Energy Storage Test Facility (ESTF)

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Energy Storage Test Facility

Motivation

- Unbiased, third party evaluation is a helpful step to bring new technologies to market
- Thorough independent testing can provide data for evaluating business cases and comparing technologies.
- The equipment needed to perform systems tests at the Megawatt (MW) level can be prohibitively expensive

Some Barriers to Energy Storage Proliferation

- There is some uncertainty in the business cases for energy storage
- Companies see risk in designing and building energy storage systems so the markets for them are hindered
- New technologies are held back form their potential applications
SNL Energy Storage System Analysis Laboratory

Providing reliable, independent, third party testing and verification of advanced energy technologies for cell to MW systems

- Testing capabilities for supercapacitors, primary and secondary storage from cells to MW systems.
- Testing programs are designed to evaluate and validate battery performance.

Testing capabilities include:

**Cell Testing**

- 100 cell and battery testing channels:
  - 72 V 1000 A Bitrode (2 Channels)
  - 60 V 200 A Arbin (2 Channels)
  - 36 V 100 A Bitrode (3 Channels)
  - 36 V 25 A Bitrode (5 Channels)
  - 10 V 10 A Arbin (48 Channels)

**System Testing**

- New Energy Storage Test Pad (ESTP) expands testing capabilities to include megawatt (MW) scale energy storage. This versatile facility is capable of testing in several configurations for many different applications.
- Temperature chambers for thermal control
Energy Storage Test Pad (ESTP)

• Commissioned in April 2011
• Expands testing capabilities to include megawatt (MW) energy storage
• Testing at ESTP will increase industry confidence in large scale energy storage systems
ESTP

750 KVA Uninterruptable Power Supply (UPS) Under Test

- Validates and Demonstrates High Power Testing Equipment
- Helps Streamline Future Testing Activities
Thermal Imaging

Battery Banks

Baseline

Discharge

Charge
Operational Capabilities of the ESTP

The ESTP is a modular, dynamic testing facility. It can be reconfigured to test different characteristics of an energy storage system.

Three main configurations:

1. Frequency Regulation and Energy Shifting Applications
2. Islanded Load Following & Power Quality Applications
3. Grid Tied Reactive Power Support Applications
Configuration One

Testing: Frequency Regulation and Energy Shifting Applications

Grid Tied Transformer

Bidirectional Inverter

Controller

1 MW Energy Storage

Sandia Side

Vendor Side
Configuration Two

Testing: Grid Tied Reactive Power Support Applications

- Grid Tied Transformer
- Load Bank
  - 1 MW Real
  - 1 MVAR Reactive
- Bidirectional Inverter
- Controller
- 1 MW Energy Storage
Configuration Three

Testing: Islanded Load Following & Power Quality Applications
Capacity Test for 750KVA UPS Trailer

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RedFlow Testing

System Development Kit (SDK)

- 5kW, 10kWh Flow Battery
- Zinc-Bromine Chemistry
- To be tested in two phases
  - Phase 1: Characterization
  - Phase 2: Applications
Summary of Present Systems Testing

• The ESTP is commissioned and ready to test MW level energy storage systems in a variety of applications

• The RedFlow system has arrived at SNL and will begin testing shortly
Future Work

- Support Third Party and Collaborative Testing of Energy Storage Systems
  - Boeing Flywheel (in negotiations for May 2012)
- Automate Control and Telemetry of the Megawatt Loadbank at the ESTP with a Process Logic Controller (PLC)
- Advancement of Sandia energy storage testing methodologies
Advanced Testing Methodologies

ES meant for frequency regulation are tested using a very simplistic charge discharge profiles.

When ES is used for frequency regulation they see a complex, stochastic profile

Advanced Testing Methodologies

Figure 5-1 Parallel testing of batteries with simple and combined application cycles
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