Advanced Electrochemical Energy Storage Training Course

Professional Development Training Course Outline

Category	Renewable Energy	**Duration**	10 Days
Base Fee	$3,000 USD	**Delivery Mode**	Online / On-site Hybrid

Course Introduction

Advanced Electrochemical Energy Storage Training Course is designed to provide in-depth knowledge of next-generation energy storage technologies, covering lithium-ion batteries, solid-state batteries, sodium-ion batteries, flow batteries, supercapacitors, battery management systems (BMS), and sustainable energy storage solutions. With the rapid global transition toward renewable energy integration, electric mobility, smart grids, and carbon-neutral technologies, advanced electrochemical storage has become a critical field for researchers, engineers, energy professionals, and technology leaders. This course focuses on battery innovation, energy density optimization, safety enhancement, lifecycle management, advanced materials, and emerging storage architectures shaping the future of the energy ecosystem.

Through a combination of theoretical foundations, practical applications, industrial case studies, simulation approaches, and technology analysis, participants will gain expertise in designing, evaluating, and managing advanced electrochemical energy storage systems. The program explores global trends such as battery recycling, green manufacturing, artificial intelligence-driven battery analytics, fast charging technologies, grid-scale storage, and sustainable energy transition strategies. Participants will develop the skills required to support the future of clean energy, electric vehicles, decentralized power systems, and next-generation battery technologies.

Programme Curriculum

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Course Objectives

1. Understand the fundamentals of advanced electrochemical energy storage technologies and their industrial applications.
2. Explore next-generation battery chemistries including solid-state, lithium-sulfur, sodium-ion, and metal-air batteries.
3. Develop expertise in battery materials engineering, electrode design, electrolytes, and cell optimization.
4. Analyze battery performance metrics including energy density, power density, efficiency, degradation, and reliability.
5. Learn advanced approaches for battery safety management and thermal runaway prevention.
6. Understand Battery Management Systems (BMS), digital monitoring, and intelligent battery diagnostics.
7. Evaluate large-scale energy storage solutions for renewable energy integration and smart grids.
8. Apply machine learning, artificial intelligence, and predictive analytics in battery lifecycle management.
9. Explore sustainable approaches for battery recycling, circular economy, and green manufacturing.
10. Understand advanced testing methods for battery characterization and performance validation.
11. Analyze global developments in electric vehicle battery technology and energy transition markets.
12. Develop skills for designing high-performance and sustainable energy storage systems.
13. Gain industry insights through real-world case studies and emerging technology assessments.

Target Audience

1. Battery engineers and energy storage professionals
2. Electrical and chemical engineers
3. Renewable energy specialists
4. Electric vehicle (EV) technology professionals
5. Researchers and scientists in energy materials
6. University professors and academic professionals
7. Manufacturing and process engineers
8. Energy policy makers and sustainability managers

Course Modules

Module 1: Fundamentals of Electrochemical Energy Storage

- Principles of electrochemical energy conversion and storage
- Battery terminology, components, and architectures
- Energy storage technology landscape and market trends
- Electrochemical reactions and charge-transfer mechanisms
- **Case Study:** Evolution of lithium-ion batteries in consumer electronics and EV markets

Module 2: Advanced Battery Chemistry and Cell Technologies

- Lithium-ion battery chemistry advancements
- Sodium-ion and lithium-sulfur battery technologies
- Solid-state battery innovations
- Metal-air and emerging battery concepts
- **Case Study:** Solid-state battery development programs by automotive manufacturers

Module 3: Battery Materials Engineering

- Cathode materials: NMC, LFP, high-nickel systems
- Anode materials: graphite, silicon, lithium metal
- Electrolyte innovations and additives
- Nanomaterials and advanced coatings
- **Case Study:** Silicon-anode technology for high-energy-density batteries

Module 4: Electrochemical Cell Design and Manufacturing

- Battery cell architecture and design principles
- Manufacturing processes and quality control
- Electrode fabrication technologies
- Cell assembly and formation processes
- **Case Study:** Gigafactory production models for EV batteries

Module 5: Battery Performance Analysis and Optimization

- Energy density and power performance evaluation
- Charging and discharging characteristics
- Efficiency and capacity optimization
- Battery degradation mechanisms
- **Case Study:** Improving battery lifespan through advanced operating strategies

Module 6: Battery Testing and Characterization

- Electrochemical impedance spectroscopy (EIS)
- Cycling and durability testing
- Thermal and mechanical evaluation methods
- Advanced diagnostic techniques
- **Case Study:** Battery validation testing for electric vehicles

Module 7: Battery Management Systems (BMS)

- BMS architecture and functional design
- State of Charge (SOC) estimation
- State of Health (SOH) monitoring
- Intelligent battery control algorithms

- **Case Study:** AI-enabled BMS systems for EV fleets

Module 8: Thermal Management and Battery Safety

- Battery thermal behavior analysis
- Thermal runaway mechanisms
- Cooling and heat management technologies
- Safety standards and compliance
- **Case Study:** Advanced cooling systems used in EV battery packs

Module 9: Artificial Intelligence in Energy Storage

- Machine learning for battery prediction
- Digital twins for battery monitoring
- Data-driven performance optimization
- Predictive maintenance strategies
- **Case Study:** AI-based battery lifetime forecasting platforms

Module 10: Grid-Scale Energy Storage Systems

- Utility-scale battery storage technologies
- Renewable energy integration strategies
- Frequency regulation and grid balancing
- Energy storage economics
- **Case Study:** Large-scale battery farms supporting renewable grids

Module 11: Electric Vehicle Energy Storage Systems

- EV battery pack architecture
- Fast charging technologies
- Battery swapping systems
- Vehicle-to-grid (V2G) technologies
- **Case Study:** Global EV manufacturers implementing advanced battery platforms

Module 12: Sustainable Battery Technologies

- Green battery manufacturing approaches
- Low-carbon energy storage solutions
- Environmental impact assessment
- Sustainable material sourcing
- **Case Study:** Sustainable battery initiatives in Europe and Asia

Module 13: Battery Recycling and Circular Economy

- End-of-life battery management
- Lithium, cobalt, and nickel recovery
- Recycling technologies and processes
- Second-life battery applications
- **Case Study:** Repurposing EV batteries for stationary storage

Module 14: Future Trends in Electrochemical Storage

- Next-generation battery innovations

- Quantum materials and advanced electrodes
- Hybrid energy storage systems
- Emerging global research directions
- **Case Study:** Future solid-state battery commercialization pathways

Module 15: Industry Applications and Strategic Implementation

- Energy storage project development
- Technology selection strategies
- Cost optimization and scalability
- Market trends and investment opportunities
- **Case Study:** Renewable energy storage deployment projects worldwide

Training Methodology

- Interactive lectures and presentations.
- Group discussions and brainstorming sessions.
- Hands-on exercises using real-world datasets.
- Role-playing and scenario-based simulations.
- Analysis of case studies to bridge theory and practice.
- Peer-to-peer learning and networking.
- Expert-led Q&A sessions.
- Continuous feedback and personalized guidance.

Register as a group from 3 participants for a Discount

Send us an email: info@fineskilltrainingcenter.org or call *+254769199797*

Certification

Upon successful completion of this training, participants will be issued with a globally- recognized certificate.

Tailor-Made Course

We also offer tailor-made courses based on your needs.

Key Notes

a. The participant must be conversant with English.

b. Upon completion of training the participant will be issued with an Authorized Training Certificate

c. Course duration is flexible and the contents can be modified to fit any number of days.

d. The course fee includes facilitation training materials, 2 coffee breaks, buffet lunch and A Certificate upon successful completion of Training.

e. One-year post-training support Consultation and Coaching provided after the course.

f. Payment should be done at least a week before commence of the training, to Fineskill Training Center account, as indicated in the invoice so as to enable us prepare better for you.

Upcoming Scheduled Sessions

Start Date	End Date	Location	Price
23 Nov 2026	04 Dec 2026	Online	$2,000
23 Nov 2026	04 Dec 2026	Physical	$3,000
23 Nov 2026	04 Dec 2026	Physical	$6,000
23 Nov 2026	04 Dec 2026	Physical	$6,000
23 Nov 2026	04 Dec 2026	Physical	$12,000
23 Nov 2026	04 Dec 2026	Physical	$9,000
23 Nov 2026	04 Dec 2026	Physical	$12,000
23 Nov 2026	04 Dec 2026	Physical	$12,000

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