



NERC/NAGF/ESIG Workshop on Battery Storage, Hybrid Resources, Frequency Response and Grid Services

**NERC Washington D.C. Office
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**Tuesday, September 17th – 9:00 AM to 5:00 PM
Wednesday, September 18th – 8:30 AM to 4:00 PM**

- 9:00 Orientation, Welcome and Overview (Allen Schriver/NAGF, Mark Ahlstrom/ESIG)**
- 9:10 Opening Keynote – Storage and other drivers of grid transformation**
- **Elizabeth Salerno**, Technical Advisor to FERC Commissioner Glick
- 9:30 Panel 1 – Technical capabilities of battery energy storage systems**
- Battery and inverter technologies
 - Services storage can provide (energy, peak shaving, PFR, FFR, regulation, etc.)
 - Reactive capabilities of battery energy storage systems (including while charging)
 - Economics of provision (efficiency, degradation, implications on PPAs and offers)
 - Batteries in hybrid systems – DC-coupled versus AC-coupled, does it affect the above?
 - **Jeff Plew**, NextEra Energy
 - **Chris Larsen**, Dynapower
 - **Arvind Tiwari** and **Jason MacDowell**, GE
- 11:30 Lunch**
- 12:30 Panel 2 – Hybrid projects: motivations, drivers and challenges**
- Driving factors behind hybrid projects – in regulated and market regions
 - DC-coupled versus AC-coupled – drivers and implications for integrating into existing power systems (e.g., visibility, controllability, forecasting, dispatch, evaluation)
 - Arguments for a hybrid resource model and treatment as a unified resource type
 - Hybrids versus renewables – differences in approaches for offering ancillary services
 - Implications for hybrid capabilities, offers and higher-level grid services
 - **Mahesh Morjaria**, First Solar
 - **Ray Hohenstein**, Fluence
 - **Mark Ahlstrom**, ESIG/NextEra Energy
- 2:30 Coffee Break**

3:00 Panel 3 – Planning, interconnection and modeling with storage and hybrids

- Modeling – DC/AC coupling, charging as negative gen vs load, etc.
- Communications, controls and protection
- Interconnection requirements/expected performance of storage when charging
- Interconnection studies for “service less than nameplate” interconnections
- BES-connected storage and hybrid resources
- Distribution-connected storage, hybrids, aggregated DERs and load patterns
 - **Ryan Quint**, NERC
 - **Cody Doll**, MISO
 - **Adam Guinn**, Duke

5:00 End of Day 1

DAY 2

8:30 Panel 4 – ISO/RTO market participation of storage and hybrids

- Beyond Order 841 – using storage and considering hybrids in ISO/RTO markets
- Distribution-connected storage, hybrids and aggregated DERs
- Potential role of storage and hybrids in grid services (both BES and DER)
 - **Ric O’Connell**, GridLab
 - **Michael Herbert**, Delorean Power and former FERC 841 tech lead
 - **Kevin Vannoy**, MISO
 - **Kenneth Ragsdale**, ERCOT

10:15 Coffee Break

10:45 Panel 5 – PFR and grid services considerations - conventional and inverter resources

- Impacts of providing PFR and ramping with synchronous machines
- Impacts/implications of providing PFR and ramping with IBRs
- Provision of PFR and contingency services post FERC Order 845
- Implications of “service less than nameplate” provisions of 845
- Discussion of PFR provision in excess of interconnection and line ratings
 - **Tom Pruitt**, Duke (in ATL)
 - **Al Schriver**, NAGF
 - **Julia Matevosjana**, ERCOT
 - **Jason MacDowell**, GE

12:30 Lunch

1:30 Panel 6 – Policymaker viewpoints on grid services and grid transformation

- Local, state and federal considerations
- Regional differences and considerations
- DER/BPS interactions via emerging DER participation concepts
- Electric vehicle charging systems and electrification trends/directions
 - **Jeff Dennis**, Advanced Energy Economy
 - **Jason Burwen**, Energy Storage Association
 - **Schuyler Matteson**, NYSERDA

3:15 Closing Session – Discussion, next steps and actions

4:00 End of Workshop