restoration, creating opportunities for kamaʻāina to thrive in fields that are rooted in place, resilience, and long-term community wellbeing. This approach is particularly well-suited to climate workforce development, which by nature requires solutions that are locally appropriate, ecologically sound, and socially just. To support implementation, AAEF developed the ʻĀina Aloha Assessment Tool, a values-based rubric that can be used to evaluate policies, programs, and public investments, including workforce initiatives and RFPs. Integrating this tool into workforce planning processes can help ensure that investments align with community priorities and advance culturally grounded, regenerative economic pathways.

There is a clear need in workforce development initiatives for collaboration across public, private, nonprofit, labor, and educational entities, as well as across industry sectors. Programs are often fragmented across islands and lack coordination. There is a need for stakeholders to convene regularly, align efforts, and reduce duplication by sharing best practices and centering shared goals. Intermediary organizations that help coordinate across institutions and sectors can play a key role in matching training curricula to real hiring needs, facilitating partnerships, and ensuring that support services are integrated across systems. For example, the Hawaiʻi Workforce Pipeline functions as an intermediary connecting educators and employers to coordinate project-based learning and work-based experiences. Their model streamlines employer engagement while expanding real-world career exposure for students. These cross-sector collaborations are especially important for developing inclusive pathways for underrepresented populations and scaling up sector-specific solutions. Another strategy to cross-sector collaboration is to codify a unified state workforce strategy and set a "North Star" goal for shared metrics and accountability.[245]

8.2 Anticipated Labor Changes

Workforce projections in Hawaiʻi's clean energy sectors show clear growth potential. According to a 2022 study by the National Renewable Energy Laboratory (NREL), significant increases in employment are expected in solar PV, battery storage, and wind energy installation by 2030. [246] As Hawaiʻi moves towards a climate-resilient economy, workforce demands will shift dramatically. Job growth is anticipated in sectors such as:

- Regenerative agriculture and aquaculture
- Renewable energy
- Energy-efficient and climate-resilient building construction and retrofits
- Disaster preparedness and resilience

- Land management
- Coastal zone management
- Ocean resource management
- Clean transportation
- Clean water
- Waste management and circular economy industries such as composting and recycling.
- Data science, climate modeling, and GIS technology applications.
- Public health related to climate impacts

To effectively prepare for projected job growth in these sectors, Hawai‘i must identify training pipeline deficiencies and map existing workforce pathways. These analyses should emphasize outcomes for historically underrepresented populations, including efforts to retain local talent and support the return of kama‘āina and Native Hawaiians who wish to come home. They should also be informed by meaningful engagement with those actively developing and implementing workforce strategies. With additional resources, DLIR is well-positioned to lead these efforts in partnership with sectoral experts, educational institutions, and third-party consultants with experience in climate workforce planning.

These sectors will require workers with specialized technical skills and certifications. Reskilling and lifelong learning must be supported through stackable credentials, microcredentials, and technology-driven training programs. Increasing involvement in the Eligible Training Provider List will also be an important strategy. [247] This program enables workforce training programs in Hawai‘i to be funded through the Workforce Innovation and Opportunity program.

8.3 Sector-Specific Technical Skills for a Climate-Ready Workforce

To effectively implement the climate measures identified in this plan, Hawai‘i must invest in developing a workforce with the technical skills necessary to meet sector-specific demands. These technical skills form the foundation for building Hawai‘i’s climate-resilient workforce. Each sector offers an opportunity to align job training programs, certifications, and educational pathways with the growing demand for climate-related services. By developing targeted curricula, expanding hands-on training opportunities, and connecting learners to career pathways in these fields, Hawai‘i can grow a workforce that is both capable and reflective of the meeting state’s goals for a climate resilient future.
The following outlines the foundational skillsets required across key sectors driving the state’s climate action efforts.

Agriculture:

- Sustainable crop production (e.g., agroforestry, regenerative agriculture)
- Soil health monitoring and amendment
- Pest and nutrient management with reduced chemical inputs
- Drip irrigation and water efficiency technologies
- Climate-smart farm planning and risk assessment
- Agricultural drone use and remote sensing

Aquaculture:

- Hatchery operations and aquatic animal husbandry
- Water quality monitoring and testing
- Native species restoration
- Integrated multi-trophic aquaculture systems
- Disease prevention and biosecurity
- Marine aquaculture infrastructure maintenance

Clean Energy:

- Solar PV system design, installation, and maintenance
- Battery storage technology installation and integration
- Grid modernization and smart grid deployment
- Wind turbine operation and maintenance
- Energy system modeling and forecasting
- Compliance with safety and renewable energy codes

Clean Transportation:

- Electric vehicle (EV) charging infrastructure installation
- EV repair and diagnostics
- Transit system electrification planning
- Micromobility deployment and maintenance
- Traffic data analysis and smart mobility tech
- Active transportation design (e.g., bike/pedestrian infrastructure)

Clean Water:

- Drinking water treatment and distribution systems
- Wastewater management and decentralized systems
- Stormwater catchment and green infrastructure
- Leak detection and water conservation technologies
- Hydrological modeling and groundwater management
- Regulatory compliance for water quality standards

Coastal Zone Management:

- Shoreline erosion monitoring and modeling
- Nature-based solution design (e.g., living shorelines)
- Coastal infrastructure planning and permitting
- Climate risk assessment and adaptation planning
- GIS and remote sensing for coastal resilience
- Stakeholder engagement and community-based planning

Data Sciences:

- Climate modeling and scenario planning
- Geographic Information Systems (GIS)
- Environmental sensor calibration and maintenance
- Programming languages for analysis (e.g., Python, R)

- Data visualization and dashboard design
- Integration of socio-environmental datasets

Disaster Preparedness and Resilience:

- Emergency operations planning and logistics
- Community-based risk assessment
- Early warning system design and communication
- Hazard mitigation and retrofit techniques
- Shelter operations and mass care
- Incident command system (ICS) training

Energy Efficient and Climate Resilient Buildings:

- Building energy audits and thermal envelope assessments
- HVAC and ventilation system retrofits
- Passive cooling and green design strategies
- Building electrification and heat pump installation
- Use of low-carbon and recycled construction materials
- Resilient siting and flood-proof construction practices

Land Management:

- GIS mapping and land use analysis
- Forest restoration and native plant propagation
- Invasive species detection and removal
- Prescribed fire planning and implementation
- Conservation planning and carbon sequestration estimation
- Monitoring of ecosystem services and soil erosion

Ocean Resources:

- Marine spatial planning
- Coral reef monitoring and restoration
- Fisheries management and stock assessment
- Marine protected area enforcement
- Ocean acidification impact monitoring
- Underwater ROVs and ocean data instrumentation

Public Health:

- Vector-borne disease surveillance and prevention
- Heat stress monitoring and response
- Air quality data interpretation
- Public health emergency planning
- Environmental health and climate communication
- Health impact assessments for infrastructure and land use projects

Waste Management and Circular Economy:

- Deconstruction and materials salvage
- Composting, organic waste treatment, and anaerobic digestion

- Recycling stream sorting and quality control
- Hazardous and e-waste handling and disposal
- Lifecycle analysis and waste audits
- Repair and remanufacturing technologies

8.4 Strengths, Risks, and Opportunities

Hawai‘i’s workforce benefits from a growing network of registered apprenticeships and an emerging ecosystem of workforce development initiatives. These programs can be directed to support climate resilience and equitable economic opportunity. Programs like Good Jobs Hawai‘i offer training in climate-related sectors such as clean energy, skilled-trades, and technology, while education-industry collaborations are beginning to design place-based curricula responsive to Hawai‘i’s workforce and environmental needs. Challenges that need to be addressed include a need for stackable credentials, barriers to workforce retention, and a lack of clear and effectively promoted pathways to climate-specific careers.

One example of education-industry collaborations that can be scaled across sectors is the earn-and-learn model, where workers can participate in online and in-person training to earn credentials and advance their careers while remaining employed. Employers can allow for adjustments in work schedules to accommodate training hours and may also provide supplemental pay. These models are especially critical for adult learners, incumbent workers, and individuals without the means to pursue unpaid training or full-time study. They allow individuals to gain industry-relevant skills while earning income, reducing financial barriers and enhancing retention. A strong example of earn-and-learn collaboration is the Healthcare Association of Hawai‘i’s CNA to LPN Glidepath program, which combines online instruction with hands-on clinical training through a partnership between UH Community Colleges, local employers, and labor organizations. This type of employer-aligned, applied learning model could be replicated in clean energy, climate resilience, conservation, or emergency response fields where hands-on skills are equally critical.
A lack of stackable credentials and alignment across training programs and sectors is a significant barrier to creating the long-term pools of skilled workers needed to implement our climate goals. Students and workers often face dead-ends when attempting to transition between educational institutions or career advancement pathways. Without a statewide framework that ensures alignment and stackability of credentials, apprenticeships, and training experiences, Hawai‘i may fail to create a sustainable workforce pipeline that can meet the demands of the future.

Many climate-related careers lack clear, structured educational pathways, particularly at the 2-year college level, which creates major gaps in awareness, access, and affordability. Emerging fields like climate resilience, energy systems, sustainability science, and waste management often don’t have associate degrees or stackable credentials that serve as on-ramps to long-term careers. This absence disproportionately affects students from underrepresented and resource-constrained backgrounds, who rely on affordable entry points and visible outcomes to guide their education decisions. The new ASNS–Natural Resources and Environmental Management (NREM) program launching in the 2025–2026 academic year exemplifies how these gaps can be addressed. Developed by Kapi‘olani and Windward Community Colleges in partnership with UH Mānoa, KUPU, Hawai‘i P-20, and community leaders, this program offers a direct transfer route into UH Mānoa’s NREM bachelor's degree. It also raises awareness of natural resource careers through

early exposure and structured guidance. This structure and the process for creating it could be replicated in other climate-relevant areas such as renewable energy, circular economy, or environmental health, helping build a more inclusive and robust local workforce.

Another pressing issue in Hawai‘i is workforce retention. Hawai‘i’s high cost of living and lack of affordable housing result in a trend for skilled workers to leave the state. Despite considerable investment in educational and training programs, many residents leave the state to seek affordable living elsewhere, and this dynamic undercuts the return on investment in local workforce development. Addressing this challenge requires not only reducing the cost of housing but also ensuring that climate-related careers offer livable wages that reflect the realities of Hawai‘i’s economy. This can be supported through policies such as prevailing wage standards, wage subsidy programs tied to apprenticeship models, and leveraging public procurement to reward employers who commit to fair compensation in climate-critical sectors. Unless the cost-of-living crisis is addressed as a workforce issue, efforts to prepare a climate-ready workforce may serve only to train talent for areas outside of Hawai‘i.

Workforce retention strategies could be scaled to help address this outmigration of local talent. Programs that support a transition home for local residents that are pursuing careers on the continental U.S. may help alleviate this issue. For example, the Kamaʻāina Come Home initiative offers a compelling model in the engineering sector. A partnership between the Chamber of Commerce Hawai‘i and the Hawai‘i Island Economic Development Board, this program provides returning residents with one-on-one mentorship from local engineering executives, curated job leads, and access to networking events. It makes the return home more accessible, while spotlighting in-demand career opportunities in Hawai‘i. Similar return pathways could be developed for climate-aligned careers such as environmental planning, energy efficiency, or green infrastructure, helping to reverse brain drain and ensure training investments serve Hawai‘i's communities.

There is also a need to expand CTE and higher education programs that are aligned with real-world climate resilience projects. For example, only a small number of DOE high schools offer CTE pathways in climate-related pathways. Expanding climate-related CTE pathways could significantly increase student awareness of emerging career opportunities and inspire early interest in sectors critical to Hawai‘i’s climate resilience. Moreover, these pathways can help close equity gaps by providing practical, affordable entry points into sustainable careers, especially for students from underrepresented and resource-constrained backgrounds. Intermediary organizations can help align curricula with industry needs, coordinate work-based learning placements, facilitate wraparound services, and monitor employment outcomes across systems. Intermediary organizations may include workforce nonprofits, sector-based partnerships, workforce development boards, or regional economic collaboratives that serve to bridge the gap between training providers and employers.

Expanding Work-Based Learning (WBL) programs will offer students direct exposure to climate resilience careers and build stronger employment pipelines. If WBL efforts focus particularly on rural, underserved, or marginalized communities, where access to career-connected learning is often limited, they can help retain local talent and allow kamaʻāina to pursue fulfilling careers without leaving the islands. There is also a need to need to strengthen career navigation supports, including peer mentorship, comprehensive career counseling, labor market data tools, and

community-embedded navigators who can help individuals move through education and employment transitions. These services are especially important for learners from underrepresented backgrounds, who may face added barriers to navigating the workforce.

Another promising opportunity lies in deepening climate-ready career integration across Hawai‘i P-20’s Education to Career Pathways Alignment initiative. The existing pathway maps already span a wide range of industries, including construction, healthcare, information technology, and agriculture, many of which are deeply affected by climate change. However, climate career connections are not consistently emphasized within these pathways. A coordinated effort to identify and embed climate-resilient roles within each sector, such as clean building design in construction, disaster readiness in public health, or sustainable IT infrastructure, could greatly increase awareness and uptake of climate-aligned careers by youth across the state. This would not require creating new pathways, but rather, leveraging and enhancing the relevance of existing ones. Doing so would ensure students see their own interests and talents reflected in Hawai‘i’s climate future, regardless of sector.

Expanding early exposure to technical careers is critical for ensuring equitable access and building future workforce capacity. Pre-apprenticeship models are particularly effective for engaging disconnected youth, low-income students, and others who may not see themselves represented in traditional workforce pipelines. These programs often include stipends, mentorship, dual credit options, and soft skills training to help young people transition successfully into Registered Apprenticeship Programs (RAPs) or college. RAPs provide structured, paid, on-the-job training combined with classroom instruction, leading directly to industry-recognized credentials and stable employment. To expand these opportunities, Hawai‘i should prioritize funding, streamline employer engagement to develop new apprenticeship positions, and strengthen the connection between pre-apprenticeships and RAPs through formal partnerships, ensuring seamless transitions and clear career pathways for participants.

The Hawai‘i Youth Apprenticeship Network (HYAN), supported by the Harold K.L. Castle Foundation and guided by Jobs for the Future, is a leading example. This initiative focuses on designing equitable, place-based apprenticeship readiness pathways for youth aged 16–24. It emphasizes community partnerships, regional implementation, and barrier-reducing supports such as wraparound services and dual enrollment. A climate-focused version of this model could include placements in green construction, conservation, or solar installation, and would be especially impactful in rural communities where opportunity gaps are widest.

In addition to investing in workforce training, Hawai‘i must also streamline business regulations to make it easier for new industries to grow and thrive. Many stakeholders have emphasized that without expanding local industries beyond tourism and hospitality, job creation will remain limited regardless of how well-prepared the workforce is. Building a climate-ready workforce must go hand in hand with growing the sectors that can actually absorb and retain that talent.

8.5 Equity and Underserved Communities

Equity must be central to all workforce development strategies. Strategies should prioritize Native Hawaiians, Pacific Islanders, rural communities, women, youth disconnected from school or

employment, English Language Learners (ELLs), formerly incarcerated individuals, and people with disabilities. These groups face overlapping barriers including transportation challenges, lack of nearby job centers or training programs, language access barriers, the absence of culturally relevant curriculum or mentorship, lack of paid training or stipends to support basic needs while attending programs, exclusionary eligibility requirements for programs or funding, and scheduling conflicts with work or family obligations due to rigid training formats. Many people are also challenged by limited access to devices, internet, and remote learning options. These challenges are often exacerbated by housing insecurity, inconsistent access to childcare, and inflexible or low-wage employment that limits time and mobility for upskilling.

To address these challenges, the state and its partners can explore multiple strategies, including locating job centers, training programs, and resilience hubs within underserved neighborhoods, and expanding the use of mobile training units and digital learning platforms. Targeted outreach through trusted community-based organizations will also help ensure inclusive participation.
Providing robust wraparound services is essential to supporting retention and success. These services include childcare, transportation subsidies, stipends or paid training models, language translation and tutoring, mental health counseling, and reentry support for justice-involved individuals. Partners for these services may include local nonprofits Native Hawaiian-serving institutions, the Office of Hawaiian Affairs, health clinics, and county economic opportunity councils. If partnerships for these services do not already exist or are under-resourced, identifying and building them should be treated as a priority.

Asset-Based Community Development (ABCD) offers a powerful model for advancing equitable and inclusive workforce strategies by focusing on the strengths, relationships, and skills that already exist within communities. Vibrant Hawai‘i’s use of ABCD and its development of sector-specific Comprehensive Economic Development Strategies (CEDS) is a strong example of how to operationalize this model through an equity, resilience, and ‘āina lens, ensuring that planning processes are rooted in community voice and led by those most affected. [248] As Hawai‘i scales climate-aligned workforce initiatives, it is essential to expand culturally competent training programs that integrate local knowledge, place-based practices, and ‘āina-based values into workforce development, particularly in agriculture, conservation, land management, and resilience fields.

Formerly incarcerated individuals face unique barriers to employment and economic stability, making them a key population to support through equitable workforce development strategies. The nonprofit Men of PA‘A offers a valuable example of how restorative justice and ‘āina-based programs can be integrated to provide job training, skill development, and meaningful employment opportunities for individuals transitioning out of the criminal justice system. Their model, which combines emotional healing with practical workforce readiness, represents a community-centered approach that could be scaled statewide to create inclusive pathways to economic opportunity and reduce recidivism. Events like the 2024 Chaminade University symposium, “Pathways to Meaningful Work: A Justice-Involved Symposium,” highlight the importance of statewide collaboration in addressing these barriers and advancing policies, partnerships, and investments to support reentry success. Nationally, initiatives like Jobs for the Future’s Center for Justice & Economic Advancement provide a framework for removing systemic barriers and connecting

people with criminal records to quality education and employment, offering models that Hawai‘i can learn from and adapt to local needs.

8.6 Messaging Opportunities

Effective messaging can build broader support for climate workforce initiatives. Climate careers positioned not just as good jobs, but as meaningful, resilient careers tied to the stewardship of Hawai‘i’s land, waters, and people will expand the public’s understanding of what a “climate career” can look like. Many people assume these jobs are limited to clean energy or transportation sectors, but climate resilience requires a far more diverse range of skills and professions—including data science, GIS, communications, business development, construction, public health, arts and culture, and nonprofit management. Individuals from nearly every background and training can play a meaningful role in climate solutions. Messaging must be creative, inclusive, and specific—showcasing diverse real-life examples and emphasizing that climate work is interdisciplinary, accessible, and deeply connected to place. Stories of young people finding purpose and belonging through work that aligns with their values and serves their community can be especially compelling and can inspire a new generation. Messaging should also tie workforce development to pressing community needs like food security, energy affordability, and disaster resilience.

Messaging can also play a roll in driving cohesion. A scattered and siloed approach dilutes the impact of each investment and creates confusion among both providers and participants. Messaging should encourage alignment across agencies and highlight the need to invest in strategic systems change. One successful example of a unified messaging and action strategy is the effort by the Hawai‘i Workforce Development Council, which convened a broad coalition of stakeholders, including the Department of Education, University of Hawai‘i, state agencies, private businesses, and county governments, to come together behind a single unified state workforce plan with support from the National Governors Association. This effort resulted in agreement on a small set of strategic actions that each partner could contribute to in different ways. Elevating this type of model through messaging and public storytelling reinforces the value of collaboration and shared accountability.

8.7 Recommendations

To address the opportunities and challenges detailed in this chapter, Hawai‘i should implement workforce development measures that build on existing efforts while improving coordination between programs, making it easier for people to access opportunities, and help more residents successfully train for and enter climate-related careers. These recommendations can equip the state with the tools needed to prepare a climate-ready workforce, remove participation barriers for underserved communities, and retain local talent for the long term.

Support and Scale Intermediary Organizations and Employer Partnerships for Work-Based Learning

The state should strengthen the ecosystem of organizations that serve as intermediaries between educational institutions and employers to facilitate work-based learning opportunities. These

organizations play an essential role in aligning curricula with real workforce needs, arranging pre-apprenticeship and apprenticeship placements, and supporting students, educators, and employers throughout the training-to-employment pipeline. While creating new programs is one option, the state can also provide flexible, sustained support to existing intermediaries to scale their efforts and coordinate across islands and sectors. This could include public–nonprofit partnerships and technical assistance for smaller community-based organizations that are already connecting learners to job opportunities. One key role these intermediaries can play is helping education and training providers stay aligned with actual employer needs, by coordinating outreach, sharing information about upcoming hiring needs, and making sure that students in training programs are being prepared for real jobs in their region.

Intermediaries can also take on the logistical and administrative responsibilities that often make work-based learning difficult for schools and employers to manage on their own. This includes designing and planning programs, developing curriculum in collaboration with employers, coordinating student schedules, onboarding participants, tracking outcomes, and providing support throughout the placement. By handling these functions, intermediaries reduce the burden on teachers and businesses, making it more likely that meaningful and equitable work-based learning partnerships can be sustained over time. ʻEwalu Industries and the Hawaiʻi Workforce Pipeline are two examples of existing organizations that fulfill such a role.

Partnerships with large employers such as public utilities, water agencies, and clean energy companies are especially valuable in this effort. These employers can serve as anchor sites for training programs by providing access to real-world facilities, mentorship, and long-term job opportunities. In rural areas or underserved communities, they can also offer land, infrastructure, or project sites that make place-based learning possible.

Develop a Statewide Framework for Stackable Climate Credentials

To ensure learners can advance from entry-level training to long-term careers, Hawaiʻi should develop a credential system made up of smaller, skill-specific courses or certifications that can be combined over time. This framework should begin by identifying key climate sectors with the greatest workforce demand and clarifying the skills and competencies needed in those fields through consultation with employers, educators, and workforce experts.

Credential pathways should include both credit-bearing and non-credit programs, enabling flexibility for diverse learners including high school students, community college enrollees, incumbent workers, and adults seeking to reskill. These smaller credentials must be intentionally designed to build on one another, allowing individuals to start with foundational training and continue adding skills as they advance into higher-level roles. To support this progression, the system should ensure clear connections between training programs, such as between DOE, UH Community Colleges, and UH Mānoa, and credentials should be recognized by employers as meaningful qualifications.

Where possible, credentials should align with national standards while also integrating Hawaiʻi-specific knowledge. This effort would also strengthen the connections between high school CTE programs, UH Community College degrees, and employment opportunities, ensuring that students

can build on what they've already learned without losing credit or hitting dead ends as they move from education into the workforce.

Expand Work-Based Learning and Paid Apprenticeship Opportunities

Hawai'i should expand paid, work-based learning opportunities in climate sectors through registered apprenticeships, pre-apprenticeship programs, and project-based learning aligned with DOE, university, and community college programs. These programs should include stipends, mentorship, and earn-and-learn flexibility for working learners. Employer participation can be encouraged through wage subsidies, flexible scheduling support, and intermediary-led facilitation. To support equity, programs should target youth, women, and rural communities.
The state should also help employers and community partners better understand and access existing federal workforce resources, such as those available through the American Job Centers and the Workforce Innovation and Opportunity Act (WIOA). WIOA funding helps cover the cost of training for eligible individuals, particularly those facing barriers to employment, and includes wage reimbursement programs that incentivize employers to take on apprentices or trainees by reducing the financial risk of hiring someone new. Despite its potential, many employers are unaware these supports exist or don't know how to access them. Increasing awareness and simplifying access to these programs could significantly expand participation in work-based learning partnerships. At the state level, the Department of Labor and Industrial Relations (DLIR) should be resourced and empowered to play a stronger coordinating role across agencies, employers, and training providers to help align efforts, monitor outcomes, and sustain long-term strategy implementation.

Strengthen Climate Career Pathways and Early Exposure in Education

The state should work with the DOE, UH, and partners in the Hawai'i P–20 system to integrate climate-aligned career content into K–12 and postsecondary pathways. This includes expanding CTE programming in high schools to cover green careers; incorporating climate-related content into existing pathway maps (e.g., healthcare, construction, agriculture); and aligning classroom learning with hands-on experiences such as internships, project-based learning, and field-based courses. Place-based framing, such as the ahupua'a system, can help make climate topics more culturally relevant and meaningful for students.

Career exposure should begin early, ideally in middle school, to help students see the real-world value of green careers and build interest over time. Teacher externship opportunities should be expanded, as they help align classroom instruction with actual workforce needs by giving educators direct experience in the field. When teachers are familiar with the work, they're better able to spark curiosity and connect lessons to real job opportunities. These externships should be incentivized through professional development credits, stipends, or career advancement pathways. To support these efforts, the Department of Education should consider adding dedicated staff positions focused on green career pathway development and climate-aligned curriculum coordination across schools and CTE programs.

To ensure learners can make full use of these pathways, the state should also expand career navigation supports such as peer mentorship programs, school-to-career transition coaches, and community-based workforce navigators. These services help learners understand their options,

make informed decisions, and access training and job opportunities. Navigation supports should be embedded in schools and other trusted community spaces such as resilience hubs, with a focus on reaching students and workers in rural areas, underserved communities, and those facing language or accessibility barriers.

Address Structural Barriers to Participation and Workforce Retention

Hawai‘i’s climate workforce strategy must explicitly address the structural barriers that keep residents from completing training or remaining in the state after receiving it. This includes supporting wraparound services such as childcare, transportation, mental health care, and food assistance. It also means expanding digital access for learners who depend on remote or hybrid instruction. Climate workforce investments must also be linked with broader efforts to address the affordability crisis, including housing costs, cost of living, and economic insecurity. Otherwise, the state risks training a workforce that may ultimately move away due to affordability challenges. To support retention, climate-related jobs must offer livable wages that reflect Hawai‘i’s high cost of living. The State can support this through tools such as prevailing wage standards, wage subsidies tied to apprenticeship or earn-and-learn models, and public procurement policies that favor employers committed to fair compensation. These strategies can help ensure that public investment in climate workforce development leads to long-term, economically viable employment for local residents.

Integrate the ‘Āina Aloha Economic Futures Framework into Workforce Planning

As Hawai‘i’s progresses in expanding climate-aligned job training, it is important for workforce initiatives to be connected to the cultural values, lived experiences, and long-term visions of local communities. The ‘Āina Aloha Economic Futures (AAEF) framework helps achieve this by providing a community-informed approach to economic development that aligns with the goals of climate resilience and place-based stewardship.

Integrating AAEF into workforce planning can improve program design and increase retention by ensuring that training pathways resonate with local priorities and community-defined visions of well-being. This is especially important for engaging Native Hawaiian, rural, and youth participants who may be more motivated by opportunities that contribute to their communities and ‘āina. By grounding workforce planning in AAEF principles, the State can build pathways that are culturally relevant, support retention of kama‘āina talent, and strengthen community ownership over economic outcomes.

The AAEF Assessment Tool offers a practical mechanism for evaluating proposed workforce initiatives, funding strategies, and public–private partnerships through a values-based lens. Applying this tool to climate workforce initiatives can help ensure investments are responsive to local needs, advance equity, and reinforce a regenerative, place-based economy.

8.8 Workforce Funding Needs

Achieving a climate-ready and equitable workforce in Hawai‘i will require strategic and sustained investment by both the State and private sector. While much of this plan outlines systems and programs that should be scaled, it is important to recognize that funding is what enables those

systems to function equitably and effectively. Investment is needed not only in technical training but also in the infrastructure, tools, and partnerships that support access, retention, and long-term success. This includes not only funding for education and infrastructure, but also addressing economic pressures, such as housing and wage instability, that undermine workforce retention. Priority funding areas include:

- **Infrastructure for hands-on training**, such as physical training sites, mobile training units, and equipment required for learning in climate-critical fields.
- **Technology and digital access**, including broadband, devices, and software to support remote and hybrid training—especially important for rural and neighbor island communities.
- **Capacity building for community-based organizations (CBOs)** that already serve as trusted partners in delivering training and support services. Many of these organizations need funding to expand staffing, manage grants, and sustain programming.
- **Seed funding for innovation**, including pilot programs that test new models of climate workforce development. These may include cross-sector approaches (e.g., climate and public health), community-led curricula grounded in local knowledge systems, or new circular economy training pathways. Innovation grants offer a low-risk way to evaluate promising models before scaling them and should prioritize equity, cultural relevance, and long-term employment outcomes.

By resourcing these foundational elements, the state can ensure that workforce initiatives outlined in this plan are not only visionary, but achievable, equitable, and impactful across all communities.

9. Conclusion

Hawai‘i, a state uniquely vulnerable to the escalating impacts of climate change due to its isolated island geography, has long demonstrated international leadership in comprehensive climate action. This Climate Action Pathways (CAP) builds upon nearly two decades of progressive legislative and policy frameworks. It represents a collaborative effort involving state agencies, counties, technical experts, academic institutions, and a diverse array of community and non-profit organizations across the islands. The CAP outlines a strategic pathways to achieve Hawai‘i’s ambitious climate goals: a 50% reduction in greenhouse gas (GHG) emissions below 2005 levels by 2030, and the pioneering commitment to achieve net-negative emissions by 2045.

Beyond mitigation, this plan is deeply rooted in the principles of aloha ‘āina (love for the land), the circular and wellbeing economy, and self-sufficiency, aiming to enhance resilience, create high-quality jobs, spur economic growth, and improve the quality of life for all residents, particularly low-income and disadvantaged communities (LIDACs). The CAP identifies 23 key measures across five critical sectors - Energy Industries, Buildings Energy Efficiency, Transportation, Agriculture, Forestry, and Other Land Use (AFOLU), and Waste and Material Management - each designed to contribute significantly to Hawai‘i’s decarbonization targets.

Energy Industries:

The energy sector, the largest source of emissions in Hawai‘i, is undergoing a profound transformation. The state is committed to achieving a 100% Renewable Portfolio Standard (RPS) for electricity generation by 2045, with interim targets of 40% by 2030 and 70% by 2040. This ambitious goal is driven by the economic imperative to reduce reliance on expensive imported fossil fuels, which currently account for approximately 80% of total energy consumption and result in the nation’s highest electricity prices. Key measures include the rapid deployment of utility-scale and distributed solar photovoltaic (PV) systems, wind farms, and the strategic utilization of geothermal energy on Hawai‘i Island. Crucially, the plan emphasizes massive investments in utility-scale battery energy storage systems (BESS), such as Kapolei Energy Storage, to firm variable renewable generation and ensure grid stability. Innovations include advanced grid technologies like smart grids and microgrids, and the exploration of alternative fuels as bridging solutions. The sector’s success is foundational to decarbonizing other sectors, as electrification strategies rely on a clean grid.

Buildings Energy Efficiency:

Recognizing that buildings are major energy consumers, this sector focuses on reducing energy demand in both existing and new constructions. Measures include implementing solar PV and solar hot water systems in residential and non-residential buildings, with a target of solarizing 10,000 rooftops annually until 2030. A comprehensive building retrofitting plan aims to achieve a 46.4% reduction in energy consumption by 2040 and 60% by 2050, supported by the Energy Efficiency Portfolio Standard (EEPS) goal of 6,000 GWh cumulative savings by 2045. Furthermore, new building codes, specifically the adoption of the 2021 International Energy Conservation Code (IECC) by 2030, will decrease energy consumption in new buildings by 10%, alongside mandating solar water heaters in new residential constructions. These efforts are critical for stabilizing high electricity costs and enhancing energy security.

Transportation:

Decarbonizing Hawai‘i’s transportation sector, which accounts for a substantial portion of the state’s GHG emissions, is a monumental task given its reliance on air and marine transport for inter-island connectivity and tourism. The plan outlines a multi-pronged approach across ground, air, and marine modes. For ground transportation, measures include widespread vehicle electrification (transitioning state and county fleets to EVs, incentivizing EV rentals, expanding charging infrastructure) and fuel decarbonization (supporting clean fuel standards, carbon taxes, and local production of clean fuels like ethanol blends). Mode shift initiatives promote sustainable alternatives such as walking, biking, and public transit through multimodal network implementation, transit-oriented development, and road usage pricing. In air transportation, the focus is on decarbonizing fuels through Sustainable Aviation Fuel (SAF) adoption, reducing fuel consumption by optimizing airport operations, and electrifying airfield vehicles. For marine transportation, measures promote renewable fuels (biodiesel, bio-LNG, e-methanol, green hydrogen) and implement fuel consumption efficiency in cruise ships by reducing calls and size. The sector aims for zero emissions across all modes by 2045.

Agriculture, Forestry, and Other Land Use (AFOLU):

The AFOLU sector holds immense potential for carbon sequestration and strengthening local food systems. Hawai‘i’s AFOLU sector is already a net carbon sink, offsetting 7% of total gross emissions. Measures focus on enhancing this capacity through agricultural soil amendments (capturing carbon in soils using waste streams, biochar, and regenerative agriculture practices) and nature-based solutions. Goals include planting 11 million native trees and plants, preserving 23,000 acres of forested lands, and protecting 30% of priority watersheds by 2030. Wetland restoration, including 20 wetland and loko‘ia sites, is also a key component. These actions are rooted in aloha ‘āina and traditional ecological knowledge, aiming to heal degraded lands, reduce wildfire risk, and improve water quality.

Waste and Material Management:

This sector aims to minimize waste generation and maximize resource recovery. Key measures include aggressive waste diversion targets of 70% by 2030 and 90% by 2050, moving away from landfilling and incineration. This involves infrastructure investments in regional material recovery hubs, advanced sorting facilities, remanufacturing centers, and repair/reuse marketplaces. Composting is a significant focus, aiming to treat 70% of the organic waste fraction by 2030 and 90% by 2050 through a decentralized, community-based compost network. Waste reduction efforts are supported by legislation redefining producer accountability for imported goods, targeting a 10% reduction in paper, cardboard, and plastic waste by 2040. The plan also addresses wastewater management, including efforts to address substandard cesspools and expand recycled water programs, contributing to water security.

Benefits for the People of Hawai‘i:

The implementation of the CAP measures is anticipated to yield a broad spectrum of benefits, significantly enhancing the quality of life, economic well-being, and resilience of all Hawai‘i residents, with a particular focus on equitable outcomes for Low-Income and Disadvantaged Communities (LIDACs).

Improved Public Health and Environmental Quality: The reduction in greenhouse gas emissions across all sectors will lead to significant co-pollutant reductions (NOx, PM2.5, SO2, VOC, HAP). This translates directly into improved air quality, reducing respiratory and other health issues, particularly in communities near industrial areas or high-traffic corridors. Enhanced waste management practices, including reduced landfilling and improved wastewater treatment, will lead to better water quality, protecting vital marine ecosystems and public health. Forest and wetland restoration efforts will improve biodiversity, enhance natural flood protection, and provide cooler urban environments, directly benefiting community well-being.

Economic Benefits and Affordability: The transition to a clean energy economy is a powerful economic driver. Reduced reliance on imported fossil fuels will stabilize and lower Hawai‘i’s notoriously high electricity prices, providing significant financial relief to households and businesses. Investments in renewable energy, energy efficiency retrofits, and sustainable agriculture will create high-quality, local jobs across various sectors, fostering economic growth and diversification beyond tourism. Investments in local food systems and circular economy initiatives will enhance food security and create new economic opportunities within the islands, reducing vulnerability to global supply chain disruptions.

Enhanced Climate Resilience: The CAP measures directly address Hawai‘i’s vulnerabilities to climate impacts. Investments in resilient infrastructure, such as hardened energy grids and improved transportation networks, will better withstand extreme weather events, sea-level rise, and coastal erosion. Nature-based solutions, including forest and wetland restoration, will enhance natural defenses against flooding and wildfires. Decentralized energy systems and microgrids will improve energy security and provide resilience during outages. These efforts are crucial for protecting communities, critical infrastructure, and natural resources from the unavoidable impacts of climate change.

Equitable Outcomes for Low-Income and Disadvantaged Communities (LIDACs): A core principle of this CAP is to ensure that the benefits of climate action flow equitably to LIDACs, which are disproportionately affected by climate change and high living costs. Hawai‘i has adopted a customized methodology for identifying LIDACs, going beyond national screening tools to capture localized vulnerabilities, including all Hawaiian Homelands tracts. The plan explicitly aims to reduce the energy burden on LIDAC households through programs like “Solar for All” funding, HEAR/HOMES energy rebate programs, and appliance replacement initiatives. Workforce development strategies are designed to create pathways to sustainable careers for residents from these communities, prioritizing Native Hawaiians, Pacific Islanders, rural communities, women, youth, formerly incarcerated individuals, and people with disabilities. This includes providing wraparound services (childcare, transportation, stipends), developing stackable credentials, and fostering partnerships with community-based organizations (CBOs) like the Council for Native Hawaiian Advancement and Kupu. The emphasis on community-led resilience planning and the exploration of “resilience hubs” further ensures that solutions are culturally responsive and address community-defined goals, fostering self-determination and empowerment.

Workforce Development:

The CAP recognizes that a skilled workforce is essential for achieving climate goals. It anticipates significant job growth in sectors such as regenerative agriculture, renewable energy, green building, disaster preparedness, land management, clean transportation, and waste management. Strategies include strengthening workforce partnerships across public, private, non-profit, labor,

and academic entities; conducting workforce gap analyses; and developing sector-specific technical skills through targeted training, certifications, and earn-and-learn models. The plan also addresses critical workforce retention challenges, such as Hawai‘i’s high cost of living and lack of affordable housing, advocating for broader economic stabilization policies to ensure that trained talent remains in the state. Messaging efforts will highlight climate careers as meaningful, resilient, and deeply connected to the stewardship of Hawai‘i’s land, waters, and people.

Challenges to Implementation:

The State of Hawai‘i's Climate Action Pathways (CAP) sets forth an ambitious and essential roadmap for achieving net-negative emissions by 2045 and building resilience against the escalating impacts of climate change. While the plan is comprehensive and built upon extensive stakeholder engagement, its successful implementation will inevitably encounter significant challenges. Proactive strategies to address these hurdles will be paramount to translating the plan's vision into tangible outcomes.

Financial Sustainability and Resource Mobilization: A primary and overarching challenge lies in securing the substantial and sustained financial investment required. The CAP identifies a minimum need of $2.23 billion over the next three years for critical climate projects, a figure that far exceeds currently available state resources. While the recently enacted "Green Fee" on visitor accommodations is a positive step, it alone is insufficient. The heavy reliance on federal funding, such as that from the Inflation Reduction Act (IRA) and Bipartisan Infrastructure Law (BIL), introduces a vulnerability to policy uncertainty and delays at the federal level, posing a serious risk to long-term planning and project delivery. Furthermore, engaging the private and philanthropic sectors, though crucial, presents its own difficulties. Many local businesses operate on thin profit margins, limiting their capacity for climate-related investments, and building sustained relationships with high-net-worth individuals requires dedicated outreach infrastructure. Overcoming this will necessitate a diversified funding strategy, including innovative financing mechanisms, expanded public-private partnerships, and potentially new state revenue streams, alongside consistent advocacy for robust and flexible federal support.

Regulatory and Permitting Complexities: Navigating Hawai‘i's intricate regulatory and permitting landscape can significantly impede the pace of implementation. Existing policy and regulatory barriers, coupled with potential uncertainty around emerging technologies (e.g., tariffs on clean energy technologies), can discourage private investment and delay project initiation. Streamlining these processes while upholding environmental safeguards and ensuring community input will be critical. This requires close collaboration between regulatory bodies, project developers, and affected communities to develop clear, efficient pathways for climate-aligned projects.

Inter-Agency and Cross-Sector Coordination: While the CAP highlights an impressive institutional framework and extensive coordination efforts involving numerous state offices, agencies, county planning offices, legislative representatives, and a wide array of "Hui Participants" (partners from non-profits, academia, and the private sector), the sheer breadth of these stakeholders presents an ongoing coordination challenge. Ensuring harmonized efforts across federal, state, and county agencies, aligning diverse county-level climate action plans with statewide goals, and fostering genuine, sustained partnerships with the private sector and communities will require continuous communication, shared understanding, and adaptive

governance. The document itself emphasizes the need to "deepen and continue partnerships," underscoring that this is an ongoing endeavor, not a one-time achievement.

Unique Geographic and Socio-Economic Realities of Hawai‘i: The distinct characteristics of an isolated island chain introduce several unique implementation hurdles:

- *Island Geography* - The dispersed nature of the islands complicates inter-island clean transportation solutions (e.g., electric aircraft, hydrogen ferries), requiring significant technological maturity and infrastructure development.
- *Import Dependence* - Hawai‘i's reliance on imported goods means that "upstream" emissions from international shipping and air travel, often excluded from state-level inventories, are significant and challenging to address through direct state policy.
- *High Cost of Living and Energy* - The elevated costs of electricity and goods can hinder the affordability and widespread adoption of new technologies like electric vehicles (EVs) and sustainable fuels without robust incentive programs.
- *Limited Land Availability* - Densely populated islands face land constraints that challenge the expansion of renewable energy infrastructure and transportation networks.
- *Infrastructure Vulnerability* - Existing infrastructure is highly susceptible to climate impacts like sea-level rise and extreme weather, necessitating substantial investment in adaptation and resilience alongside decarbonization efforts.

By acknowledging these challenges transparently and committing to these proactive strategies, Hawai‘i can reinforce its leadership in climate action and move closer to its vision of a regenerative and just transformation.

The Path Forward

Implementation has already begun, with renewable energy projects coming online, electric vehicle adoption accelerating, and restoration projects breaking ground across the islands. But the full transformation envisioned in this plan will require sustained commitment from all sectors of society—government, business, nonprofits, and communities working together with the urgency the climate crisis demands.

The CAP acknowledges significant challenges ahead: securing sustained funding, navigating complex permitting processes, coordinating across multiple jurisdictions, and maintaining public support through what will inevitably be a long-term transformation. But it also recognizes that Hawai‘i has unique advantages: strong environmental values, innovative spirit, collaborative governance structures, and communities with deep connections to the land and ocean.

Perhaps most importantly, the plan embodies hope, not the passive hope that problems will solve themselves, but the active hope that comes from having a clear vision and the tools to achieve it. It recognizes that while climate change presents existential challenges, responding to those challenges can create opportunities to build the kind of society many have long dreamed of, one that runs on clean energy, provides meaningful work for everyone, manages resources sustainably, and prioritizes the wellbeing of both people and planet.

The path is clear, the community is engaged, and the work has begun. Hawai‘i's climate future is being written today, one solar panel, one native tree, one community project at a time. The question

isn't whether this transformation is possible - it's how quickly it can be achieved and how broadly its lessons can be shared with a world desperately in need of climate hope and practical solutions.

HAWAI'I CLIMATE COMMISSION

The Hawai'i Climate Change Mitigation and Adaptation Commission (CCMAC) consists of a multi-jurisdictional effort between 20 different departments, committees, and counties. It is co-chaired by the Department of Land and Natural Resources and the Office of Planning.

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