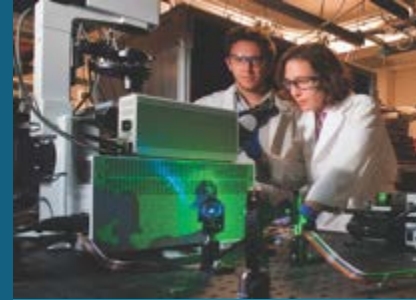


Sandia Energy Storage



PRESENTED BY

Ben Schenkman

October 28, 2019

SAND2019-12886C



Sandia National Laboratories is a multimission laboratory managed and operated by National Technology & Engineering Solutions of Sandia, LLC, a wholly owned subsidiary of Honeywell International Inc., for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-NA0003525.



Overview of Sandia Energy Storage Program

Multidisciplinary R&D program with synergetic collaboration with several departments across Sandia

Outward looking program with significant external reach to industry and academic collaborators. Leveraging resources across the labs and outside partners.

- Materials Research - Advancing battery chemistries through technology development and commercialization
- Power Electronics - Optimization at the interface between power electronics and electrochemistry. New power converter topologies, high voltage passives and magnetics.
- Energy Storage Safety – Cell and module level safety test and analysis. Engineered safety of large systems. Predictive models for ES safety. Storage safety standards and protocols.
- Energy Storage Analytics and Controls - Developing competencies in analytics and controls for integration of utility class storage systems. Lower BOS and integration costs. Software tools for optimal use of energy storage across the electricity infrastructure. Standards development.
- Energy Storage Project Development – Support for DOE demonstration projects
- Industry Outreach - Outreach to utilities, regulators, and the industry.



Energy Storage Analytics and Controls

Developing analytics and controls for integration of utility class storage systems. Software tools for optimal use of energy storage across the electricity infrastructure. Standards development. Engineering analysis for demo projects.

Key Projects

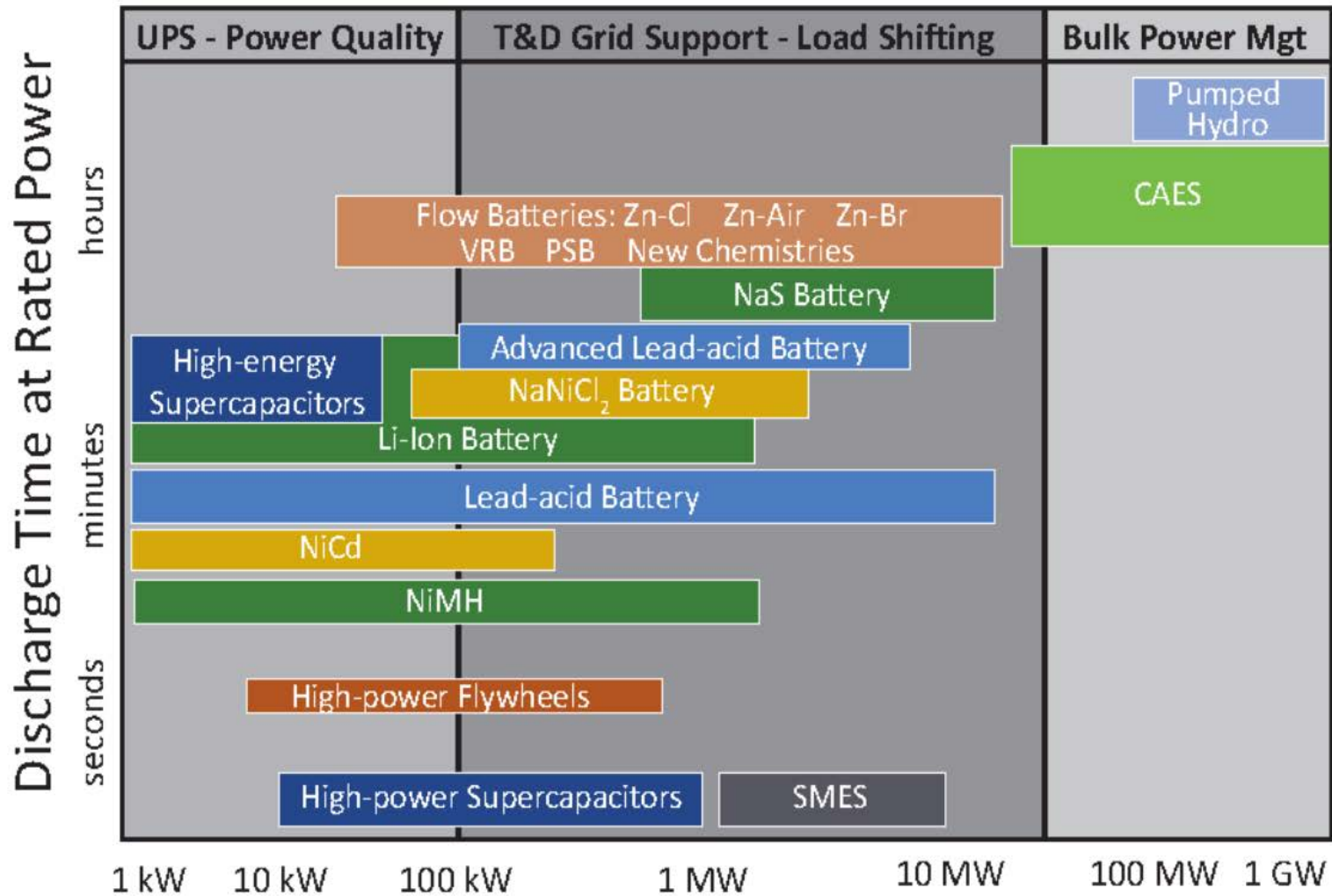
- Open Source Tools for Energy Storage Analytics (QuEst)
- Control of Distributed Energy Storage, Optimal control and dispatch of energy storage
- Modeling for ES Enabled Distribution Grid (NRECA)
- Energy Storage in the Transmission System
- Tech Specific Modelling & Optimization (Univ of Utah)
- Energy Storage Financing Roadmap (Mustang Prairie)
- Hydrogen Energy Storage Analytics
- Holistic Optimization Framework for Grid Integrated ES (Michigan State Univ)
- Integrating Virtual Inertia in Energy Storage Systems and Energy Markets (South Dakota State University)
- Distributed Control Algorithms Wide-Area Power Grids using Energy Storage (Clemson Univ)

Quest Open-source, Python-based Energy Storage Analysis Suite



Energy Storage Technologies

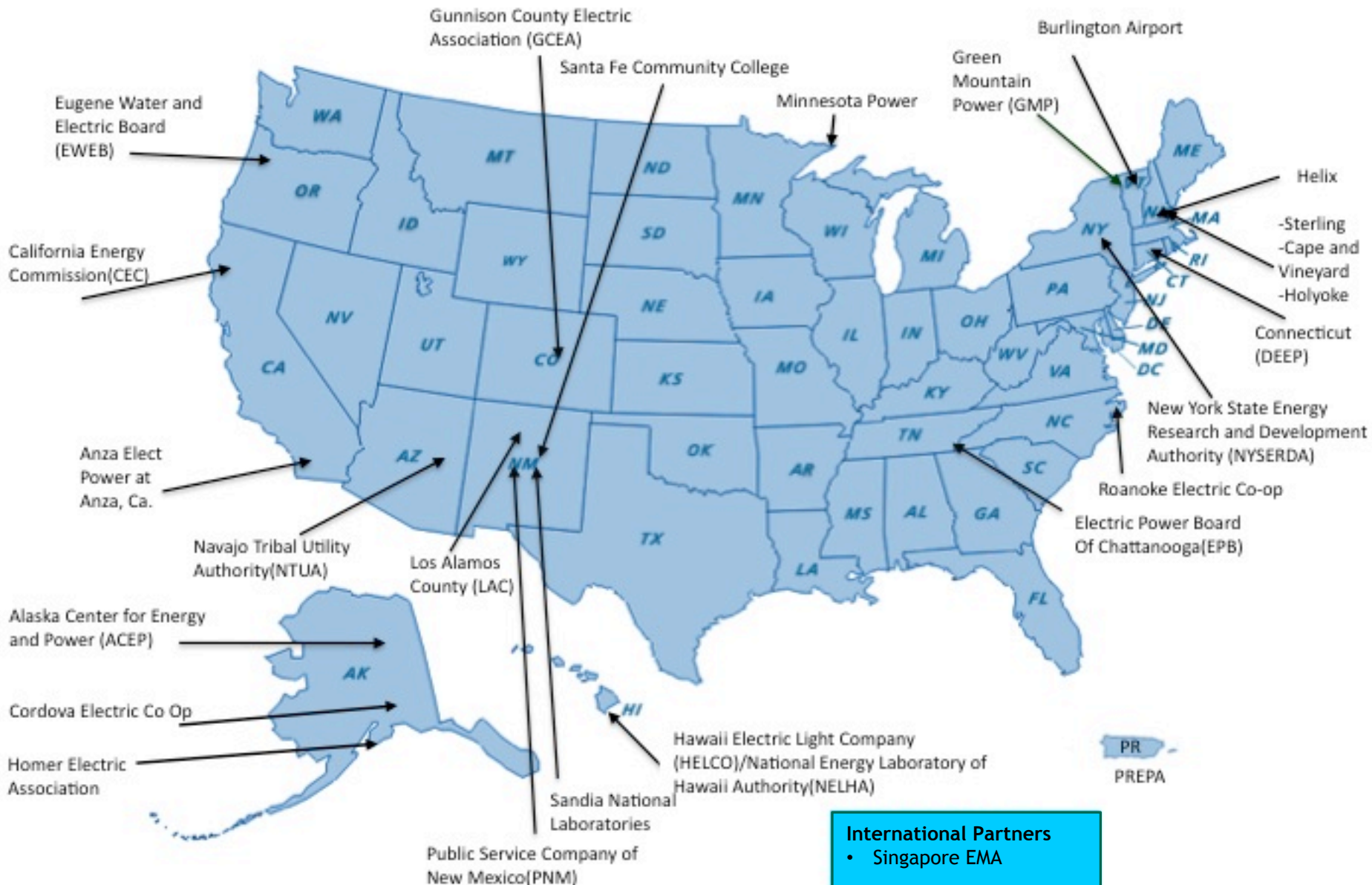
4



System Power Ratings, Module Size

Source: DOE/EPRI Electricity Storage Handbook in Collaboration with NRECA, 2013

DOE/SNL Energy Storage Projects



Contact Information

Benjamin Schenkman

blschen@sandia.gov

(505) 284-5883

Babu Chalamala

bchalam@sandia.gov

(505) 845-7185

Dan Borneo

drborne@sandia.gov

(505) 284-9880