Hawaii Renewable Hydrogen Program

State & Regional Initiatives Webinar

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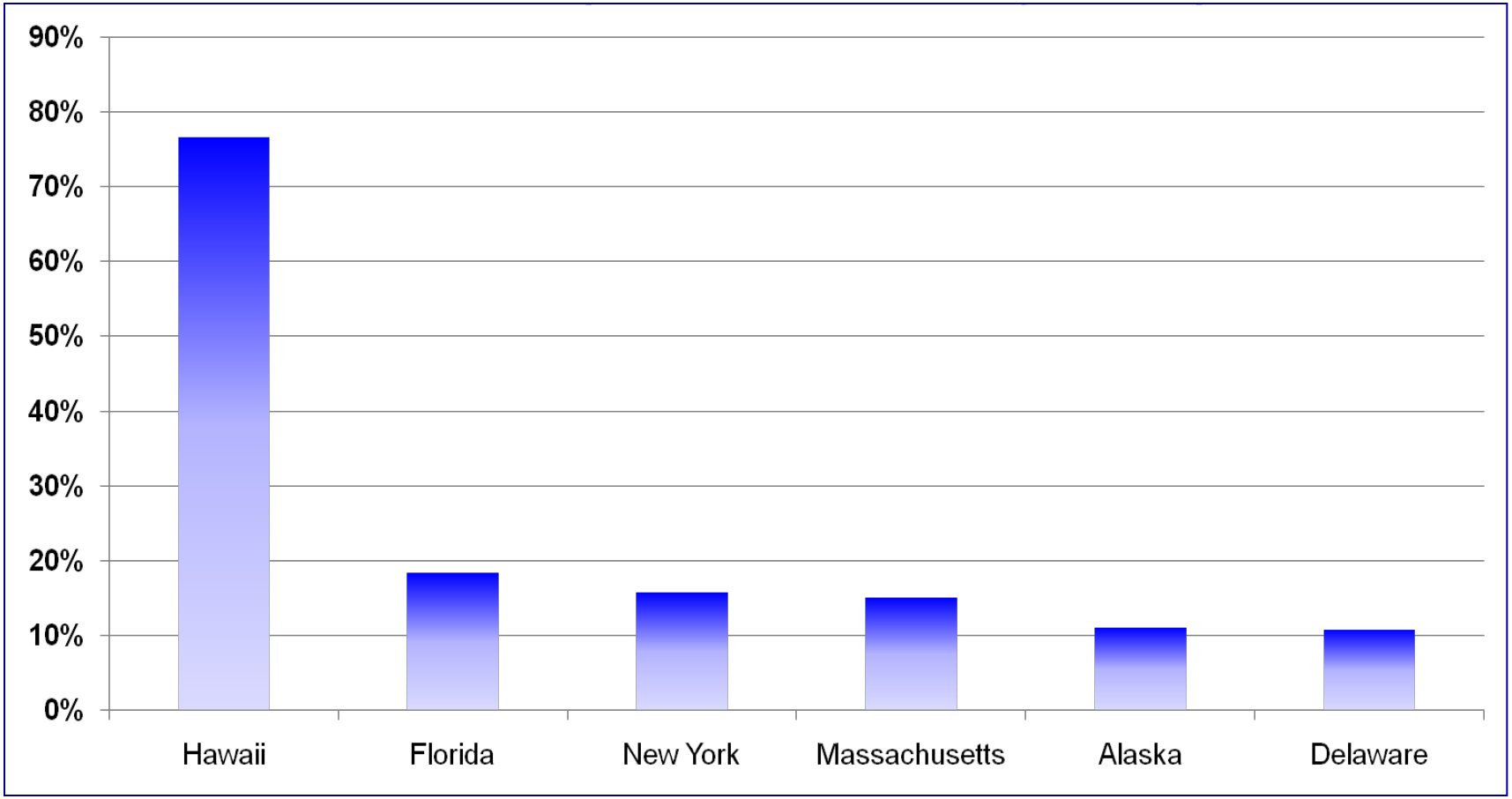
Overview

- Hawaii's Energy Situation
  - Mitch Ewan
- Hawaii Power Park Project
  - Mitch Ewan
- The Renewables-to-Hydrogen Fund
  - Chenoa Farnsworth

Hawaii – Most Petroleum Dependent State



Petroleum dependence for electricity – top six states

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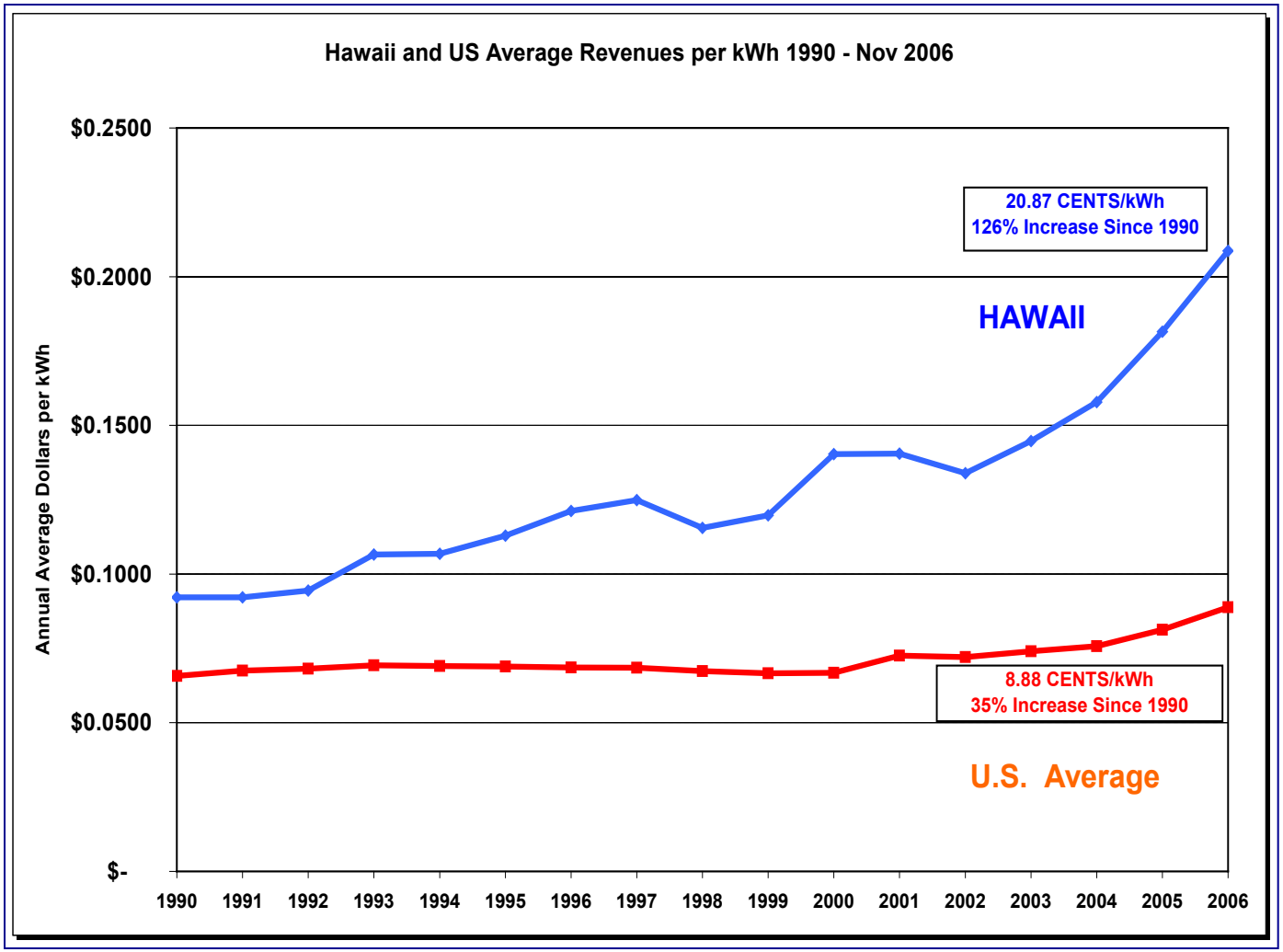
Highest Electricity Prices in U.S.



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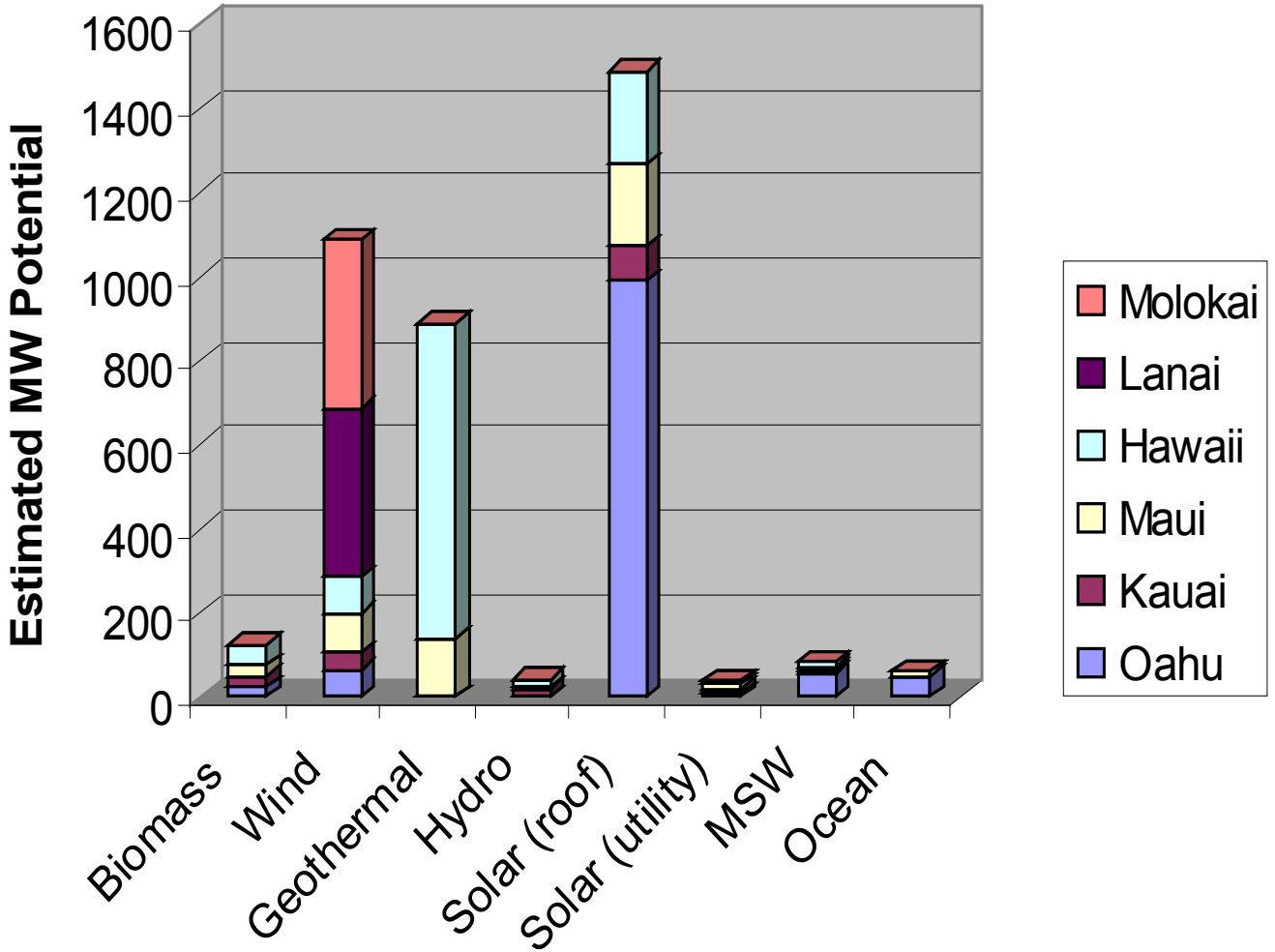
Hawaii Renewables Estimated @ 150% of Current Installed Capacity



http://hawaii.gov/dbedt/info/energy/

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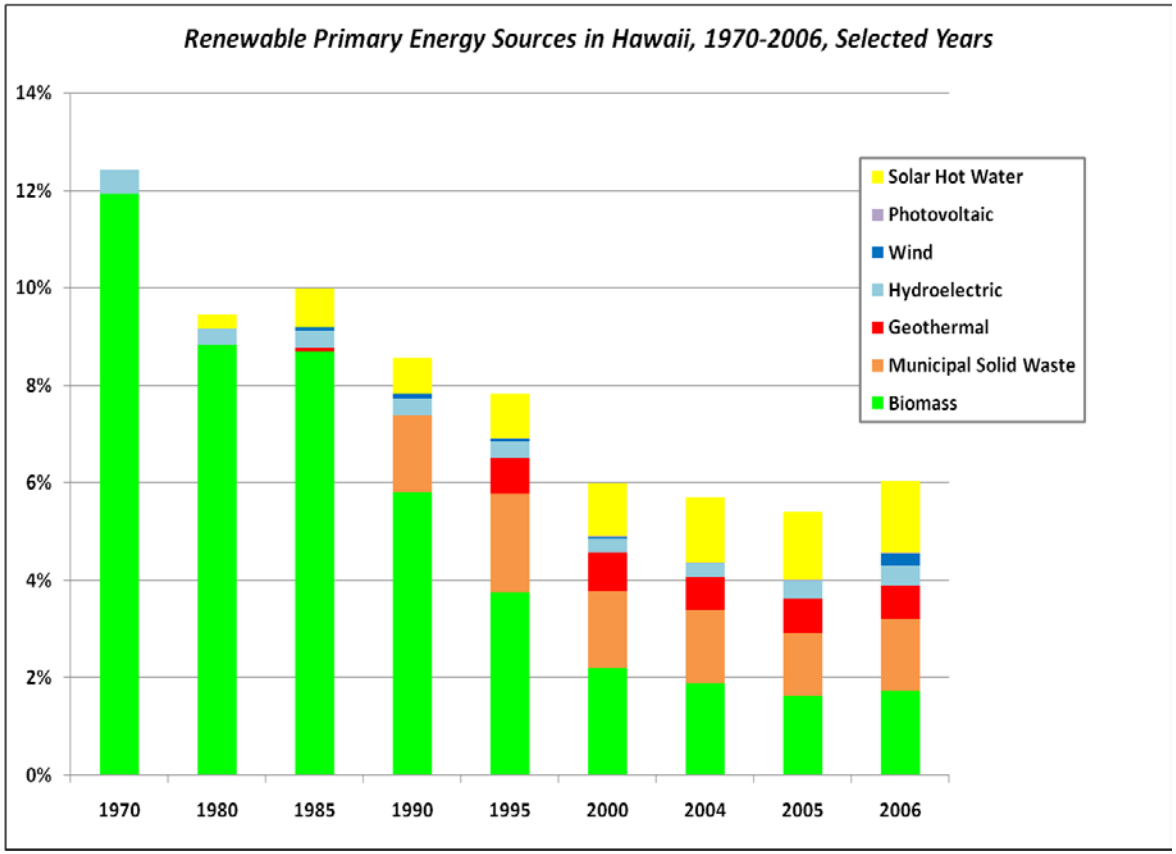
Negative Progress in Renewables



Barriers must be removed for Hawaii to realize energy independence and economic stability

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Hawaii Clean Energy Initiative

GOALS:

- ✓ ***Achieve a 70% clean energy economy for Hawaii within a generation***
- ✓ ***Increase Hawaii's energy security***
- ✓ ***Capture economic benefits of clean energy for all levels of society***
- ✓ ***Foster and demonstrate innovation***
- ✓ ***Build the workforce of the future***
- ✓ ***Serve as a model for the US and the world***

Hawaii Hydrogen Power Park

Power Park to provide hydrogen infrastructure to support hydrogen shuttle bus program at Hawaii Volcanoes National Park (HAVO)

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Hawaii Volcanoes National Park

- ✓ **Power Park supports NPS "Climate Friendly Parks" program to reduce carbon footprint & improve visitor experience.**
  - ➢ **Reduce/eliminate diesel buses in park**
  - ➢ **Reduce visitor car volume**
  - ➢ **Reduce size of buses in the park**
  - ➢ **Reduce emissions pollution**
  - ➢ **Reduce noise pollution**
  - ➢ **Reduce traffic congestion**
- ✓ **Evaluate performance of fleet of plug-in hybrid electric vehicle (PHEV) shuttle buses using hydrogen**
- ✓ **Test bed for range of NPS transportation solutions**

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Power Park Hydrogen Fueling Station

- ✓ **Fueling station sited at Kilauea Military Camp**
  - ➢ **DOD recreational facility located within HAVO**
  - ➢ **Provide shuttle bus operators to support project**
- ✓ **Hydrogen production using electrolysis**
- ✓ **Electrolyzer powered by renewable electricity from HELCO at special research rate.**
- ✓ **Initial design to produce 10-20 kg of hydrogen per day @ 350 Bar with flexibility to expand**

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Fueling Station Supply

- ✓ Station to be supplied on a “turn-key” basis including production, compression, storage & dispenser
- ✓ Compressor, storage & dispenser sized to support increased production capacity.
- ✓ RFP for supply of station released in Mar 09
- ✓ Project station to be operational by Mar/Apr 2010
- ✓ Station to be co-located with EV recharging station

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Vehicle Supply

- ✓ Vehicle support by Hawaii Center for Advanced Transportation Technology (HCATT)
  - ➢ Conversion of shuttle buses
  - ➢ Leverages Hickam Air Force Base hydrogen vehicle programs
- ✓ Initial vehicle funding ($1 million) from Advanced Transportation for Parks and Public Lands program (ATPPL) .
- ✓ HAVO has prepared specification for supply of basic bus. To be issued soon.
- ✓ Initially 2 buses with potential for additional
- ✓ Additional Hawaii locations to leverage investment

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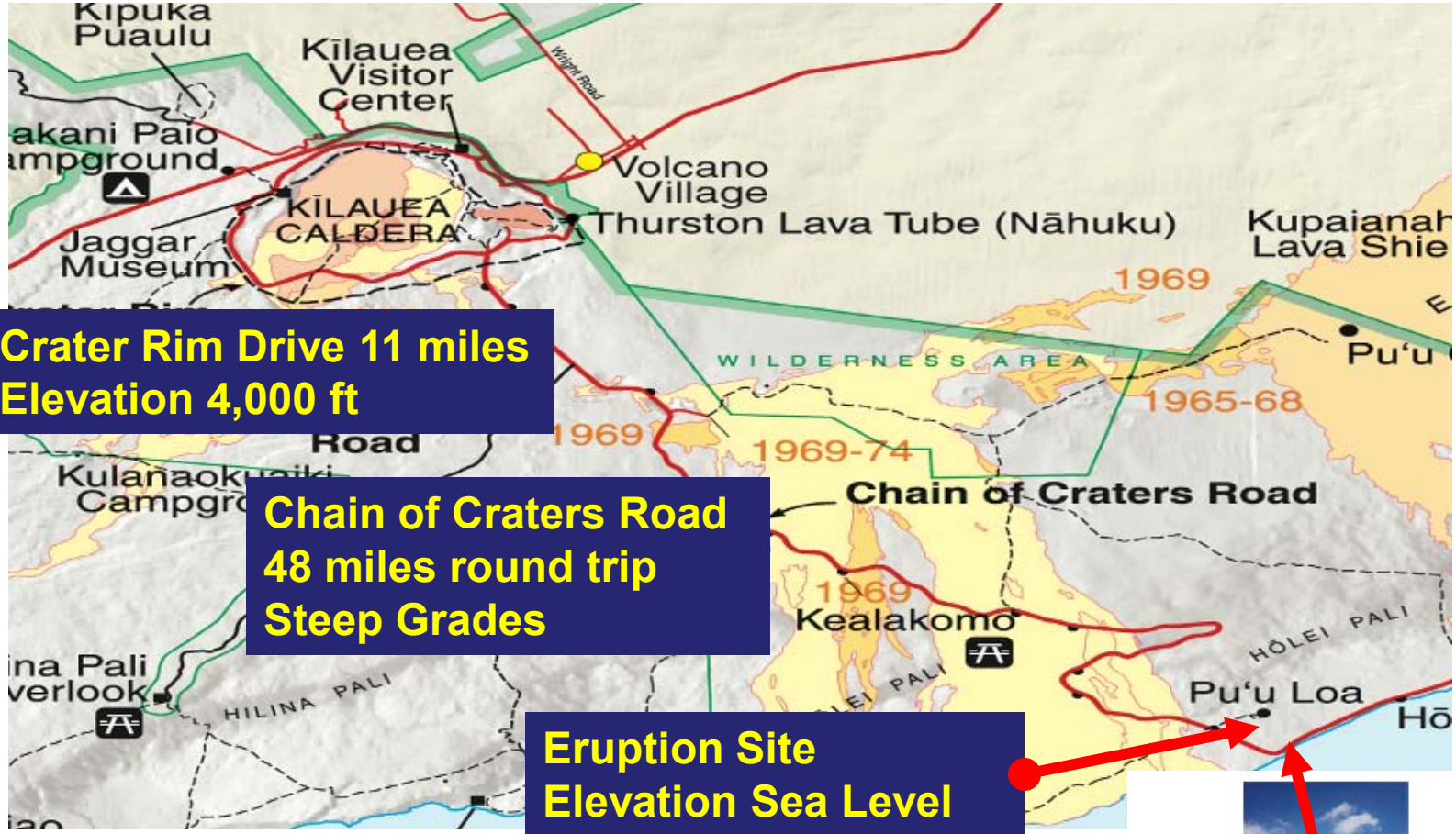
Bus Routes



- ✓ FROG building at eruption site (pending)
- ✓ Bus rapid recharge station

FROG Unit

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Partner Roles

- ✓ HNEI – Program management & implementation
- ✓ US DOE – program leadership & funding
- ✓ State of Hawaii – cost share & policy support
- ✓ HAVO & National Park Service
  - ➢ Host site.
  - ➢ Vehicle funding
  - ➢ Education & public outreach.
- ✓ Hawaii Electric Light Company (HELCO) – supply of renewable electricity.
- ✓ Puna Geothermal Venture – geothermal power (pending)
- ✓ Kilauea Military Camp (DOD)
  - ➢ Host fueling infrastructure & provide bus operators
- ✓ HCATT – vehicle conversion & technical support

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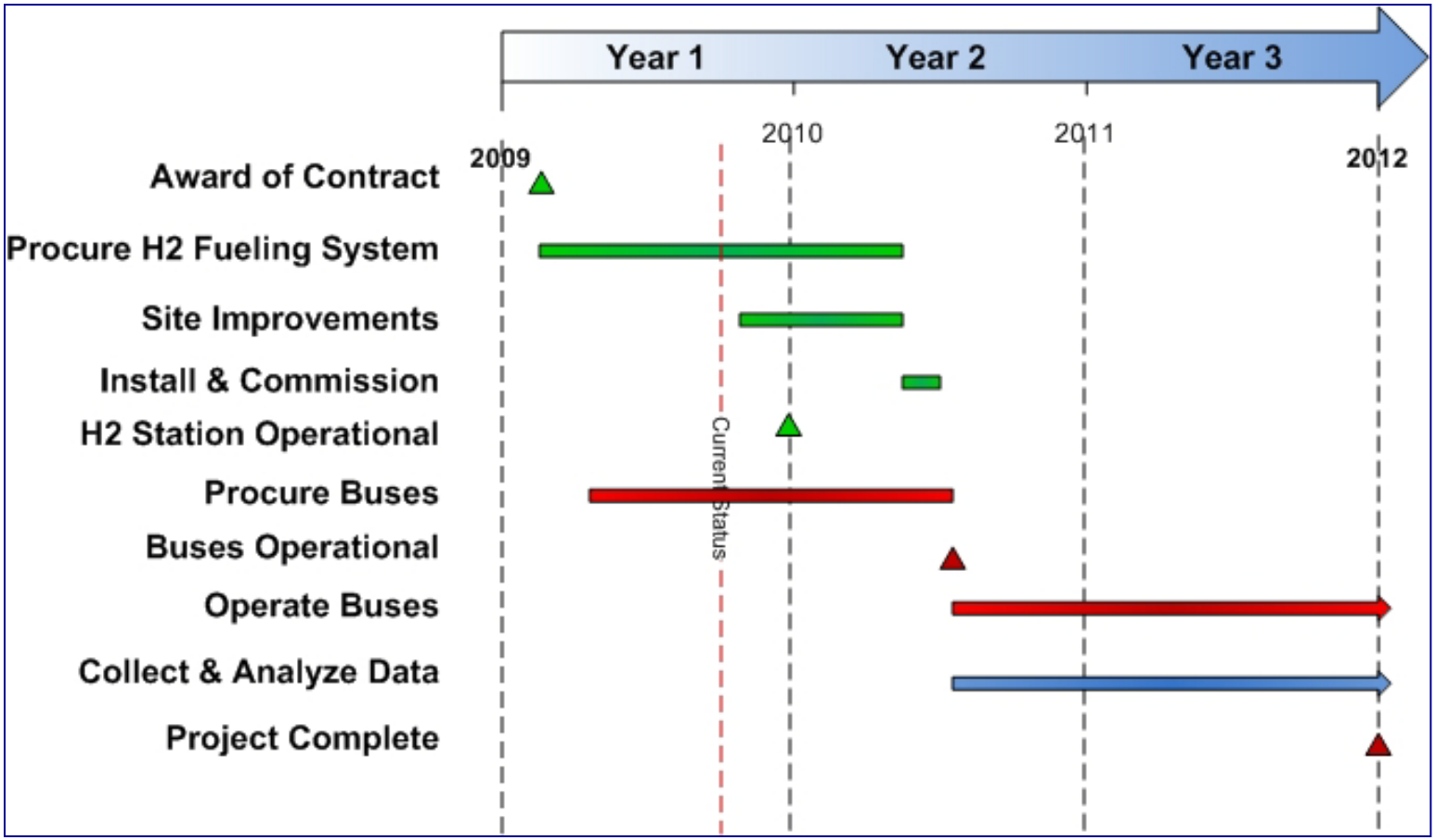
Milestones


Year 1
Year 2
Year 3
2009
2010
2011
2012
Award of Contract
Procure H2 Fueling System
Site Improvements
Install & Commission
H2 Station Operational
Procure Buses
Buses Operational
Operate Buses
Collect & Analyze Data
Project Complete
Current Status

HAVO Education & Outreach

- ✓ Over 2 million park visitors annually. Hawaii's biggest tourist attraction.
- ✓ HAVO has facilities & team of tour guides dedicated to public outreach.
- ✓ Visitor Center theater and interpretation center will host static displays & movie
- ✓ Theater to be powered by 5 kW stationary fuel cell
- ✓ Park interpreters on shuttle buses to incorporate hydrogen outreach into presentations.

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Leveraging Power Park

- ✓Position HAVO and HNEI as NPS system-wide resource to demo zero emission transportation solutions.
- ✓Use project to expand H2 infrastructure
  - ➢HNEI funded to develop hydrogen plan for State
  - ➢Ongoing negotiation with ONR for Project FROG and addition of hydrogen infrastructure
  - ➢Additional shuttle buses

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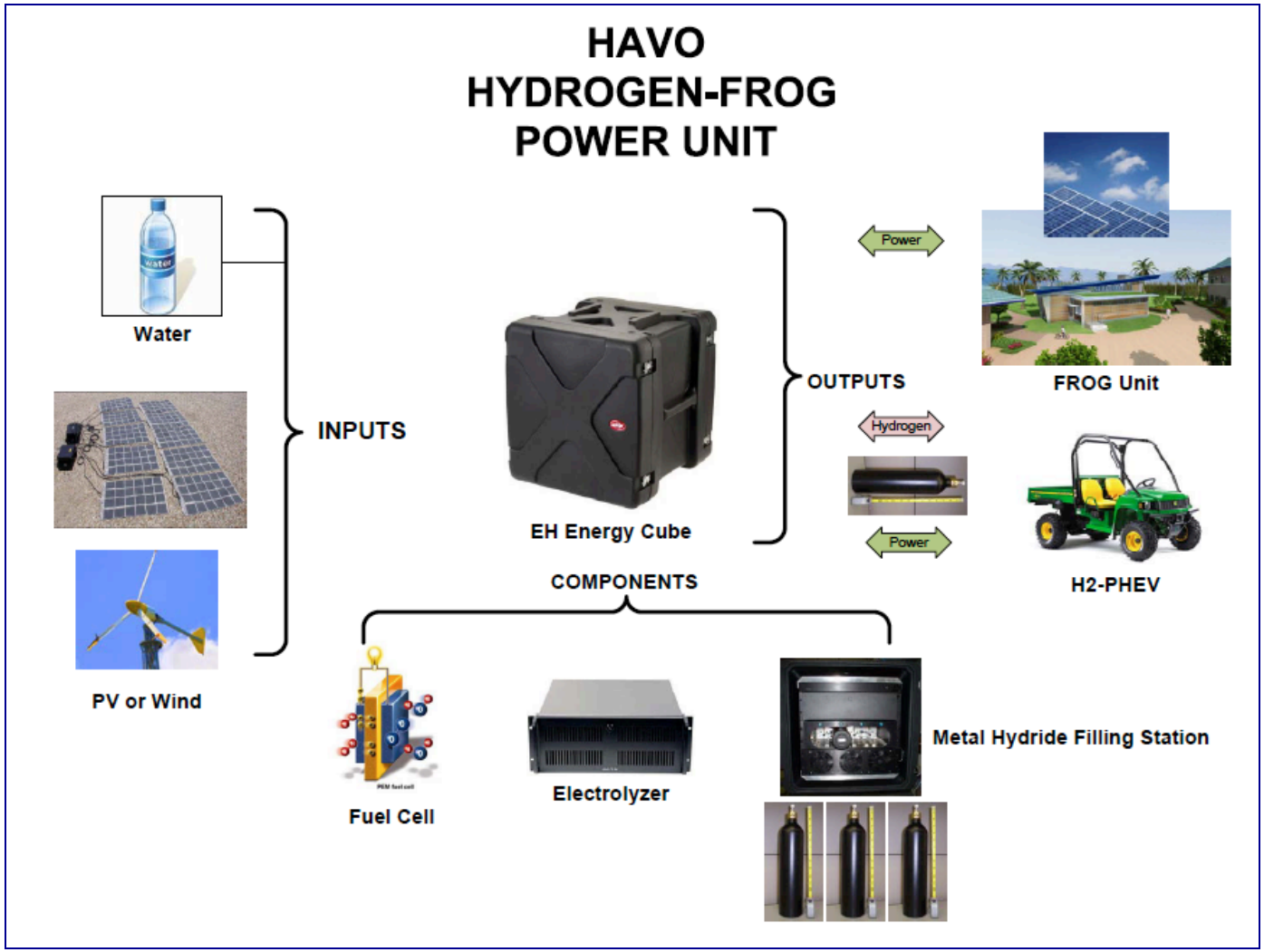
ONR Project FROG at HAVO



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Hawaii Renewable Hydrogen Fund

- ✓ **$10 million State fund established by legislature in 2006**
  - ➢ **Program development**
  - ➢ **Investment – cost share, seed, venture**
- ✓ **Kolohala Holdings LLP (VC) fund manager**
- ✓ **Kicked off operations in Dec 2008**
- ✓ **$8.7 million under management**
- ✓ **4 investments made to date**

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Management Consortium

Hydrogen Fund Objectives

1. Develop world-class renewable H2 program in Hawai`i
2. Build hydrogen infrastructure on the island of Hawai`i
3. Grow successful Hawai`i - based advanced energy technology companies
4. Leverage state funds with additional sources of private and public capital

Investment Allocation

- ✓ Multiply state funds by combining cost share and seed/venture
- ✓ Cost Share: $100,000 - $1,000,000 per project
  - ➢ For infrastructure or pre-commercial validation
  - ➢ Federal or private sources
- ✓ Seed: $25,000 - $500,000 per idea
  - ➢ To test or develop an idea
  - ➢ Sample: bench scale to pilot plant scale
- ✓ Venture: $500,000 to $2,500,000 per company
  - ➢ To grow a company
  - ➢ Sample: pilot scale to commercial scale

Cost Share Methodology

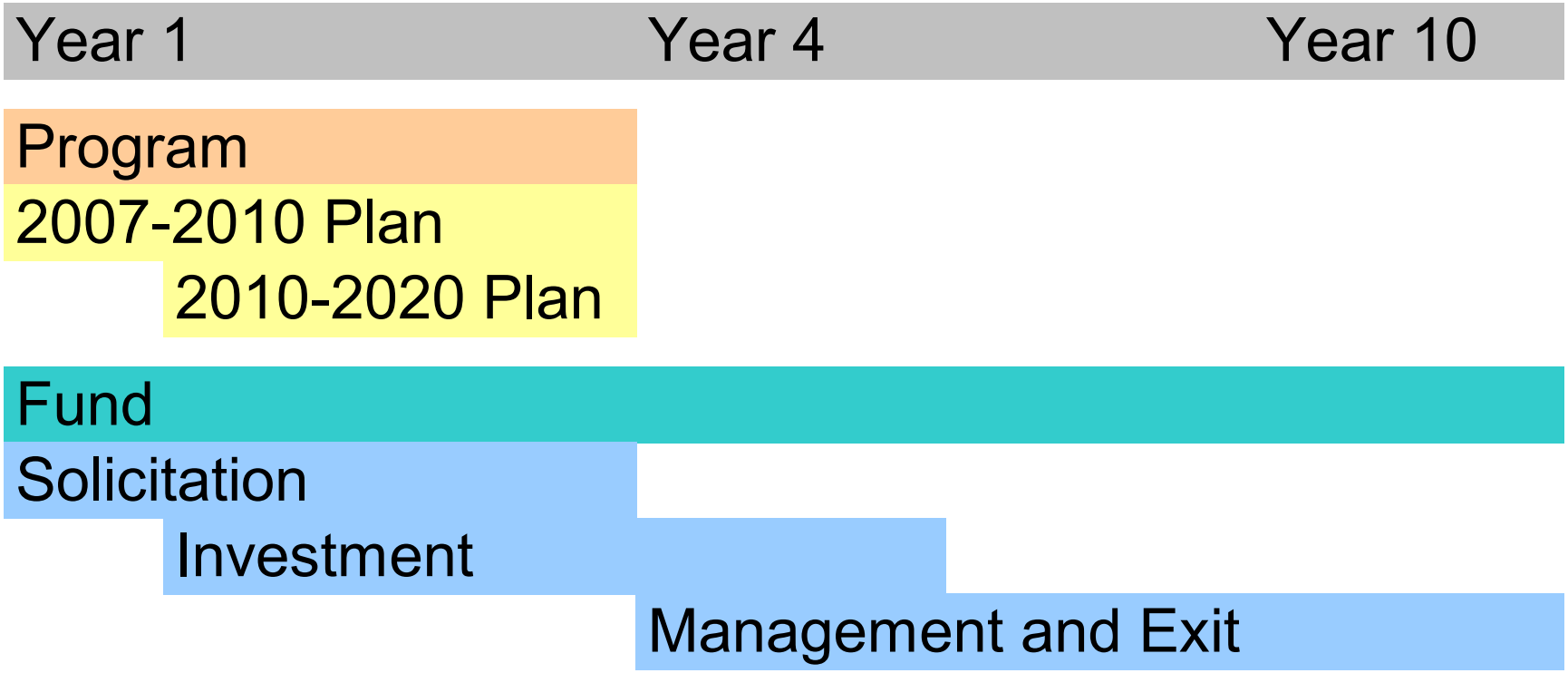
- ✓ **Cost Share and Seed/Venture are not mutually exclusive**
- ✓ **Two major methods for cost share projects:**
  - ➢ **<u>Reactive</u>: Respond to Solicitations**
    - **Pros – Program already established & funded**
    - **Cons – Highly competitive**
  - ➢ **<u>Proactive</u>: Develop our own projects**
    - **Pros – Can be more effective & specific to Hawai`i needs**
    - **Cons – Takes time**

Achieving Investment Returns for State

Kolohala Holdings will help the portfolio company to achieve liquidity. Methods:

- ✓ **Acquisition: Portfolio company purchased by a national firm.**
- ✓ **Initial Public Offering: A company could offer its shares to the general public.**
- ✓ **Distribution: A company with positive cash flow can distribute free cash back to its investors**

Timeline



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