NYSERDA/DOE Energy Storage Initiative Data Management and Analysis

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October 8, 2009

Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000

Acknowledgements

- The Data Acquisition and Analysis for these demonstration projects is funded by the U.S. Department of Energy.
  - Project Manager - Georgianne Peek, Sandia National Lab

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Project Statement

- Core Requirements – PON 846
  - The proposed Energy Storage System (ESS) must include a Data Acquisition System (DAS) for the purpose of providing system operating data to be used for evaluation and generation of reports on the overall performance of the EES.

Approach

- Transport to monitoring center via secure communications link over Internet
- Convert data from vendor systems into standard formats
  - IEEE 1159.3 PQDIF
  - IEC 61850 data models for metering
- Expose via dynamically generated tables, graphs on demand on project web site
- Provide project information, archived data and real-time data on open project web site
  - www.storagemonitoring.com

Past Projects

- Site 1 was an 11kW Gaia Power Technologies Battery, Edge of Grid residential application
- Used a Plug Power Fuel Cell, then used
- A Briggs 15 kW generator
- Started June 2005,
- Monitored until March 2007

Lessons Learned, Site 1

- Edge of grid residential application successfully proven
- Battery energy storage system worked as designed
- However, several power quality issues emerged
  - Load shedding relay caused 2 cycle interruptions
  - Inverter operation of Power Tower caused severe voltage flicker that caused homeowner to put system into bypass on numerous occasions

Past Projects, Site 2

- Beacon Power – Grid frequency regulation demonstration at an industrial facility in Amsterdam, NY, using 7 flywheels producing 100 kW for 15 minutes
- Using the system to provide energy as needed, with quick response, and to absorb energy, too

Lessons Learned, Site 2

- Beacon Power has successfully shown that the EM flywheel system can react to a frequency signal and inject or absorb power as needed assuming energy is available from storage system
- The frequency support comes from balancing the supply = load equation, making the supply as responsive as the load

Long Island Bus Terminal

- New York Power Authority/ABB – Peak-shaving and emergency backup application utilizing a 1 MW/7.2 MWh commercial-scale sodium-sulfur (NaS) battery system at a Long Island Bus facility
- System up and running after some delay

Difficulties

- Some paperwork issues
- Protection Design - Grounding Transformer, Direct Transfer Trip
- Parallel operation of the PCS units
- Compressor start on Battery alone
- Thermal management during commercial curtailment
- Battery Failure – Warranty Repair

Status, Long Island Bus Terminal

- System commissioned and operational, site operators experience benefits in fueling operations (schedule flexibility)
- Data Acquisition Issues addressed by ABB and EnerNex
- www.storagemonitoring.com modified to reflect revised data acquisition scheme
- Charge/Discharge Cycles, 108 as of July 1

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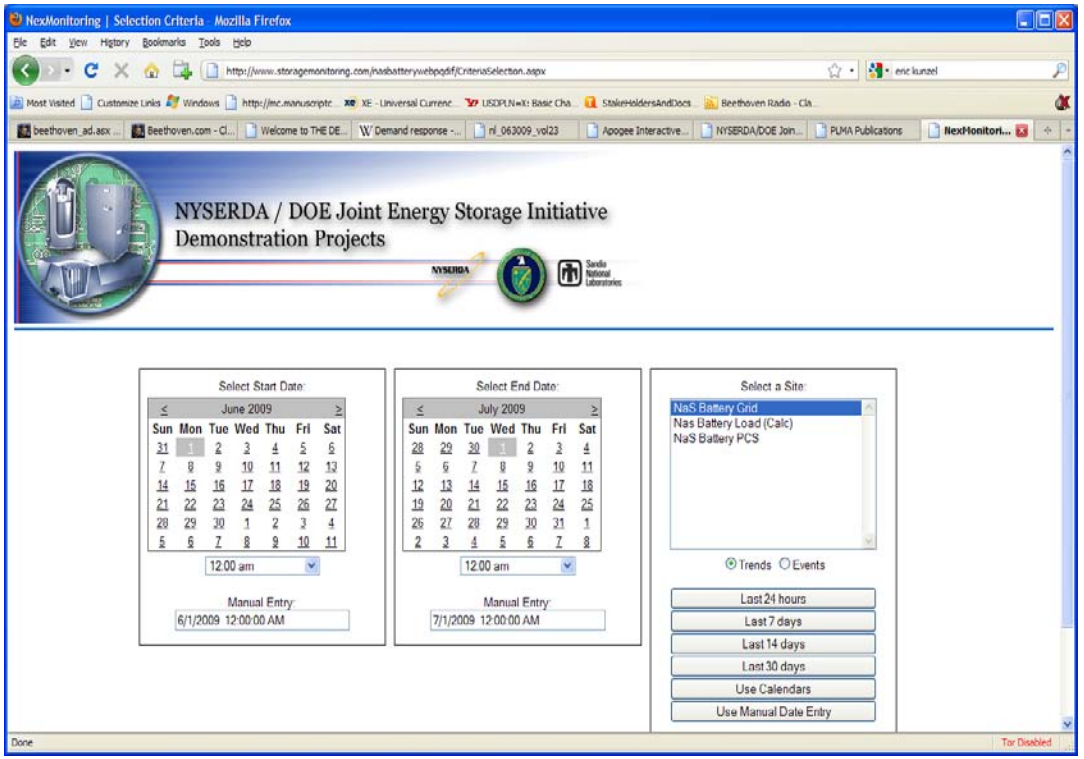
Data Acquisition

- The website was combining the different power readings daily
- Gave a confusing plot
- Solution was to create three “sites” to separate power readings



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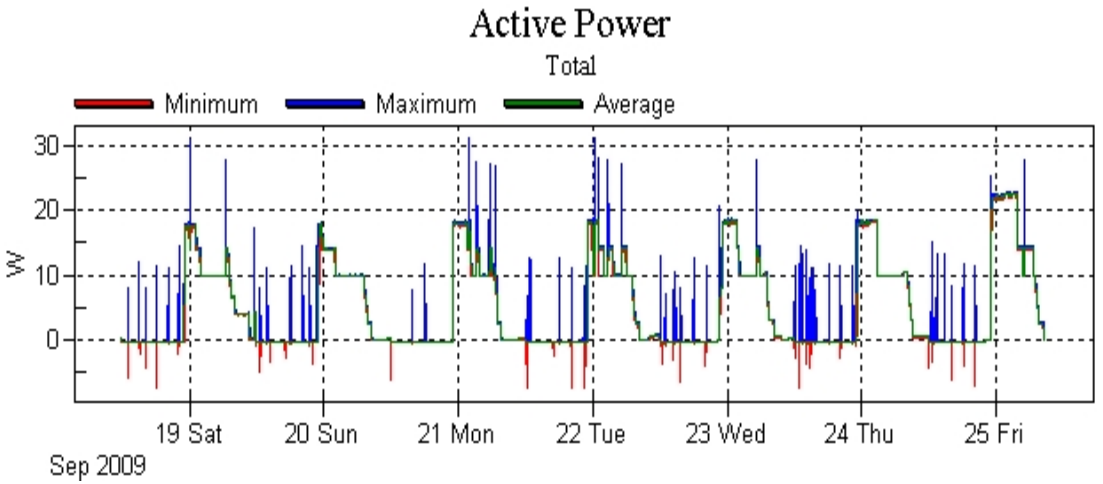
Long Island Bus Terminal

Now that the data is sorted out correctly, the power data looks to have the correct shape and direction.

This is the power from the grid to the system.



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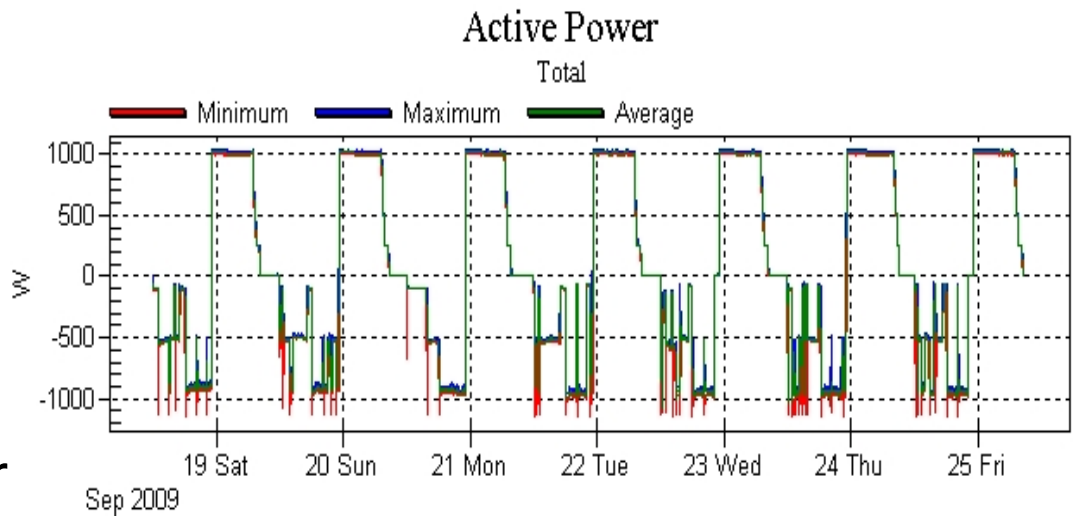
Long Island Bus Terminal

And this is the load power at the battery system.

These figures are calculated by the ABB system and show that the power goes into the system and back out of the system



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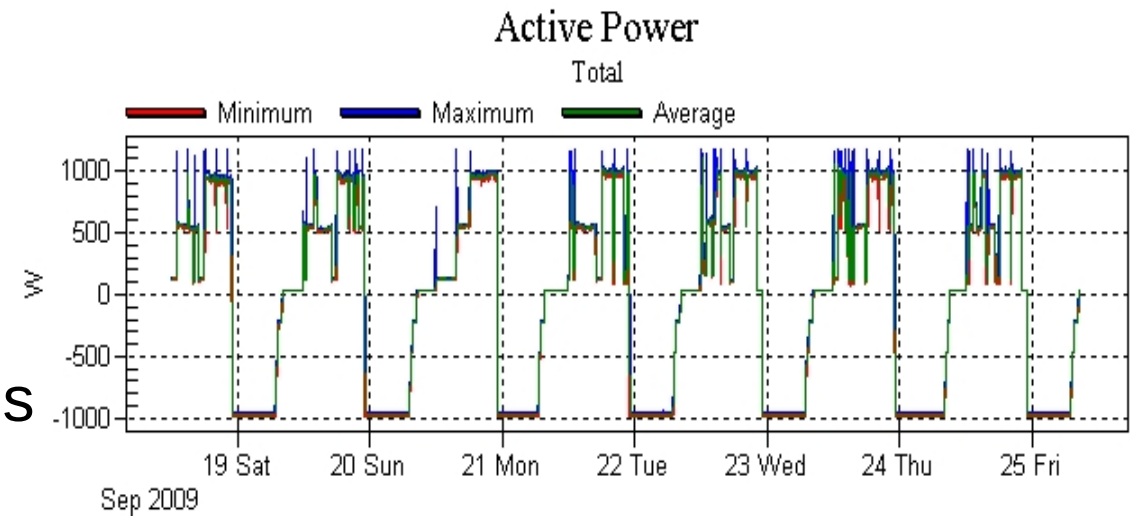
Long Island Bus Terminal

And this is the power at the battery inverter.

These figures are calculated by the ABB system and it is the inverse of the battery power.



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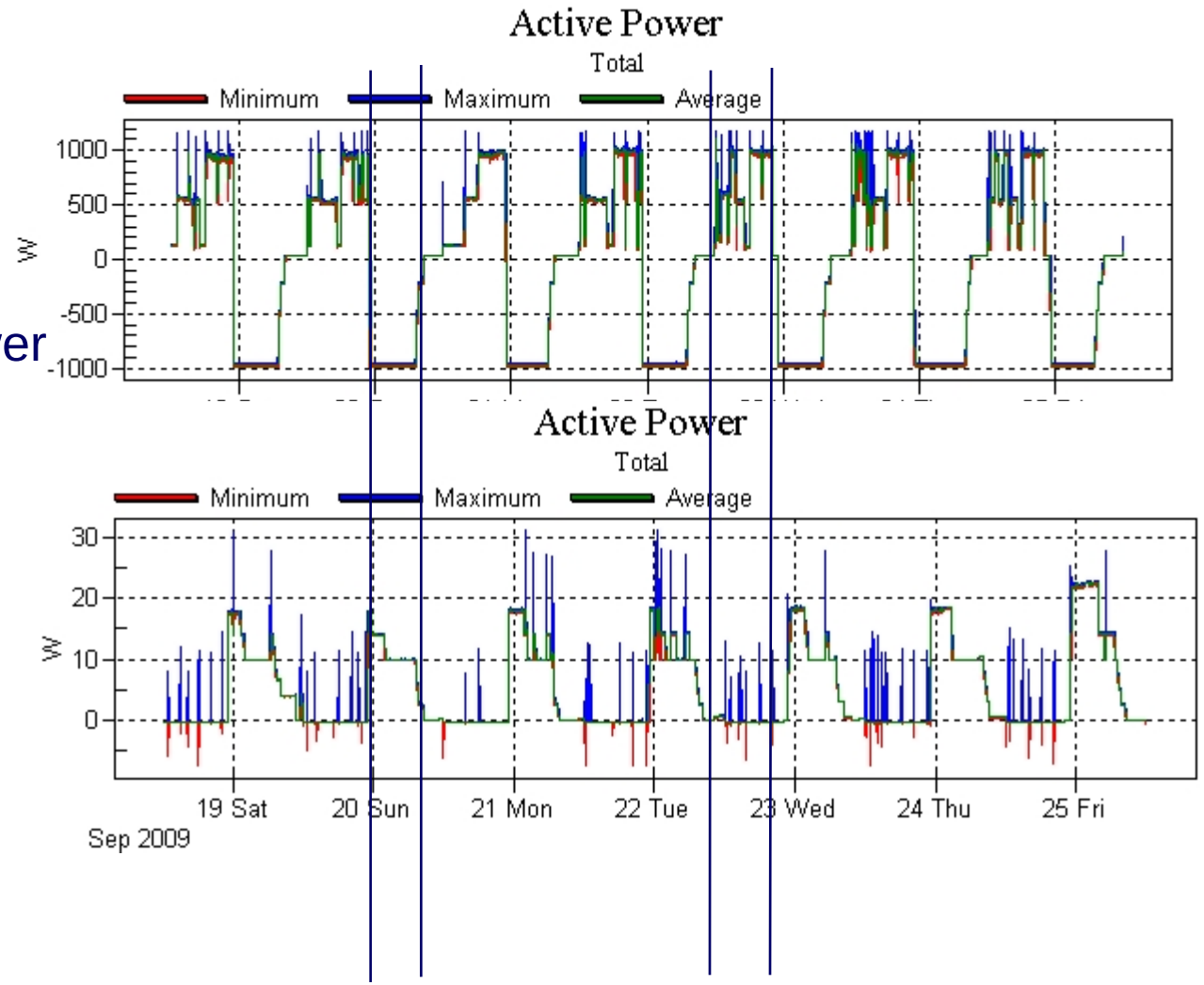
Battery Power

Grid Power



Time alignment shows that the grid power drops as the battery power rises.

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Lessons Learned, LIBT

- Batteries require conditioning at installation, then proper thermal management
- Consider all aspects of operation during specification (black start, e.g.)
- Consider all aspects of operation during system design (utility protection, e.g.)

Lessons Learned, LIBT

- Coordinate the Data Acquisition early and often

Niagara Falls

- Establish on-site generation and energy storage
- Level the energy demand throughout the day
- Provide backup power when needed
- Install 30 kW PV generation, 150 kWh storage, 100 kW short term supply

Niagara Falls

- Kickoff meeting held April 17,2009
- Plan to install one Premium Power Corporation PB150 mobile Energy Storage System
- Up to 100 kW power, 150kWh demand backup power and peak reduction
- Support 30 kW photovoltaic system, making the PV generation “dispatchable”

Niagara Falls

- Factory Assembly of the PB150 completed
- Testing underway
- Data acquisition tests underway
- Interconnection issues between the PV system and the battery system to be resolved.

LIRR Voltage Support

- Voltage support for transportation system
- LIRR site, located between two distant traction power stations
- Issue: track voltage gets low, affecting the train operation
- Modern locomotive manages its demand to avoid making the voltage too low…
- - Even if the operation slows to a crawl

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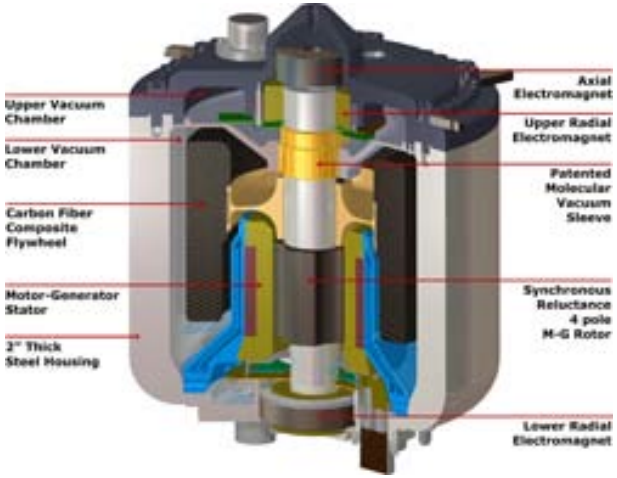
LIRR Voltage Support

- Pentadyne Flywheel System
- 12 independent high-speed flywheels
- Packaged to operate as a system
- Able to operate with one or more out for maintenance



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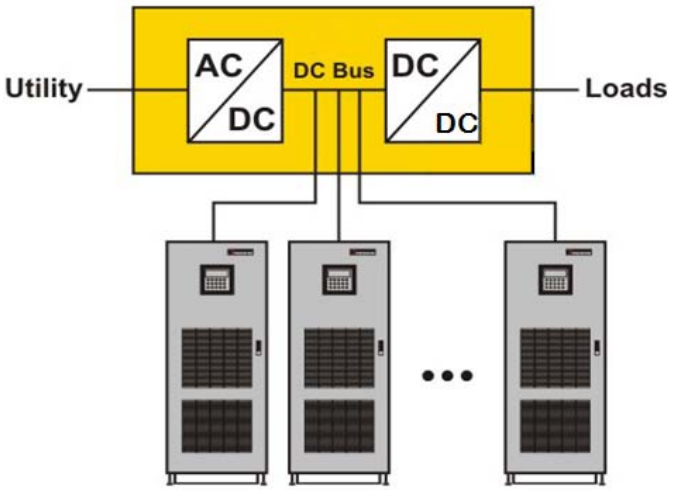
LIRR Voltage Support

- The system will be used to supply energy to the rails when necessary, but can also absorb braking energy from a passing train
- Data Acquisition requirements vary
- Energy System monitors 12 units, bearings, temps, etc.
- DOE looks at the total system performance

LIRR Voltage Support

- The system is something like this, with the flywheels operating in parallel and the regulated DC connected to the rails



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LIRR Voltage Support

- Data acquisition system designed, some parts in place
- Site survey done at the kickoff meeting
- Data decisions made for the DAS
  - Same software and website for this project
  - Similar data collected and displayed
- Final DAS design elements to be completed soon

DAS Action Items

- NAS Battery – continue monitoring, now that the past data has been rebuilt in the new format on the website
- Niagara Falls – continue to work with Premium Power to install monitor
- LIRR – continue to work with Pentadyne to install monitor
- Discuss internet access on new sites