Sandia National Laboratories Energy Storage Demonstration Projects & Policy Capabilities

Presented by:

SNL ES Demonstration Projects & Policy Team

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Sandia's Energy Storage Deployment Team

What we do and why:

Support communities, state energy offices, utilities, academia, and the overall ES industry to **demonstrate and validate the equitable use of resilient, and secure energy storage systems on and off the grid through deployment projects**. Sandia's work in innovative deployment projects advance DOE's goals of facilitating decarbonization of the grid by improving acceptance and understanding of energy storage systems and serving communities by enabling equitable clean energy access.

Why are Sandia's Deployment Team projects important?

Facilitate the early adoption of energy storage technologies in support of DOE's goals of an equitable, clean, resilient and secure grid of the future

- Act as a bridge between R&D efforts and commercial adoption of safe, resilient, and secure energy storage systems
- Validate technical models and results through collection and analysis of operational energy storage data
- Inform Codes and Standards development and best practices for installation and operation
- Increase public confidence by demonstrating energy storage technologies and showcasing its range of benefits

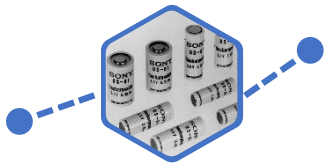
Deployment Projects Are a Foundational Element of the DOE/SNL ES Program

Mid-1970's – 1980's

Energy Storage Program early years, first use of cost-share development projects to advance technologies

1990's

Major ES developments occur through SNL's cost-share deployment projects program



4-yr, $2.8M, cost-share deployment program for VRLA battery improvement with GNB

Cooperative Agreement placed by DOE/SNL to support the design, fabrication, and testing of the first modular "AC Battery" - PQ2000
R&D 100 Award in 1997

1992 – Sandia performs specialized evaluation of flooded lead acid batteries for PREPA's 20MW BESS (C&D Charter Power Systems)

2000 - 2010

Sandia performs multiple characterization/life-cycle studies on Li-ion batteries

AEP/SNL cost-shared deployment of the first 'DESS'

SNL/CEC PIER program flywheel ES demonstration project for 'rapid response' frequency regulation

Growth period for ES on utility systems with new technologies being piloted

2010 - 2020

Major growth in the deployment of both FTM and BTM ES

Microgrid projects grow in scale and scope with several deployments in rural and remote communities including Alaska and Hawaii

Sterling Municipal Light Dept. installs first utility scale and largest system in New England.
2017 Grid Edge Award winner by Greentech Media
Finalist for the 5th Annual Energy Storage North America (ESNA) Innovation Awards

2020 - Future

Long Duration Energy Storage

Community based projects

Equity In Energy

ES cybersecurity

ES data & analytics

Demonstrate and validate the equitable use of resilient, and secure energy storage systems on and off the grid through deployment projects

SNL ES Capabilities Developed with Deployment Projects

Cyber Security

Enabling secure ES deployment/grid

ES demonstration project data collection & system analysis sofware (QuESt)

Analytics

Dedicated labs for development of future, lower cost, better performing ES electonics

Power Electronics

SNL deployments are a key part in advancing DOE's mission of an equitable, carbon-free, and secure grid of the future

Deployment Projects

Expansion of SNL's existing battery expertise to new and novel materials

Materials Research

Safety

Safety research on batteries
Fire safety for fielded systems

Energy storage education for PRC's and other State/Federal Entities

Policy

SNL ES4SE Deployment Project: Albuquerque Publics Schools Atrisco Heritage HS BESS + solar

SNL Innovative ES Technology Deployments

Lead-Acid Batteries	Aqueous Batteries	Non-Aqueous Batteries	Metal/Air Batteries	Li-ion Batteries	Other
Sealed Gel cell Flooded Advanced Ultra VRLA	Zinc/Bromine Nickel/Hydrogen Zinc/Ferricyanide Vanadium Redox Zinc/Manganese/O2	Sodium/Sulfer Sodium/Nickel/Chloride	Aluminum/Air Zinc/Air Iron/Air	NMC LFP LCO LTO	Flywheel CAES Gravity

Potential future project deployment technologies

SNL ES Deployment Team Project Specific Expertise

Project Development & Design

Refine conceptual design with details for the RFP to include current safety Codes/Standards

Construction

Monitor construction progress and schedule, provide TA for RFI responses

Operations & Maintenance

We recommend O&M practices and options to our partners when planning for service life of ES systems

Project Initiation

We work with our partners to understand the problem and potential solutions, conceptual design inception

Procurement

We help with developing RFP's, solicit proposals, bid analysis, and vendor selection

Acceptance Testing

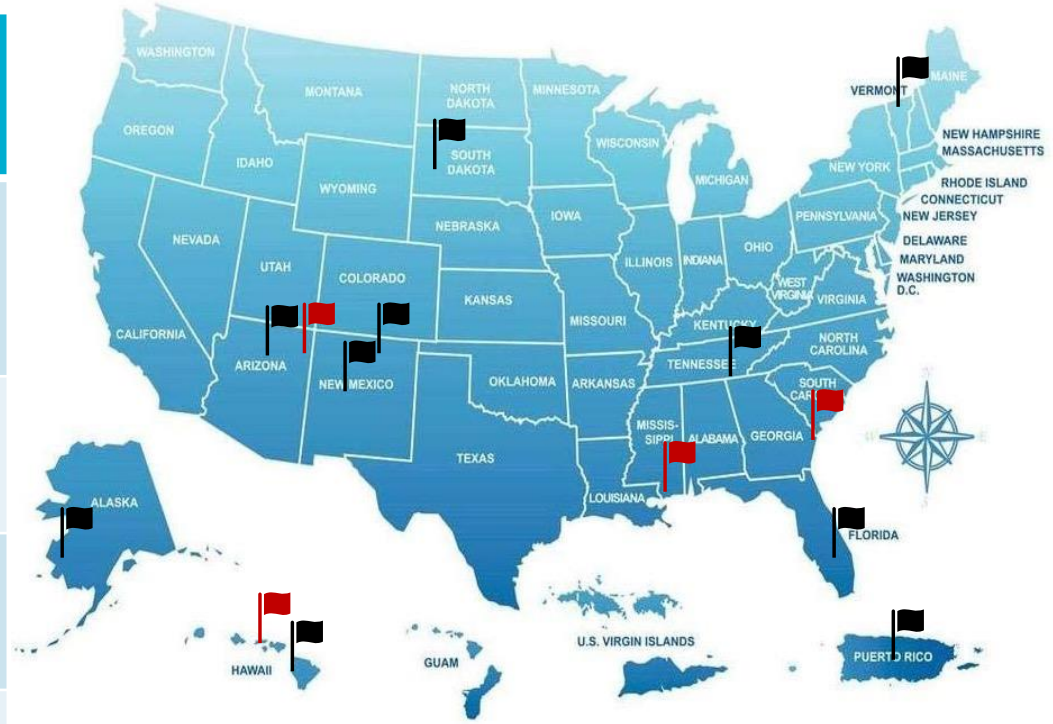
We support commissioning plan development and implementation by the system vendor(s)

ES Data Collection & Analytics

We monitor and collect system operational and performance data for ES analytics

Sandia Deployment Team Current Projects Map

State or Territory	Partner
Alaska	Alaska Village Electrical Cooperative
Arizona	Navajo Tribal Utility Authority
Arizona (x15)	Native Renewables (ES4SE)
Florida	Seminole Tribe
Georgia	Harambee House (ES4SE)
Hawaii	Natural Energy Laboratory of HI Authority



NOTE: Energy Storage for Social Equity (ES4SE) Projects in RED

State or Territory	Partner
Hawaii	Ho' ahu (ES4SE)
Mississippi	Coast Electric Power Association (ES4SE)
New Mexico	Albuquerque Public Schools
New Mexico	Picuris Tribe
Puerto Rico	Villalba Municipality
South Dakota	Ellsworth AFB West River Electric Association
Tennessee	Electric Power Board of Chattanooga (EPB)
Vermont	Green Mountain Power

Current SNL Community Deployment Projects

Energy Storage Project/Function	Application	Energy Equity & Community Benefits	Data Collection & Analytics	Technology	Current Status
Alaska Village Electric Cooperative	Spinning Reserve	-Reduces pollutants in two communities from diesel generator plants -Increased usage of renewable resources (wind)	ES system data is to be collected and analyzed on deployment projects in order to ascertain the following: ▪ <u>System performance</u> Is the system and sub-systems performance as specified by the vendor(s)? ▪ <u>Create data sets</u> Create a large, uniform, and open source sets of data for deployed systems of varying technologies	Li-ion (LFP)	System built, partially tested, and awaiting shipping from Germany to ACEP at the University of Alaska Fairbanks
Navajo Tribal Utility Authority	Off-grid Power	-Provides the only source of power to individual homes		ZnMnO2	1 of 3 systems deployed with active data collection/monitoring visualizations created
Albuquerque Public Schools	Community Resilience & Demand Reduction	-Power for a community resilience hub and health center -Reduces school districts electrical costs		Li-ion (NMC)	System deployed and commissioned, awaiting utility interconnection approval
Municipality of Villalba, Puerto Rico	Community Resilience	-Power for a multi-day community resilience hub -Reduce reliance on diesel generators and sourcing diesel fuel		TBD	System in the Project Development & Design phase

Partnership Opportunities Through DOE FOA's

Section 41001 of the Bipartisan Infrastructure Law (BIL) appropriates $505 million "to advance energy storage systems toward widespread commercial deployment by lowering the costs and increasing the duration of energy storage resources."

DE-FOA-0002777: Request for Information (RFI) BIL Section 41001 Energy Storage Demonstration Projects

- *This came out in May 2022 to solicit input on "regarding DOE's proposed implementation possibilities of the energy storage demonstration programs…"*

DE-LC-000L001: Long-Duration Energy Storage Demonstrations Lab Call - $30 million

- *Sandia, as the lead National Lab, submitted a proposal (Topic Area 2) with a Letter of Commitment from the California Energy Commission (CEC) plus Letters of Support from NYSERDA and CAISO*

DE-FOA-0002867: Long-Duration Energy Storage Demonstrations - $349 million

- *Sandia was asked to support, as a sub-recipient, three different proposals from industry partners*

NOI DE-FOA-0003035 Energy Storage Demonstration and Validation - $12 million

- *DOE seeking comments for DE-FOA-0003036*

DE-FOA-0002992: Request for Information (RFI) Regarding Creation of Storage Innovations Liftoff Announcement

- *Sandia provided input to the RFI and awaiting potential FOA*

SNL Policy and Outreach Program

Energy Storage Educational Workshops, funded by the DOE Office of Electricity (Dr. Imre Gyuk, Director) and free for all attendees, help regulatory commissions and related institutions around the United States develop the expertise they need to more quickly and efficiently integrate energy storage into their regional operations.

Our workshops, tailored to the unique needs of each utility commission, have already engaged regulators from over a dozen states with topics including energy storage technologies, performance, economics, valuation, interconnection, commissioning, safety, and policy.

Washington DC DOEE, Oct./Nov. 2022
Illinois Commerce Commission, Dec. 2021/Jan. 2022
FEMA & ISU Microgrids & ES Webinar Series, June/July 2021
Wisconsin PSC Webinar Series, April–July, 2021
NECPUC ES Webinar Series, Mar.-June 2021
New Jersey BPU ES Webinar Series, Jan.–Mar. 2021
Iowa State Univ./MISO ES Webinar Series, July-Oct. 2020
Utah Governor's Office of Energy Development Webinar Series, July-Aug. 2020
Maryland PSC Webinar Series, Mar.-Apr. 2020
Nevada PUC Workshop, Jan. 2020
Southeast Energy Storage Symposium, Summer 2021
New Mexico PRC workshops/webinars, 2019 & 2020 and ongoing
California Energy Commission (CEC), June 14, 2019
Hawaii PUC, Dec. 7, 2018, Honolulu: ES Introductory Workshop

Pacific Northwest NATIONAL LABORATORY

CleanEnergy States Alliance

New England Conference of Public Utilities Commissioners necpuc

PRC NEW MEXICO PUBLIC REGULATION COMMISSION

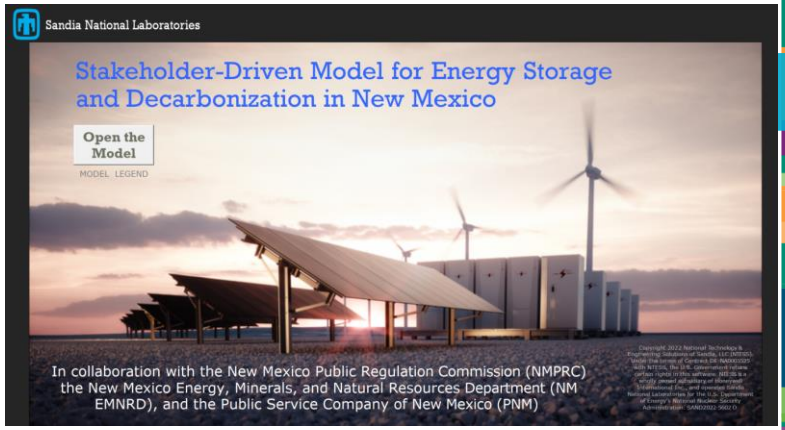
Kentucky Public Service Commission

Key Energy Storage Policy Issues—States

Policymaking at the state level has been focused on the following core issues:

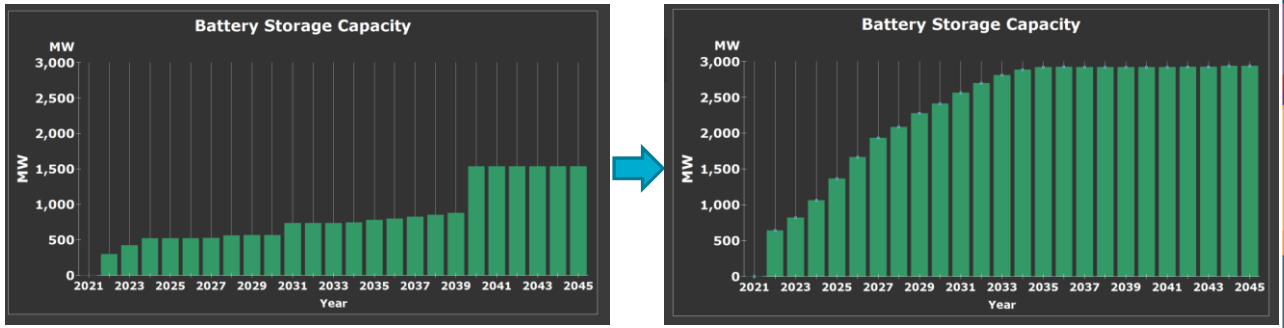
1. Procurement mandates, targets, or goals
2. Utility ownership
3. Inclusion of storage in utility IRPs
4. Incentives / tax credits
5. Multiple use applications
6. Equity
7. Cost / benefit analysis
8. Distribution system modeling
9. Changes to net metering policies
10 Changes to interconnection standards
11. Changes to RPS programs
12. BTM rate design (e.g. TOU)
13. Resilience

Energy Storage and Decarbonization Modeling Tool for Regulators



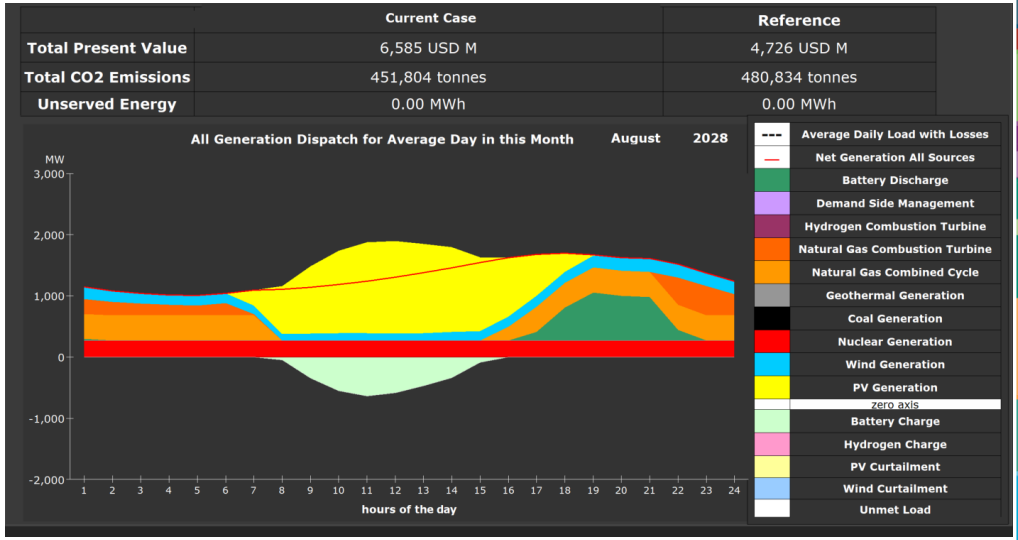
Allows policy makers to experiment with different strategies for meeting unique requirements for carbon-free electricity

Stakeholder-driven process assures that:
-- stakeholders understand abilities and limitations of the model
-- modelers understand the system and have all the right data and info
-- model will be used by policy makers and other stakeholders



System dynamics (SD) modeling environment, accommodates systems thinking, including interconnections, interdependencies, non-linearities, time lags, and unintended consequences

User-friendly, graphical, real time modeling provides tool for exploration, education, and consensus building



Putting the "Policy" in Policy and Outreach . . .

Publications led by Will McNamara,
Policy Analyst,
Sandia National Laboratories

Issue Briefs, White Papers & Policy Analysis

- Inflation Reduction Act (IRA) Impact & Financing for Energy Storage
- Energy Storage & Resource Adequacy
- Energy Storage as a Transmission Asset
- State Level Incentives for Energy Storage
- Energy Storage to Replace Peaker Plants
- Long-Duration Energy Storage Policy Issues
- Seeking Energy Equity Through Energy Storage
- FERC Order 841 Compliance
- FERC Order 2222 Impacts
- TOU Rates & BTM Energy Storage
- Rate Design for BTM Energy Storage
- State Policy Analyses: CA, IL, MA, MD, NM, NY, NJ, OR, TX, WA

Publicly available at:

https://www.sandia.gov/ess-ssl/global-energy-storage-database/

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This work was Directed by Dr. Imre Gyuk through the Department of Energy Office of Electricity Delivery and Energy Reliability (DOE-OE) Stationary Energy Storage Program.