Storage Solutions for Hawaii's Smart Energy Future

Presented to

CMRU

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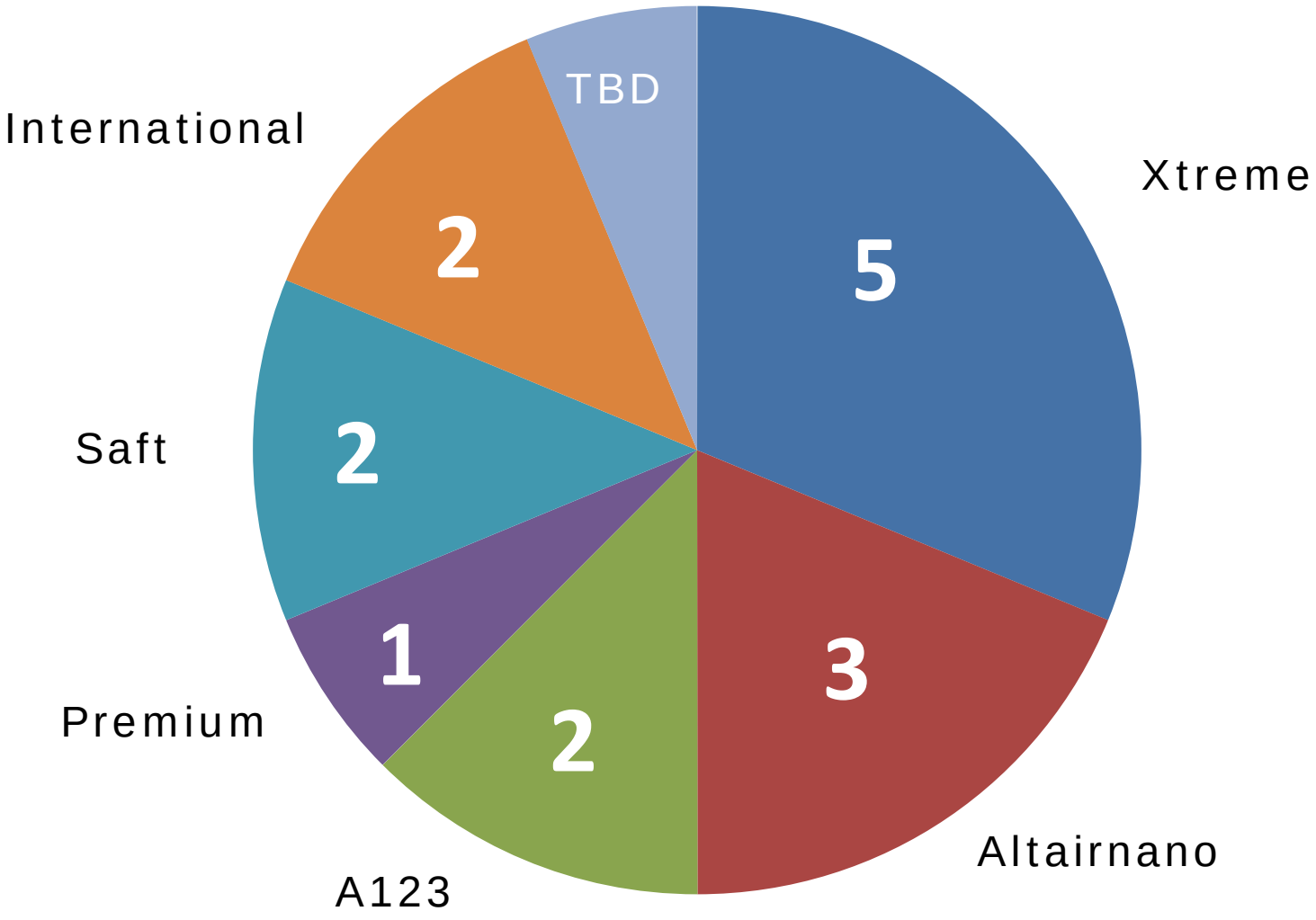
University of Hawaii at Manoa

Hawaii Natural Energy Institute

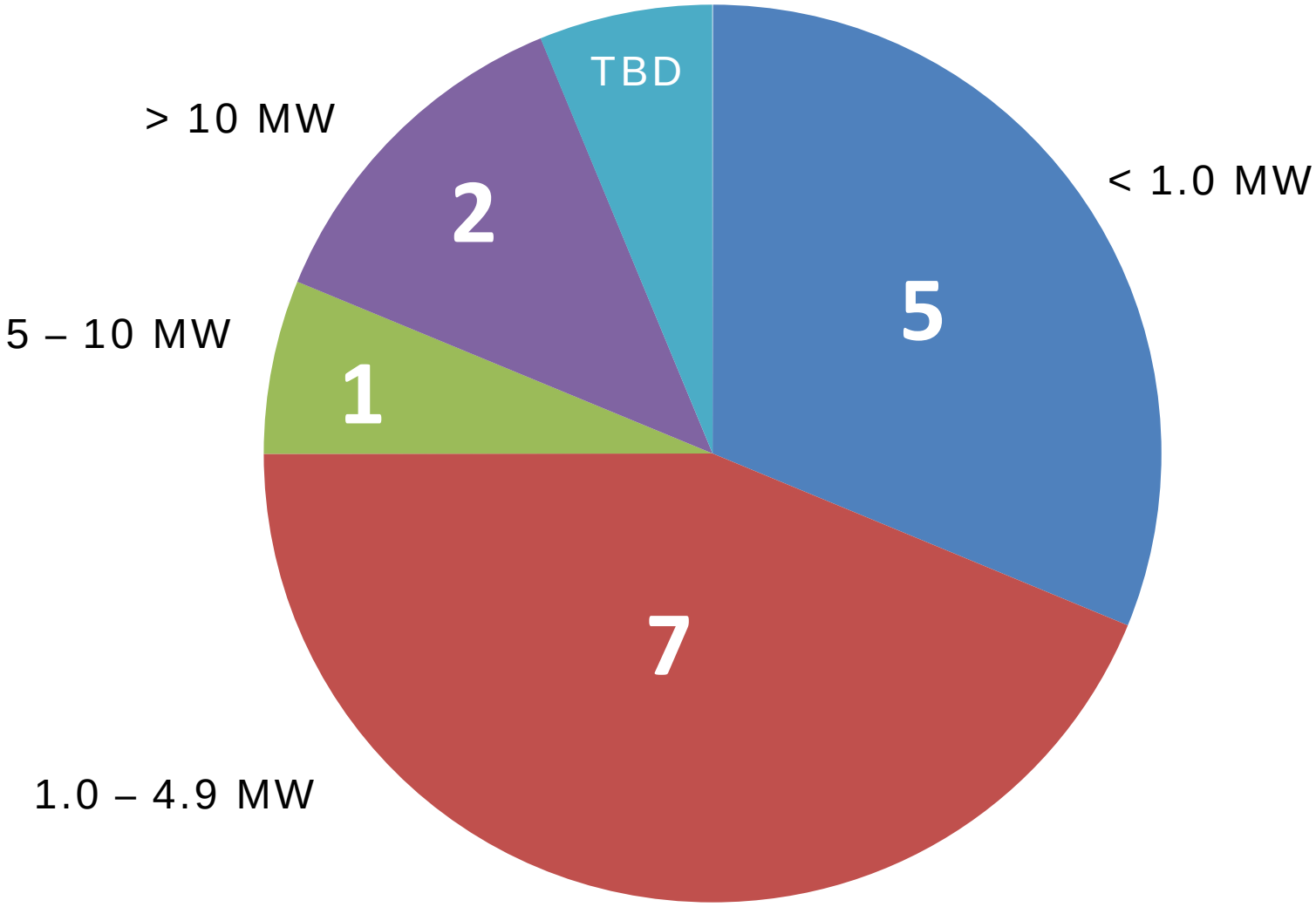
Current Energy Storage Projects in Hawaii

- 15 projects to date; more coming
  - Some are in operation, others are in development, with several more in the very early planning stages
- Most major islands (Molokai … not yet)
- Combination of “for profit” operations and integrated technology demonstrations with:
  - Wind or PV integration and control system demonstrations
  - Smart grid demonstrations
  - Other utility and University / HCEI research priorities
- Variety of funding sources and business models

6 Battery Vendors



Battery Power



Research and Demonstration Areas

- Voltage regulation (7)
- Frequency regulation (7)
- Wind Smoothing (6)
- Curtailment mitigation (3)
- RE integration/penetration (3)
- Peak load shifting/shaving; time shifting (3)
- Ramp rate (2)
- Spinning reserve/reserve support (2)

Energy Storage/Demand Control for Generation Smoothing, Frequency Regulation, and Power Quality

HNEI's Mission

Research, Test & Evaluate (RT&E) of Battery Energy Storage Systems (BESS) to validate their performance and assess value of grid-scale storage to address power quality and control issues for high-penetration renewable energy generation

- Select and deploy Grid-scale energy storage systems as operational test beds
- Develop and deploy Closed-loop Control Systems (CCS) and algorithms to support research into power quality, reliability, and management

Field Tests, Data Collection, Analysis, Assessment, and Reports and Publications

Vendor Selected for Battery Projects

Altairnano (ALTI)
1 MW/250kWhr Battery Energy Storage System (BESS)

Vendor Selected for Future Smart-grid Project

Altairnano (ALTI)
2 MW/333kWhr Battery Energy Storage System (BESS)

HELCO Wind-smoothing /Frequency Regulation

1MW, 250kW-hr located at Hawi Renewable Development's 10.6MW Wind Farm

- Grid-connected, sited on low side of 1.5MVA 480V/34.5 KV transformer
- Team developing Closed-loop control system (CCS) and real-time algorithms to optimize wind smoothing and frequency regulation
- Analysis
  - SCADA (grid) and battery performance data
  - BESS Performance and Health characterizations
  - Power quality characteristics (SEL 735) including high resolution waveform capture, and interruptions, sags, swells, harmonics, and unbalance
  - Wind and frequency spectra analysis with ALTI-ESS connected and disconnected from grid to assess ESS as tool to manage intermittency

HECO Voltage and Frequency Support

1MW, 250kW-hr located at Waiawa Substation with ~1MW of distributed PV

- Grid-connected, sited on low side of 1.2MVA 480V/12.47 KV transformer
- Team developing Closed-loop control system and real-time algorithms for Voltage and frequency support
- Analysis
  - SCADA (grid) and battery performance data
  - BESS Performance and Health characterizations
  - Power quality characteristics (SEL 735) including high resolution waveform capture, and interruptions, sags, swells, harmonics, and unbalance
  - VAR support and Load tap changer control and optimization

MAHALO NUI LOA