



Sandia  
National  
Laboratories

# Energy Storage Analytics



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# 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





## Energy Storage Finance

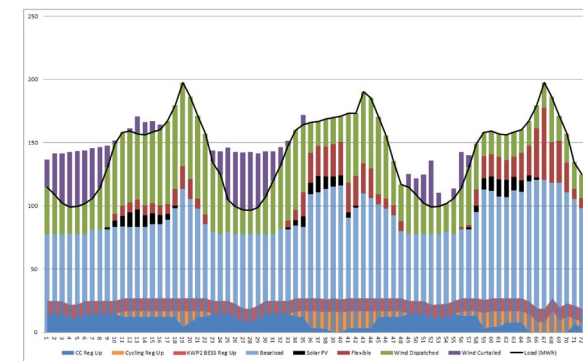
- Identifying and reducing barriers to project finance
- Pricing surveys to improve storage cost transparency
- Organize two energy storage finance summits each year

## 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

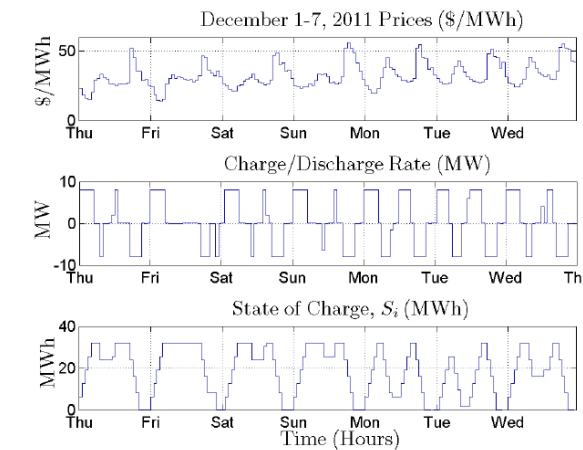
- Energy Storage Evaluation Tool (ESET), PNNL
- QuEST, SNL
- Probabilistic Integrated Resource Planning, Quanta





## 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



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