Energy Storage enabling Flexibility in Electrical Grid Systems

EEF Dinner Debate
Strasbourg
June 13, 2017
Greensmith Overview

Greensmith Energy at a glance

- Founded 2008
- US based company, global focus
- HQ in Washington, DC
- 180MW installed
- Turn-key Energy Storage System Provider
- Flagship products

Energy Management Systems for Energy Storage Assets
- Flexibility
- Efficiency
- Longevity
- Turn-Key Energy Storage Systems

Greensmith Locations

- Tucson Electric Power
  10MW / 4MWh
- Pomona Energy Center
  20MW / 80MWh
- SJC T&D Deferral
  2MW / 6MWh
- Substation Support
  0.5MW / 1.5MWh
- Texas Waves ERCOT
  2 x 10MW / 5MWh
- PRANG MTR
  1MW / 500kWh
- Deltro IESO
  13MW / 53MWh
- Frontier PJM
  20MW / 9MWh
- Beckjord II PJM
  2MW / 0.8MWh
- Meyersdale PJM
  18MW / 7MWh
- Substation Support
  0.5MW / 1.5MWh
Energy Storage Markets and Value propositions
Energy Storage Markets and Value propositions

- **Reserve & Response Services**
  - High-Energy Supercapacitors
  - Nickel Cadmium Battery
  - Nickel Metal Hydride Battery
  - Flywheels
  - High-Power Supercapacitors

- **Transmission and Distribution Grid Support**
  - Li-ion Battery
  - Lead-Acid Battery
  - Sodium-Sulphur Battery
  - Advanced Lead-Acid Battery

- **Bulk Power Management**
  - Hydrogen & Fuel Cells
  - Compressed Air Energy Storage
  - Pumped Hydropower Storage
  - Cryogenic Energy Storage

**Key – Types of Storage**
- Hydrogen-related
- Mechanical
- Electrochemical
- Electrical
- Thermal

**System Power Ratings, Module Size**
- 1 kW
- 10 kW
- 100 kW
- 1 MW
- 10 MW
- 100 MW
- 1 GW
Energy Storage Technologies Life Cycle

Electrical Energy Storage Systems

Mechanical
  - Pumped-storage Hydropower
  - CAES
  - LAES
  - Flywheels

Thermal
  - Sensible thermal
  - Latent thermal
  - Thermo-chemical

Chemical
  - Hydrogen Storage
  - SNG

Electro-chemical
  - Lithium-Ion Battery
  - Lead Acid Battery
  - NaS Battery
  - Redox flow Battery

Electrical
  - Super-capacitors
Energy Storage Industry

MATURITY OF ENERGY STORAGE TECHNOLOGIES

- Flow batteries
- Flywheel (high speed)
- Super-capacitor
- Super-conducting magnetic energy storage
- Adiabatic CAES
- Hydrogen
- Synthetic natural gas
- Thermochemical
- Lithium-based batteries
- Molten salt
- Flywheel (low speed)
- Ice storage
- Sodium-sulphur (NaS) batteries
- Compressed air energy storage (CAES)
- Residential hot water heaters with storage
- Underground thermal energy storage
- Lithium-based batteries
- Pit storage
- Pumped storage hydropower

Source: Schlumberger Business Consulting Energy Institute, Paris
Energy Storage Solutions to solve Grid Stability
Future Services needed

- RES share
  - 80%
  - 50%
  - 30%

- Frequency
- Spinning Reserve
- Ancillary Services
- Imbalance Market
- Large Scale Bulk Energy
- Large Scale Inertia replacement
- T&D Upgrade Deferral

Power Centric to Energy Centric

© 2016 Proprietary and Confidential
European Key Market Developments

Positive developments for Storage Industry and Grid Infrastructure

• UK market leading application development for commercial storage deployment

  ⇒ Gaining solid experience to leverage Energy Storage benefits

• Energy Storage System sizes seen in the range of 10MW to 100MW

  ⇒ Enables distributed deployment in DSO grid operations in accordance to the winter package

• Understanding of Energy Storage as best choice for short and ultra-short grid support function

  ⇒ Technology outpaces capabilities of and benefits expectations for the European Grid system

• Today Energy Storage offers already commercial solution to fast response grid stability problems beyond pumped hydro storage
European Key Market Developments

Barriers for EU Energy Storage deployments

• Classification and harmonization of Energy Storage as a third pillar in European Energy Supply chain
  
  => Energy Storage is neither a Generator nor a Consumer

• Lack of clearly defined trading and market segments to take advantage of the benefits of Energy Storage
  
  => Fast acting reserve market segment

• Modernization of smart grid technology enabled networks allows new re-definition and understanding of grid stabilization
  
  => Paradigm shift to a faster grid system
We look forward to working with you

Stefan Schauss
Director Business Development EMEA
Vienna, Austria
sschauss@greensmithenergy.com
+43 676 7007223