





EV and EVSE Implementation "Havailan-style"

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NREL is a national laboratory of the U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, operated by the Alliance for Sustainable Energy, LLC.

Hawaii Clean Energy Initiative

Hawaii

The most petroleum-dependent state in the US is on track to increase it's clean energy from 5% to 70% by 2030 and will have the greatest penetration of variable renewables on a grid in the US

Rationale

- Hawaii is, by far, the most petroleum-dependent state in the U.S.
- Hawaii is burdened with high energy prices that have dramatic and potentially devastating impacts on the State's economy
- Hawaii is blessed with excellent renewable energy resources and climate

Objectives

- The State of Hawaii and US DOE launched HCEI in January 2008 to help transform Hawaii to a 70% clean energy economy by 2030 and reap economic and environmental benefits:
 - Increasing Hawaii's economic and energy security
 - Fostering and demonstrating *Hawaii's innovation*
 - Developing Hawaii's workforce of the future
 - Becoming the *clean energy model* for the U.S. and the world



Transportation Fuel Use and Prices





Gasoline Prices – Regular Unleaded

-- US

Jan-12

-Hawaii

Jan-13

Jan-14

HCEI Transportation Energy Goals

Transportation energy analysis has focused on the development and definition of the HCEI Transportation Energy Roadmap

- Focus pathways and targets have been identified so that, when combined, the goal of 70% reduction is achieved
- 1. Electric Vehicles: 20% (75 MGY)
 - PHEV , EV, Fuel Cell adoption
- 2. Vehicle Efficiency: 30% (120 MGY)
 - HEVs
 - Diesel substitution
 - Standard car and truck efficiency improvements
- 3. VMT Reduction: 10% (40 MGY)
 - Public transit
 - Telecommuting
 - Others
- 4. Renewable Fuels: 40% (150 MGY)
 - Drop-in replacement for gasoline and diesel
 - Hydrogen



2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 2029 2030

Electric Vehicles for Hawaii

Hawaii EV Opportunities

- Conducive climate
- Limited driving distances
- Abundance of renewables
- Favorable State policies
- Synergies with tourism industry
- Potential to become international showcase
- Interaction with smart grid and high-penetration renewables

Hawaii EV Challenges

- Market penetration cost and vehicle turnover rate
- Establishing / optimizing EVSE home and public charging
- Potential grid integration issues
- High cost of electricity
- Maintaining the momentum





Hawaii EV-related Policies

• 1997, Act 290 EV license plates

 \checkmark EVs to park for free at state and county facilities

✓ EV access to Hawaii State HOV lanes

• 2009, Act 156 EV Parking

✓ Parking lots with more than 100 stalls designate at least one EV parking spot to be equipped with EV charging capability.

✓ Establishes the development of non-fossil fuel transportation as a state policy goal,

✓ Requires state and county agencies to Lead by Example in purchasing EVs and other alternative fueled vehicles or fuel economy leaders.

• In 2010, Act 186, chargers at multi-family housing

✓ Residents of multi-unit dwellings (condos, townhouse etc.) may install an EV charger system on or near the parking stall owned by that resident.



Electric Vehicle Supply Equipment (EVSE)



NATIONAL RENEWABLE ENERGY LABORATORY

Hawaii EV-Ready Grant and Rebate Program

EV-Ready Grants & Rebates (ARRA funded)

- ✓ \$2.6M to establish state-wide charging infrastructure
- ✓ \$1.4M EV and EVSE rebates
 - Up to \$4500 per EV, and
 \$500 / EVSE



Six competitively-awarded EVSE grants

- 1. Better Place EVSE infrastructure, rental car, hotels, county, other
- 2. AeroVironment EVSE infrastructure, hotels, commercial, other
- 3. GreenCar Hawai'i hotel-based EV car hourly rental
- **4. County of Kauai** county EVSE and EVs
- 5. City & County of Honolulu county EVSE and EVs
- 6. Plug In America EV-ready guidebook

Hawaii - Public Charger Installations



EVSE Installations and Business Models

Commercial EVSE Installations

- Charging level (1, 2, or DC Fast)
- Type of charger (unmetered, simple metered, and fully metered/networked)
- Facility characteristics (capacity of electric service, proximity to equipment, possible need to upgrade service or electric distribution panel)
- Desired location of charging stalls at your property
- Installation cost (conduit, equipment, signage)

Business Models currently in-use in Hawaii

- 1. Free or Free with Restrictions
- 2. Advertising Supported
- 3. Point of Sale Billing
- 4. Membership or Subscription Plan
- 5. Valet Charging



Home Charging with PV







<u> </u>		PV generation 38.5 kWh	EV charger 2 hr 16 min @ 3.3 kW	
		(sunny day)	= 7.5 kWh Nissan Leaf 0.34 kWh/n = 22 miles	nile
MIN		F-+	Household	
A			Load	3.00
			15kWh	2109
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EVs, Renewables and the Smart Grid Vision

Long-term Vision

- EV integration with utility-scale RE
- Vehicle-to-Grid and Vehicle-to-
 - Home / -Building
 - **Maui EV Association**

Maui Smart Grid Demo's

US-Japan international cooperation

- 200 EVs with home charging + public fast charger network
- Smart meters and appliances
- ✓ Integrated EMS, DMS, and µDMS
- ✓ EV Energy Control Center
- RE intermittency / demand response
- ✓ Use of excess renewable energy

EV Fleet, Building and Grid Integration







West Hawaii Civic Center

- Hawaii County office building
- 200+ county employees, 20 county agencies
- LEED Silver with 250kW PV on rooftop of parking lot

Approach:

- Vehicle usage patterns to determine charge demand and potential schedules
- Modeling tools used to assess tradeoffs for integrating Hawaii EVs with PV generation at Hawaii County Civic Center LEED building

Results:

- Analysis of fleet usage, building loads and PV generation indicate potential cost savings with fleet EVs;
- 14 EV chargers installed in parking garage
- Intial 7 Chevy Volts purchased by Hawaii County fleet.

Hawaii's EV Partnership

- Hawaii State Energy Office
 - State and County Government Agencies
 - Hawaiian Electric Companies and Kauai Utility Cooperative
 - Hawaii Automotive Dealership Association
- **DOE / National Labs**
- University of Hawaii Hawaii Natural Energy Institute
- Honolulu Clean Cities
- **Automotive OEMs**
- **EVSE equipment suppliers and installers**
- **US Department of Defense**
- Hotels and rental car companies
- Property owners, hotel and condominium associations
- International research and business partners

Recent developments \implies *maintaining momentum*

EV Stations Hawaii Mobile Ap

- ✓ Launched July 2013
- ✓ Charging stations locations
- ✓ Driving directions
- ✓ Charge level
- ✓ Charge fee (if applicable)







HECO rolls out two new pilot rates for EV charging

- 1. Commercial Public Electric Vehicle Charging Facility Service rate
 - businesses can offer DC fast charging without demand charges
- 2. Commercial Public Electric Vehicle Charging Service
 - allows HECO to operate up 25 DC fast chargers
 - facilitates research on load control and demand response

Information Resources

State of Hawaii – State Energy Office

EV Specialist – Margaret Larson

- Electric Vehicle (EV) Charging Stations in Hawaii
- Hawaii EV-Ready Guidebook for Commercial EV Charging Station Installations
- Case Study of the Market Introduction and Deployment of the EVs in Hawaii
- Lessons Learned: The Early Adoption of EV Charging Stations from the Perspective of Oahu's Commercial Properties

http://energy.hawaii.gov/testbeds-initiatives/ev-ready-program

US DOE - Alternative Fuels Data Center

- Plug In Electric Vehicle Handbook for Consumers
- Clean Cities PEV Handbook for Public Charging Station Hosts
- Clean Cities PEV Handbook for Electrical Contractors
- Clean Cities PEV Handbook for Fleet Managers

http://www.afdc.energy.gov/fuels/electricity.html







Chief's Canoe - Jean Charlot – 1956 Hawaii Convention Center

