

GRIDED

The Center for Grid Engineering Education

Introduction to Energy Storage Short Course Series

Course Description

This course was developed and offered by GridEd to address several evolving forces that will alter the fundamental operating characteristics of the electric grid, transforming it from a one-way central supply structure to one that has bidirectional, flexible power flows resulting from the integration of energy storage systems. The focus is on energy storage technologies and applications. Students will learn about the technical challenges facing the wider use of energy storage and what can be done to address those challenges. Additionally, considerations for energy storage project development and deployment will be discussed. This course is provided in a live-online environment and includes a 6-hour introduction to energy storage followed by three optional 2-hour deep dives on energy storage valuation, battery technology and performance, and safety.

Who Should Attend

The course is intended for anyone interested in the energy storage technology landscape and understanding how energy storage can be used as an asset to maintain or improve grid reliability and operations. Students will include utility engineers and technicians, procurement officers, regulatory compliance staff, legal staff, and possibly regulators. Previous technical training is helpful but not necessary.

Registration Information

Dates and Times:

- [Introduction to Energy Storage \(6 hours\)](#)
May 10, 9:00 AM-12:30 PM PT | May 11, 9:00 AM - 12:30 PM PT
- [Deep Dive 1: Valuation Training \(2 hours\)](#)
May 17, 9:30 AM - 11:45 AM PT
- [Deep Dive 2: Safety \(2 hours\)](#)
May 18, 9:30 AM - 11:45 AM PT
- [Deep Dive 3: Battery Technology and Performance \(2 hours\)](#)
May 19, 9:30 AM - 11:45 AM PT

Course Length: 12 Hours for all four courses

***Courses in this series can be taken combined or separately.**

Participants who attend the full course will receive a Certificate of Attendance with the appropriate number of Professional Development Hours for this course. Participants who attend the full course and pass an optional exam will be provided a Certificate of Completion.

Registration Fee: Introduction course is \$600 and deep dives are \$200 each

- 20% discount for organizations sending three or more staff
- 25% discount for government workers (non-utility)
- 25% discount for college professors*
- 75% discount for graduate students*
- *University ID required
- *Email Amy Feser to inquire on discounts: afeser@epri.com

Location: Live on-line lecture

EPRI Contacts:

EPRI Subject Matter Experts: Erin Minear, Taylor Kelly, Miles Evans, Dirk Long, Lakshmi Srinivasan

Course Coordinator: Amy Feser, afeser@epri.com

Participants will need access to an internet connection from a standard desktop/laptop computer equipped with speakers, microphone and common web browser, i.e. Internet Explorer, FireFox, Google Chrome, etc. Students will join live, synchronous web conference sessions via Webex, with two-way voice capability through a telephone bridge.

Meet the Instructors



Erin Minear is a Sr. Project Manager for the Energy Storage and Distributed Generation Program at the Electric Power Research Institute (EPRI). She manages projects related to the implementation of energy storage assets into the utility grid, including managing the Energy Storage Integration Council (ESIC). Erin has previous experience developing commercial and utility energy storage projects for an engineering, procurement, construction (EPC) firm and implementing microgrids and renewable energy projects. Erin is a registered Professional Engineer in the state of California and has a BS and MS in Electrical Engineering from California Polytechnic State University, San Luis Obispo.



Miles Evans is an Engineer Scientist at the Electric Power Research Institute (EPRI). Miles received his MS in Civil and Environmental Engineering from Stanford in 2017 and a BS in Environmental and Ecological Engineering from Purdue University in 2015. At EPRI, Miles is involved in valuation, data analysis, and modeling efforts in the energy storage and distributed generation program. He works on simulating the operation of, valuing the effects of, and characterizing the real-world performance and reliability of energy storage systems. In addition to research in these areas, Miles is leading new energy storage modeling and valuation tool development, hoping to make state of the art analysis techniques accessible to a broader audience.



Dirk Long is a Senior Technical Leader at the Electric Power Research Institute (EPRI). Dirk is a battery technology expert with experience in stationary, automotive, aerospace, and R&D sectors. His focus is on new technology evaluation and energy storage system design, safety, testing, and validation. At EPRI, he manages projects and guides research related to energy storage safety and emerging technologies and applications. Dirk earned dual BS degrees in Mechanical Engineering and Physics from Miami University in Oxford, OH and his MS degree in Mechanical Engineering from the Colorado School of Mines in Golden, CO.

Course Outline

Introduction to Energy Storage (6 hours)

- I. **Drivers and Big Picture**
- II. **Economics**
 - Cost components and trends
 - Introduction to values and services
 - Bulk storage applications
 - Utility distribution applications
 - Customer-sited applications
 - Hybrid applications
- III. **Technologies**
 - Characteristics of energy storage
 - Overview of technologies
 - Technology readiness and validation
- IV. **Technologies**
- V. **Project life-cycle** (planning, procurement, deployment, operations, and maintenance, decommissioning)
- VI. **Remaining challenges and research agenda**

Energy Storage Deep Dives (2 hours each)

- I. **Deep Dive 1: Valuation Training**
 - Modeling approaches
 - Overview of EPRI's Storage Value Estimation Tool (StorageVET)
 - Example case studies
 - Valuation sensitivity analysis
- II. **Deep Dive 2: Safety**
 - Hazards
 - Codes, standards, and regulations (CSR)
 - Risk analysis and mitigation
- III. **Deep Dive 3: Battery Technology and Performance**
 - Comparison of lithium ion chemistries
 - Emerging battery technologies
 - Integrated battery energy storage systems
 - Testing and evaluation
 - Performance guarantees