NYSERDA Energy Storage Projects

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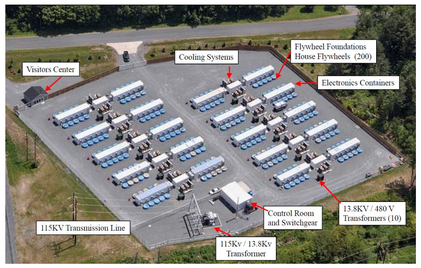
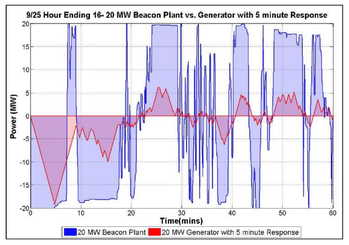
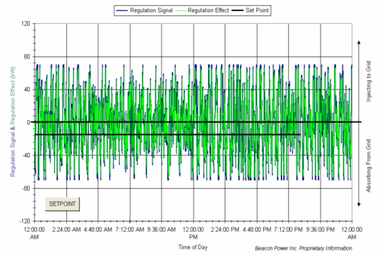
Beacon Flywheel Plant at Stephentown, NY





Regulation Signal Vs. Regulation Effect



Objective

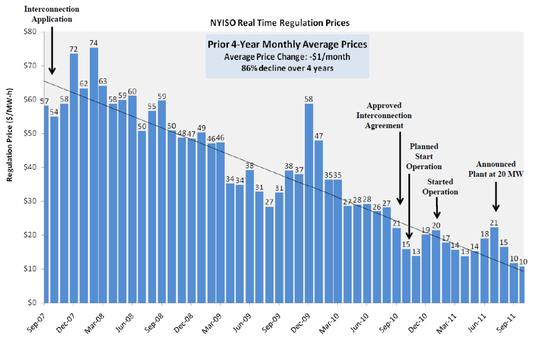
Demonstrate 20 MW flywheel energy storage plant to provide ancillary services in NYISO market

- "Merchant" area regulation service provider
- Reduced air emissions
- Reduced need for regulation capacity.

Current Status

- Beacon Power LLC operating plant at full capacity
- System operates as *the* 1st response regulation provider to NYISO
- Exploring various bidding strategies

NYISO Real Time Regulation Prices



Objectives

- Demonstrate electric energy storage to:
  - increase reliability
- Demonstrate energy management to be:
  - technically viable
  - cost-effective
  - broadly applicable

4 Demonstration Project Sites

1) Beacon Flywheel Plant at Stephentown, NY
   - Ancillary services in NYISO
2) NaS Battery at MTA Long Island Bus Depot
   - Time of day load shifting to avoid TOU rates
3) Flow Battery at Niagara Falls State Park
   - Renewables integration/firming & reduced peak demand charges
4) Dispatchable PV with Li-Ion at LaGuardia Community College
   - Renewables firming to meet CUNY sustainability goals (NYC Solar America City Partnership)

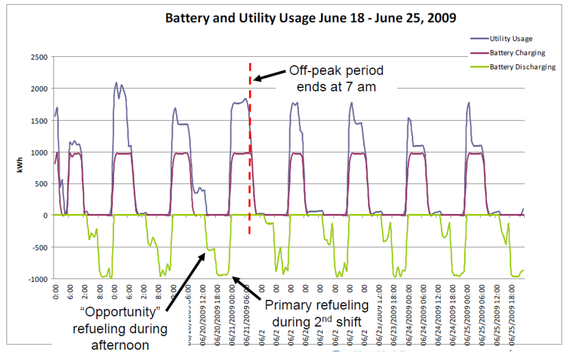
NaS Battery at MTA Long Island Bus Depot

Objective

- Demonstrate energy storage to reduce electric bills and lower operating costs (3-shift labor)
- Demonstrate long term operation of peak shift energy storage
- Reduce peak demand on loaded grid
- Increase backup power capability for regional emergency response plan

Current Status

- System removed, bus depot sold to private operator



LIPA Tariff	Time	Energy Charge ($/kWh)	Demand Charge ($/kW/month)
I. Off peak	11pm – 7am	$0.0063	$-
II. On peak	June-Sep Mon-Fri 12pm – 8pm	$0.0441	$38.10
III. Intermediate	All other	$0.0408	$3.81

- Generation (bus refueling)
  - 2nd shift 6pm to 2 am
- Charge
  - 12am to 9am
  - Off-peak and intermediate rates

Flow Battery at Niagara Falls State Park

- Premium Power Zinc-Flow PowerBlock®150
- 100kW / 150kWh
- 30 kW PV system
- National Grid distribution feeder
- Project start: FY09

Objective

Demonstrate technical and economic performance of Zinc Bromine flow battery at Niagara Falls State Park

- Reduce energy-related cost for 150kWh/day reduction of energy purchased
- Reduce peak demand charges with 100 kW peak demand reduction
- Reduce congestion at critical "load pockets"
- Mobile storage deployed for emergency backup

Current Status

- Operated during period installed
- Flow battery technical issues required removal
- Final performance report in progress

Analysis Goals

- Verify ESS Performance
- Obtain, analyze & disseminate data on ESS economics and realized benefits
- Increase collective knowledge of ESS: operations, uses, benefits & potential issues
- Accelerate growth and maturation of the electricity storage industry

PV & Li-Ion at LaGuardia Community College

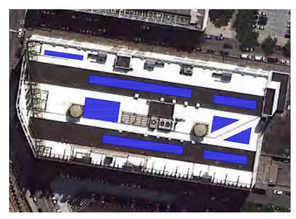
Objective

Operate dispatchable PV system configured to shave peak load

- Demonstrate efficacy of renewable energy supplied storage systems for firming electrical capacity
- Demonstrate dispatchable PV to reduce demand charges
- Demonstrate dispatchable, peak-shaving PV for enhancing grid resiliency
- Evaluate dispatchable PV as an alternative to reverse power relay requirements

Current Status

- Final design phase
- Construction complete end of 2013



PV Watts Output

Month	Solar Radiation (kWh/m2/day)	AC Energy (kWh)	Energy Value ($)
1	3.17	8190	$980
2	4.17	9628	$1,152
3	4.57	11236	$1,345
4	5.25	12102	$1,449
5	5.30	12288	$1,471
6	5.78	12581	$1,506
7	5.64	12451	$1,490
8	5.52	12355	$1,479
9	5.06	11216	$1,343
10	4.48	10654	$1,275
11	2.90	6871	$822
12	2.85	7179	$859
Year	4.56	126751	$15,172

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