EESAT TECHNICAL CONFERENCE, Portland, OR

Implementation of the NELHA Energy Storage Test Bed

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administered by the Natural Energy Laboratory of Hawaii Authority
ENERGY PROJECTS at NELHA

- Ocean Thermal Energy Conversion (OTEC)
- Solar (PV and CSP)
- Biofuels from Microalgae
- Sea Water Air Conditioning
- Energy Storage Test Bed
Why an Energy Storage Test Bed at NELHA?

Hawaii Policy
- State’s overdependence on oil
- Aggressive Clean Energy Policy – 100% by 2045
- Based on abundance of natural renewable resources (sun, wind, bio, geo, hydro, ocean)

Demonstration Needs
- Motivated customers
- User Demand (Utility, Commercial, Residential, Military) for real world demonstrations in industrial setting
- 100-150 MW storage deployment needed in next few years
- High percentage of renewables needing to be integrated on grids

Roll Out
- High electrical rates between $0.30 and $0.40/kWh
- Government private partnerships
- Master permit
Real World Testing and Validation of Pre-Commercial Energy Storage

Testing Site Power Source Monitoring

State of Hawaii NELHA

Hawaii County

HELCO (Utility)

National Labs USDOE/OE

Funding Conferences

Expertise End User

Expertise Energy Proposals Funding
**Initial Partners 2014/2015**

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<th>Government</th>
<th>National Labs</th>
<th>Private</th>
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<tr>
<td>• State of Hawaii</td>
<td>• Sandia National Laboratories</td>
<td>• Hawaiian Electric Company</td>
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<tr>
<td>• County of Hawaii</td>
<td>• National Renewable Energy Laboratory</td>
<td>• Makai Ocean Engineering</td>
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<td>• US DOE – Office of Electricity</td>
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<td>• Aquion Energy Inc.</td>
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Energy Storage Test Bed Short List

- Aquion Energy
  Pre-commercial aqueous hybrid ion battery (1.7 kWh)

- Imergy Power Systems
  Vanadium flow battery

- JuiceBox
  Integrator of small scale <60kW lithium-ion storage
First Installation: Aquion Battery (Generation 1)

- Installation March 2015
- One M100 Battery Module
- Minimum 21.9kWh based on C/20 standard discharge rate
- Local Partner: Renewable Energy Services
Aquion Battery (Generation 1) – Initial Duty Cycle (HELCO preferred)

- Full data collection started June 10, 2015
- Sandia to perform evaluation on 6 months data in November 2015
Aquion Battery (Generation 1) - Duty Cycle (Compromise)
Aquion Gen 1 Battery Efficiency (Daily)
from June 10 to September 7, 2015
Developing an ESS Test Bed – Lessons Learned

- *Consumer vs industrial* – integration challenges

- *Rapidly moving field* - permitting process must be streamlined

- *Value of partnerships* – utility in particular

- *Data Accessibility* – central, user friendly, web accessible
Future Work and Projects

- **Oct 2015 (in progress):** Hawaii Natural Energy Institute (HNEI) Hydrogen production and fueling station (65 kg/day)
- **Jan 2016:** 200kW PV and energy storage installation at Research Campus – Microgrid
- **Feb 2016:** Use of reconditioned Prius hybrid vehicle batteries as potential energy storage solution
- **2016 (?):** Ocean Compressed Air Energy Storage (OCAES)
- **2016 (?):** Modular Pumped Hydro Demonstration
- **2016(?):** Wave Energy/Desalination Demonstration
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NELHA/HOST Park

Explore the possibilities...

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