Hydrogen Station on Hawai'i Island

County of Hawai'i
Research and Development

Hydrogen Transformation on Island of Hawai'i

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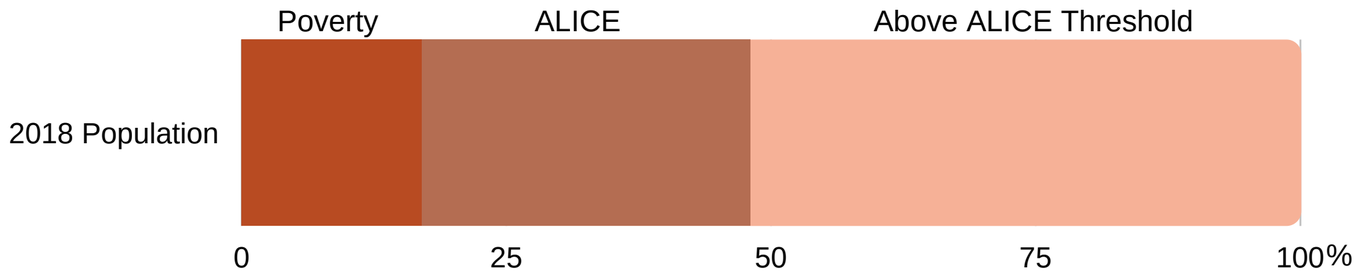
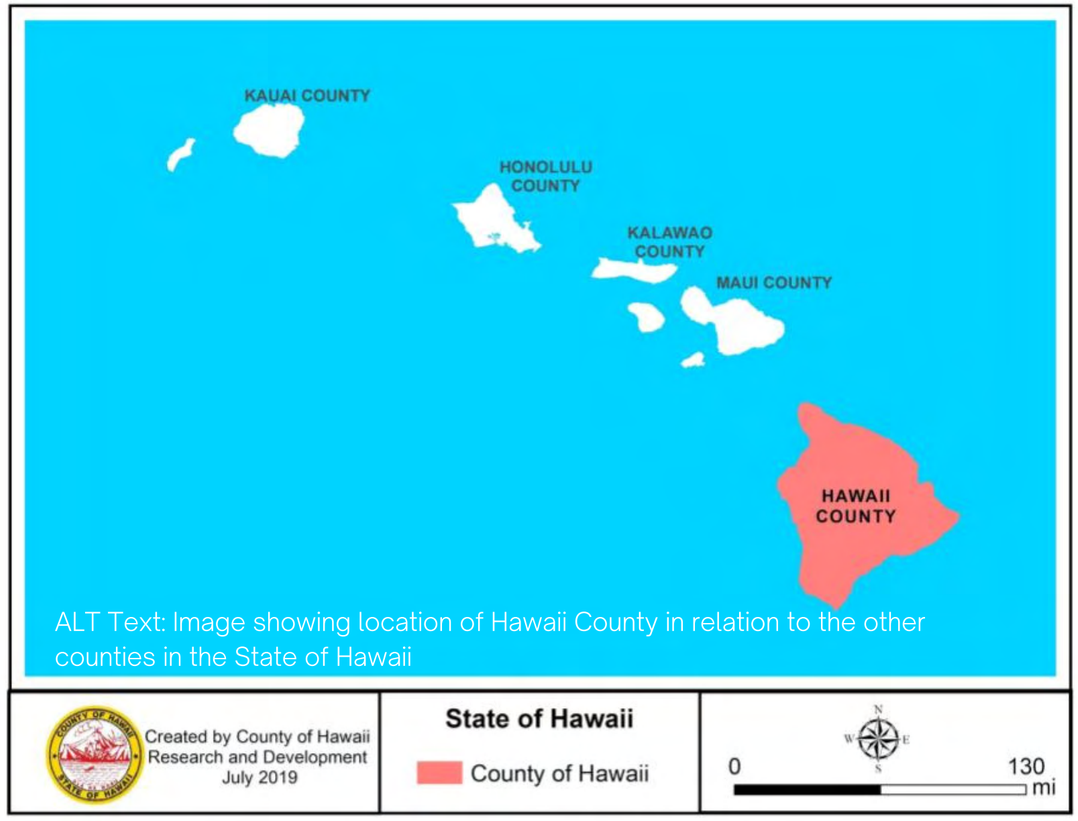
“Ua Mau ke Ea o ka ʻĀina i ka Pono”

The life of the land is perpetuated in righteousness.

Hawai'i County "Big Island" Profile

- Size: 4000 sq mi & average elevation of 3800 ft
- Population: 200,983
- Median Household Income: $57,571 (State Avg: $80,212)
- Unemployment Rate: 6.8% (State Avg: 7.3%)
- ALICE (Asset Limited, Income Constrained, Employed): 31% (State Avg: 33%)
- Households in Poverty: 17% (State Avg: 9%)





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Source: ALICE Threshold, 2007-2018; American Community Survey, 2007-2018

Community Needs

~200K Registered Vehicles

~$1.7B Annual Cost of Vehicle Ownership

~$39M Cost of Air Pollution

Image 1 shows percentage of jobs in specific census tracts. Kona and Hilo show the most amount of jobs, whereas Puna shows the least.

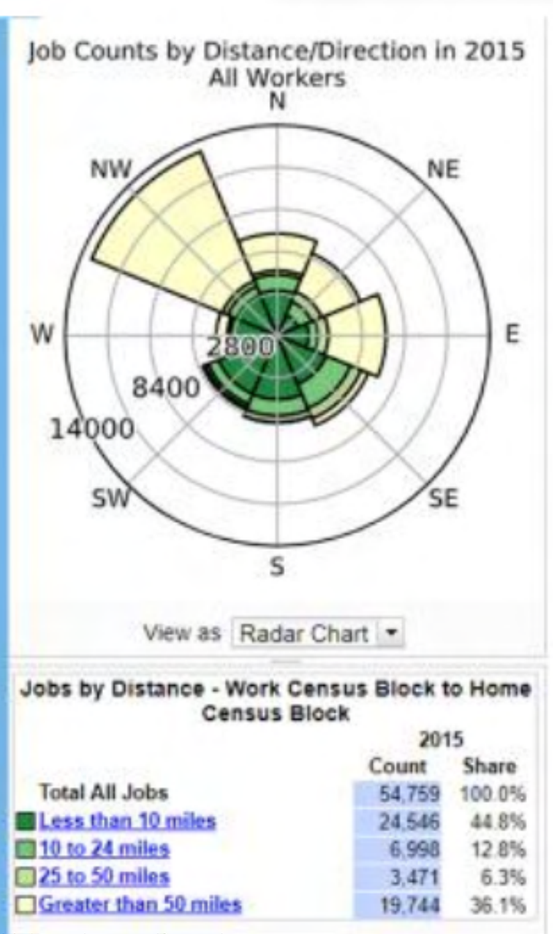
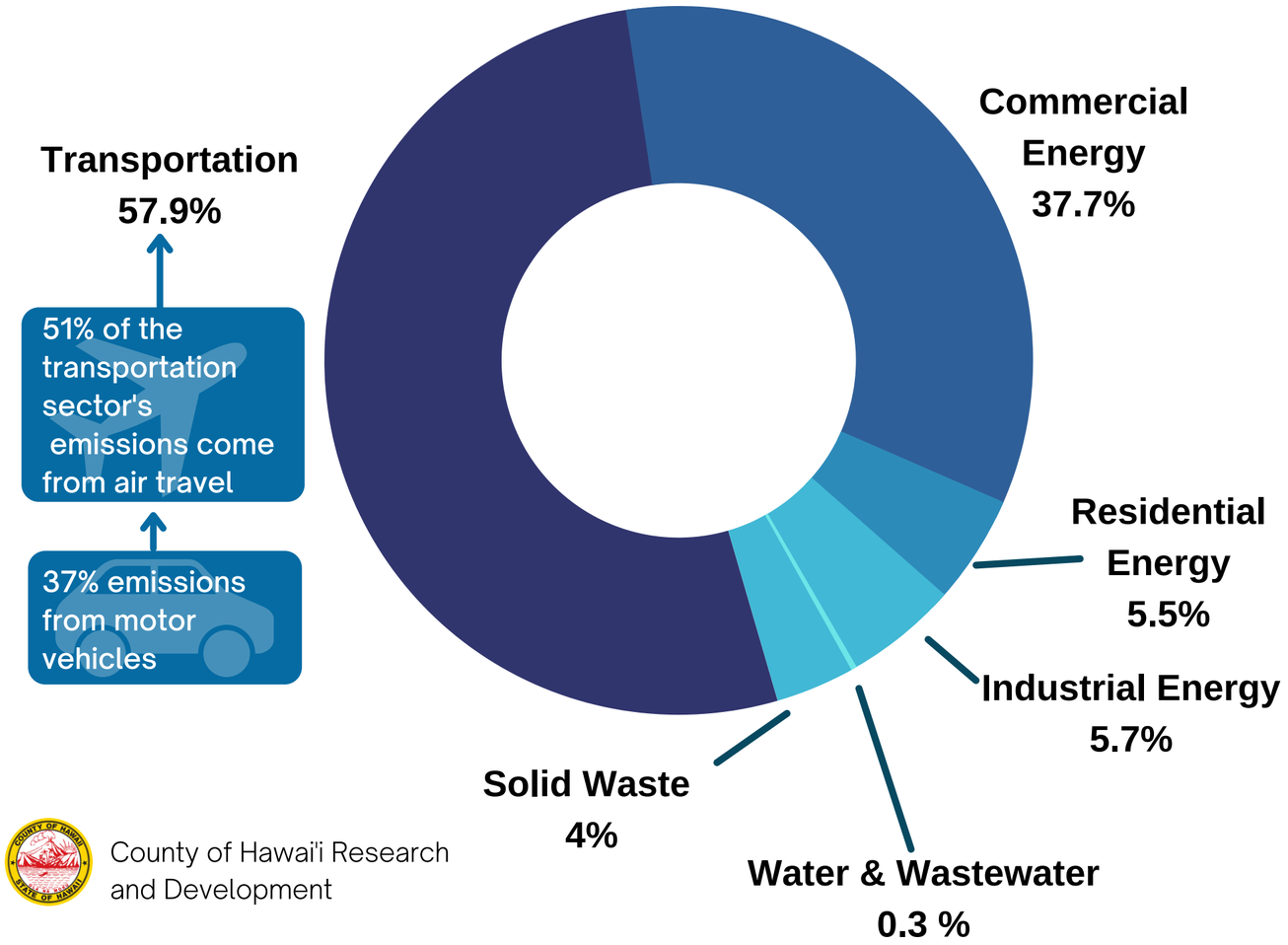


Image 2: Shows Job Counts by Distance /Direction in 2015 for all workers. ~45% have less than a 10 miles commute, ~13% between 10 to 24 mile commute, and ~42% for 25 miles and more.

Source: Hawai'i Island Shared Mobility Roadmap (Feb 2020); The Costs of the Vehicle Economy in Hawai'i Report (Jan 2021)

Climate Action- Environmental Justice

The following graph shows GHG Emissions from 2015 in Hawai'i County. Not shown, is the source Agriculture, Forestry, and Other Land Use (AFOLU) which includes both sources (fires) and sinks of emissions (trees). AFLOU emission is -11.2.



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'Akaka waterfall on Hawaii Island

Hydrogen *Enabling* Policies

HRS 196-10

Hawai‘i renewable hydrogen program. The program shall design, implement, and administer activities to manage the State's transition to a renewable hydrogen economy.

HRS 196-42

State support for achieving alternate fuel standards.

HRS 36-41 & HRS 36-42

Enabled a State-tax incentive that is refundable to out-of-state investors. Energy retrofit and performance contracting for public facilities. Third-Party Financing for buildings. **Vehicle fleet performance contracts for vehicle fleet energy efficiency programs. Third-Party Financing for vehicle fleet, fueling, and charging infrastructure**

HNEI Hydrogen Station-- "Risk Mitigation"

HYDROGEN STATION

The HNEI Hydrogen Station is in the Hawai'i Ocean Science and Technology (HOST) park at the NELHA. The station became fully operational in 2021.

*<u>*MAHALO* *USDOE FOR SEED FUNDING*</u>

HYDROGEN TRANSPORT TRAILER

The station and three Hydrogen Transport Trailers can be used for hydrogen demonstration projects including demonstrating central production and distributed dispensing at a variety of locations throughout the island.

29 PASSENGER BUS

The County's Mass Transit Agency (MTA) is in the process of acquiring three hydrogen buses. Hydrogen that is produced at the HNEI-NELHA hydrogen station will be used by hybrid hydrogen-electric fuel cell vehicles that use 350 Bar hydrogen for electromotive drive.

Central Production & Distributed Dispensing

The HNEI Station can produce up to 65 kg of gaseous hydrogen per day at 99.999% purity. The primary energy source is currently grid power that is ~83% renewable energy during sun hours reducing to ~50% at night. HNEI is working with NELHA to increase the use of solar power.

HNEI also has recently received delivery of brand-new hydrogen dispensing station equipment that is stored in crates and ready to be installed consisting of a Powertech dispenser and novel fueling post/boost compressor system.

Hydrogen would be supplied using the HNEI hydrogen Transport Trailers that would deliver hydrogen from NELHA to Hilo. A full trailer would be dropped off and an empty trailer would be delivered back to NELHA to be refilled.

Image shows hydrogen fuel pump

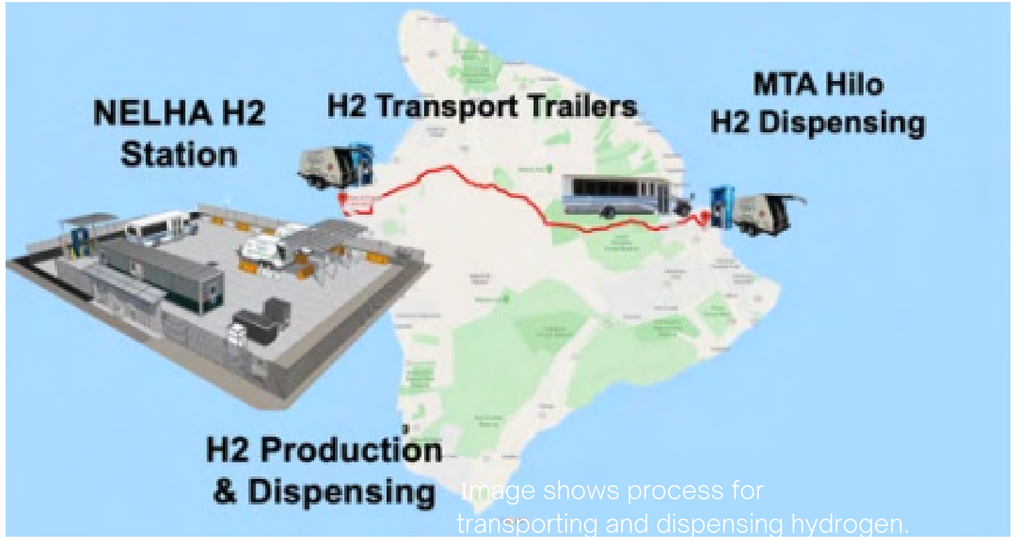


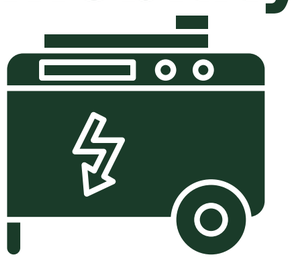
Image shows process for transporting and dispensing hydrogen.

Why Hydrogen Works for Big Island

Zero-Emission Solution

The island is the size of Connecticut with the highest peak reaching 13,803 ft, **hydrogen vehicles have the range and flexibility** needed to meet the mobility needs on the Island.

Mobility of Hydrogen



Hydrogen has an unlimited shelf-life, and the weight makes it **more easily transported** than other fuels around the Island. The mobility will increase effectiveness and reach of emergency generators at time of disaster.

Cost-Competitive

The County of Hawai'i has a wide variety of potential renewable energy sources that can be utilized to produce green hydrogen. The overall cost of the green hydrogen will be **cost-competitive or cheaper than fossil fuel** sources, improving the quality of life and resiliency of the Island.

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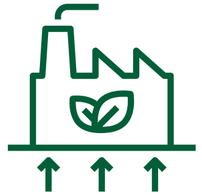
Hydrogen Production at Scale

Landfill Waste-to-Energy

The County Hawai'i plans to convert landfill methane to hydrogen using solar panels and atmospheric water generation. For every 1kg of hydrogen we will need 2.6 gallons of water. The landfill also is a source of municipal solid waste (MSW) and green waste that could be converted to hydrogen through a combination of gasification and electrolysis.



Puna Geothermal Ventures (PGV) Plant

The PGV operating on the island has potential resource of ~500MW. It is currently permitted to produce 60MW while the utility currently purchases up to 38MW. The remaining 22MW could be used for H2 production; ~3,212 tonnes/year. This could be applied to the production of aviation fuel through H2 + carbon capture. The fuel could make air travel to the County carbon neutral and moving to a "post-carbon economy".

Solar & Wind Farm Potential

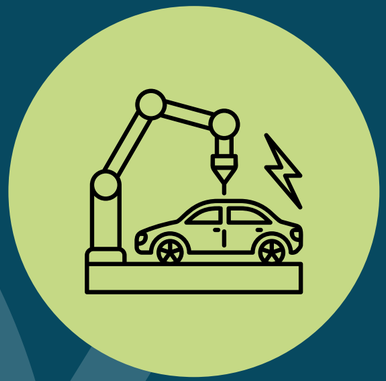
As additional renewable energy production is expanded on the Island, energy from solar and wind farms can be used to produce hydrogen with an electrolyzer on-site and transport trailers to allow for widespread hydrogen distribution.

Closed-Loop Hydrogen Economy

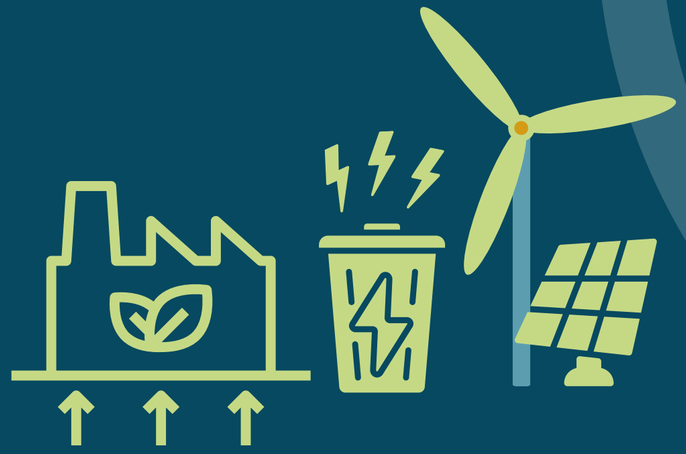
Storage Diversity & Unlimited Storage

Sub-Assembly Shop
(Wiring Harness, Piping Systems, Battery Testing / Cycling, Electric Motors)

Renewable Technical Center
(Technicians, First Responders, CDL, H2 Testing Lab, Electrolyzer Maintenance, Bus Maintenance, Van/Delivery Truck, Fuel Cell Generator Maintenance, Calibration Services, etc.)



Vehicle Assembly Facility



Geothermal, Landfill, Wastewater, Inline Hydro, Wind & PV Solar

Atmospheric Moisture Capture & Water Purifier

Hele-On Bus Parking & Fueling Station

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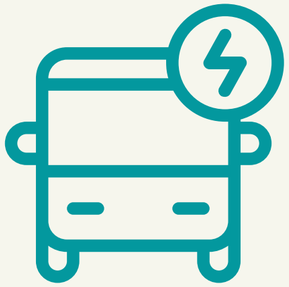
Where we are going & how DOE can help

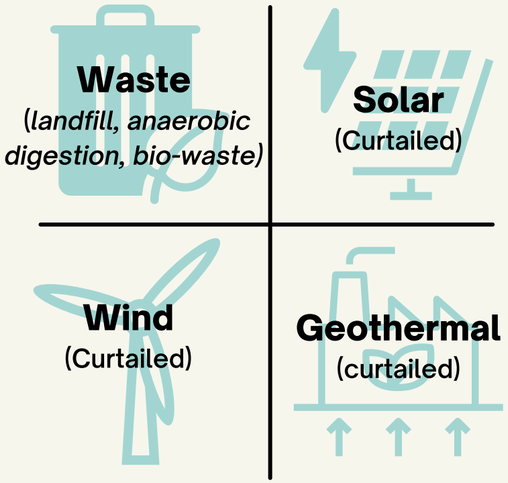
Identify funding sources to support a large up-front scale-up to support transition



Complete vehicle fleet transformation over the next 5 years

Build-out fueling and charging infrastructure over the next 5 years

Diversify on-Island hydrogen production



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