



Course length: One day

Prerequisites: None

CPE credits: 8

An in-depth study of fast-growing storage technologies and their applications in the electric grid

Electric storage technologies are rapidly advancing, and emerging technologies are being implemented on the transmission and distribution grids. Meanwhile technology companies are pushing customer-side storage and storage coupled with renewable energy while some regulatory bodies have begun to mandate use of storage. Energy Storage: Applications, Technologies, and Economics introduces participants to the various applications that storage can be used for and then explores each storage technology available today with a focus on how the technology works, and its benefits and economics. The seminar also explores the future of storage and how it is changing the design and operation of the electric grid.



WHO WILL BENEFIT FROM THIS SEMINAR?

- Utility and retail marketer procurement professionals and energy buyers for large electric users needing an understanding of how storage impacts procurement
- Utility business employees who need an understanding of how storage changes system operations, customer offerings, and business opportunities
- Employees of ISOs and other system operators needing a vision of the current and future impact of storage
- Professionals in the legal, finance, accounting, PR, and communications fields who are working for an industry participant or providing services to the energy industry
- Technical employees such as engineers and information technology professionals who need a fundamental overview of storage and issues with its integration
- Professionals from the advocacy community who want to learn the business aspects of storage and its relation to clean power

WHAT PARTICIPANTS WILL LEARN

- The various applications for electric storage including renewable integration, ancillary services, transmission services, distribution services, customer uses, and environmental mitigation
- Types of storage technology, how they work, their technical characteristics, and costs
- How to determine the value of storage in a specific application
- How storage is being used today
- The future of storage and how it will impact the electric grid

COURSE AGENDA

Introduction to Electric Storage

- History of electric storage
- Definition of storage
- Current status
- Growth projections and barriers to growth

Storage Applications

- Supply Services
 - Capacity
 - Arbitrage
 - System generation efficiency
 - Renewables integration
- Ancillary Services
 - Spinning and non-spinning reserves
 - Regulation and load following
 - Voltage support
 - Black start
- Transmission Services
 - Upgrade deferral
 - Transmission support (including stabilization)
 - Loss reduction
 - Congestion relief
- Distribution Services
 - Upgrade deferral
 - Stabilization
 - Voltage support
 - Distributed Energy Resources (DER) integration
- Customer Energy Management Services
 - Power reliability
 - Power quality
 - Time-of-use (TOU) rate management
 - Demand charge management
 - DER integration behind the meter (including PV-battery)
- Environmental Benefits
 - Increased renewable capacity factor
 - Reduced greenhouse gasses
 - Clean back-up power

Storage Technologies

- Storage technology characteristics (including technical





capabilities and cost)

- Technologies used for supply/bulk ancillary services
 - Pumped hydro
 - Compressed Air Energy Storage (CAES)
- Technologies used for T&D/distributed ancillary services
 - Flywheel Energy Storage (FES)
 - Sodium sulfur (NaS) batteries
 - Advanced lead acid batteries
 - Flow batteries
 - Nickel-based batteries (NaNiCl₂, NiCd, NiMH)
 - Supercapacitors (ultracapacitors)
 - Superconducting Magnetic Energy Storage (SMES)
- Technologies used for customer energy management services
 - Lead acid batteries
 - Thermal energy storage (TES)
 - Lithium ion (Li-ion) batteries
 - Other advanced batteries

The Future of Storage

- Determining the value of storage
- Examples of some current initiatives
- How storage can be encouraged
- Future technology and cost developments
- Impacts on the electric grid of the future

