

Energy Storage Testing and Validation

Independent testing of individual cell level to megawatt-scale electrical energy storage systems

Testing and validating the performance of electrical equipment is a critical step in the process to deploy technologies in the grid. Before these devices, such as batteries and flywheels, are installed in the grid, they must be proven to be safe and reliable. However, energy storage manufacturers and integrators are often unable to afford or have the capabilities to provide long-term testing and monitoring.

Overview

At Sandia National Laboratories, the Energy Storage Analysis Laboratory, in conjunction with the Energy Storage Test Pad, provides independent testing and validation of electrical energy storage systems at the individual cell level up to megawatt-scale systems.

In addition to various types of long-term testing, Sandia provides pre-certification and pre-installation verification and configuration of energy storage systems.

Benefits

- Manufacturers often do not have facilities to fully evaluate cells, modules, or systems under the desired conditions due to limitations in testing equipment or prohibitive cost, but they can turn to Sandia's testing capabilities to assist with testing.
- Implementing third party independent testing and verification provides potential customers with confidence that the energy storage technology will perform as promised.

Technology Capabilities

Energy Storage Analysis Laboratory—Cell, Battery and Module Testing

- 14 channels from 36 V, 25 A to 72 V, 1,000 A for battery to module-scale tests
- More than 125 channels; 0 V to 10 V, 3 A to 100+ A for cell tests
- Temperature chambers for thermal control
- 34 channels from 5 V–60 V and 15 A–500 A
- Potentiostat/Galvanostat for spectral impedance tests
- Infrared camera

Energy Storage Test Pad – System Testing

- Scalable from 5 kW to 1 MW,
- 480 VAC, three phase
- 1 MW/1 MVAR load bank for either parallel microgrid or series uninterruptible power supply operations
- Subcycle metering in feeder breakers for system identification and transient analysis

A testing device from the Energy Storage Analysis Laboratory.



The Energy Storage Test Pad.

Working with the Energy Storage Analysis Laboratory and the Energy Storage Test Pad

Both the **Energy Storage Analysis Laboratory** and the **Test Pad** are available to serve the needs of a wide variety of electrical energy storage stakeholders:

- EES system manufacturers
- Utilities
- Independent system operators
- Independent power producers
- Regional transmission operators
- Renewable project developers
- Commercial, industrial, and government agencies
- Independent laboratories, government laboratories, and universities

Various options are available for funding testing activities and protecting intellectual property. Some examples include the following:

- The Cooperative Research and Development Agreement (CRADA) funding process is used when work is performed by Sandia and industrial or other non-federal partners that benefit the goals of each participant. CRADAs may be cost-shared or 100% funded by the industrial partner.
- Work for Others (WFO) is work performed for non-U.S. Department of Energy (DOE)/National Nuclear Security Administration (NNSA) sponsors that is not directly funded by DOE/NNSA. WFO agreements can be utilized in order for an entity to enlist Sandia to provide it with private results.
- Non-disclosure agreements are legally binding agreements promising that the party receiving information will not disclose that information to any other party. The receiving party undertakes certain obligation regarding the information. Foremost, the obligation is a restriction on disclosing the information for a certain time period.

Specialized Testing Services

- Verifying storage device's reliability
- Analyzing performance relative to standards
- Developing new testing procedures
- Testing devices with different applications (e.g., energy time shift and load following)
- Evaluating system parameters

Current Industrial Users

- Altair Nano
www.altairnano.com
- International Battery
www.internationalbattery.com
- RedFlow
www.redflow.com
- Deka/East Penn
www.dekabatteries.com

For More Information

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Related Reading

Sandia National Laboratories, "Energy Storage Systems Program (ESS)," <http://www.sandia.gov/ess/>.

Summer Ferreira, "Life Cycle Testing and Evaluation of Energy Storage Devices," presentation at the 2012 DOE Energy Storage Program Peer Review, http://www.sandia.gov/ess/docs/pr_conferences/2012/papers/Friday/Session1/03_Ferreira_PeerReview_Print.pdf.

David Rose, "Life Energy Storage Test Pad," presentation at the 2012 DOE Energy Storage Program Peer Review, http://www.sandia.gov/ess/docs/pr_conferences/2012/papers/Friday/Session1/04_Rose_PeerReview.pdf.

Importance of Energy Storage

Large-scale, low-cost energy storage is needed to improve the reliability, resiliency, and efficiency of next-generation power grids. Energy storage can reduce power fluctuations, enhance system flexibility, and enable the storage and dispatch of electricity generated by variable renewable energy sources such as wind, solar, and water power. The Office of Electricity Delivery and Energy Reliability Energy Storage Program funds applied research, device development, bench and field testing, and analysis to help improve the performance and reduce the cost of energy storage technologies.