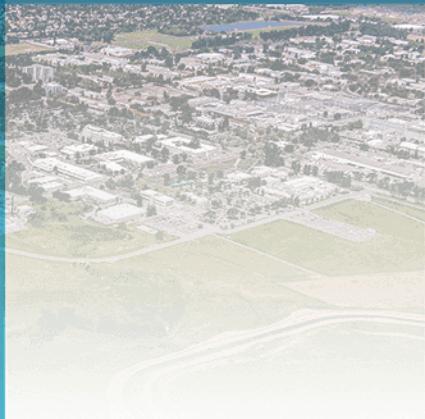




Sandia
National
Laboratories

Energy Storage Analytics



Ray Byrne, Ph.D., FIEEE
Manager, Power Electronics & Energy
Conversion systems

2021 DOE Office of Electricity Energy Storage Program Peer Review
October 25-27, 2021

Acknowledgment: This work was supported by the U.S. Department of Energy Office of Electricity Energy Storage Program under the guidance of Dr. Imre Gyuk



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.

Energy Storage Analytics Session



Ray Byrne (SNL), Session Lead and Program Overview

- *Di Wu (PNNL)*, Energy Storage Evaluation Tool (ESET)
- *Jan Alam (PNNL)*, Energy Storage Controls and Hybridization Related Efforts at PNNL
- *Dhruv Bhatnagar (PNNL)*, Energy Storage Long-Term Expansion Planning
- *Tu Nguyen (SNL)*, Long Duration Storage for Dispatchable Renewable Generation and QuEST Updates
- *Walker Olis (SNL)*, Energy Storage System Modeling for Extreme Climates
- *Richard Baxter (Mustang Prairie)*, Energy Storage Financing Study & Energy Storage Pricing Study
- *Hisham Othman (Quanta Technology)*, Probabilistic Integrated Resource Planning Tool

Energy Storage Analytics

Estimating the value of energy storage

- Market areas
- Vertically integrated utilities
- Open source SW tools

Control strategies for energy storage

- Wide area damping control, transient stability
- Maximizing revenue

Public policy: identifying and mitigating barriers

Standards development

Project evaluation

- Technical performance
- Financial performance

Model development (e.g., for dynamic simulation)



Research Priorities



Decarbonization – the transition to a decarbonized grid will require significant energy storage investments

- Longer duration energy storage (how much, where?)
- Energy storage will become an important part of the expansion planning process, tradeoffs between storage, curtailment of renewables, and transmission
- Electrification of transportation will require distribution system upgrades and/or energy storage deployments as well as tighter integration of transmission/distribution planning
- Impacts of climate change, extreme climates, impact energy storage sizing decisions

Energy and Environmental Equity

- Quantify how energy storage deployments can improve energy and environmental equity



Research Priorities

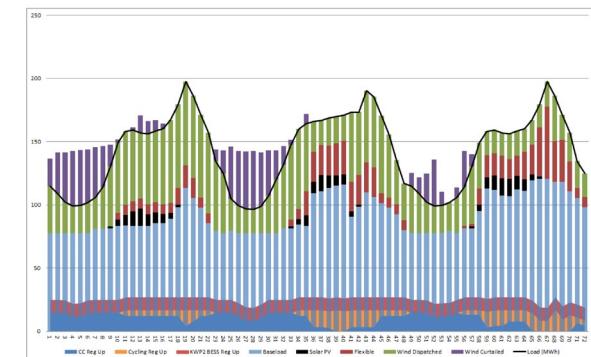
Energy Storage Finance

- Identifying and reducing barriers to project finance
- Pricing surveys to improve storage cost transparency
- Organize two energy storage finance summits each year



Control Systems for Energy Storage

- Control laws unlock the value/benefit of energy storage systems
- Represent potential new value streams
- As we decarbonize, reductions in inertia and transient stability will become more important



Open Source Tools for Energy Storage Analysis

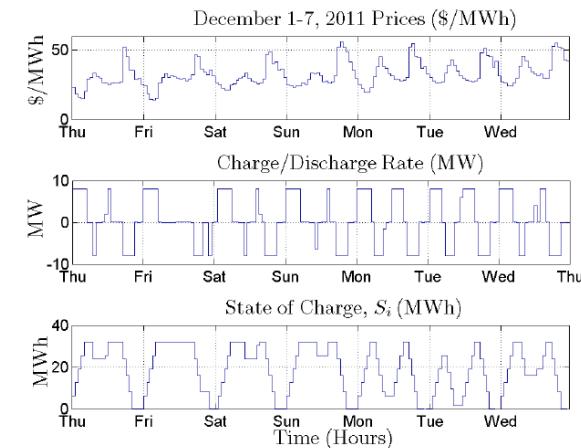
- Energy Storage Evaluation Tool (ESET), PNNL
- QuEST, SNL
- Probabilistic Integrated Resource Planning, Quanta





Resilience

- Sizing, placement and valuation of storage to enable resilience (and other factors like equity, decarbonization, etc.)
- Storage as a black start resource
- Microgrid energy storage design tools



Energy Storage Analytics Session



Ray Byrne (SNL), Session Lead and Program Overview

Di Wu (PNNL), Energy Storage Evaluation Tool (ESET)

Jan Alam (PNNL), Energy Storage Controls and Hybridization Related Efforts at PNNL

Dhruv Bhatnagar (PNNL), Energy Storage Long-Term Expansion Planning

Tu Nguyen (SNL), Long Duration Storage for Dispatchable Renewable Generation and QuEST Updates

Walker Olis (SNL), Energy Storage System Modeling for Extreme Climates

Richard Baxter (Mustang Prairie), Energy Storage Financing Study & Energy Storage Pricing Study

Hisham Othman (Quanta Technology), Probabilistic Integrated Resource Planning Tool