Grid-Scale Energy Storage Technologies Training Course

Professional Development Training Course Outline

Category	Renewable Energy	**Duration**	5 Days
Base Fee	$1,500 USD	**Delivery Mode**	Online / On-site Hybrid

Course Introduction

Grid-Scale Energy Storage Technologies Training Course provides a comprehensive, industry-focused understanding of how battery energy storage systems (BESS) and other advanced storage technologies are transforming modern power grids. As renewable-energy penetration accelerates, utilities, independent power producers, grid operators, and energy developers increasingly require long-duration energy storage (LDES), grid flexibility, energy arbitrage, frequency regulation, and renewable-energy integration solutions. The course explores lithium-ion batteries, sodium-ion batteries, flow batteries, thermal energy storage, pumped hydro storage, compressed-air energy storage, hydrogen-based storage, and emerging storage technologies, while examining system architecture, sizing, performance, degradation, safety, economics, and lifecycle management. Participants gain practical insight into BESS design, battery management systems (BMS), energy management systems (EMS), power conversion systems (PCS), grid-forming inverters, smart grids, and digital energy management.

Designed around real-world applications, the training connects technical concepts with project development, techno-economic analysis, grid services, market participation, risk management, cybersecurity, sustainability, and regulatory considerations. Participants examine case studies covering renewable-plus-storage projects, utility-scale battery deployments, microgrids, peak shaving, capacity firming, ancillary services, and long-duration storage, enabling them to evaluate technology choices and deployment strategies. By the end of the course, learners will be better equipped to support bankable energy-storage projects, resilient power systems, decarbonization strategies, energy transition initiatives, and net-zero targets, while making informed decisions about technology selection, operational optimization, safety, and total cost of ownership.

Programme Curriculum

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Course Duration

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Course Objectives

By the end of the training, participants will be able to:

1. Understand the fundamentals and evolving landscape of grid-scale energy storage and its role in the energy transition.
2. Compare lithium-ion, sodium-ion, flow battery, thermal, pumped hydro, compressed-air, and hydrogen storage technologies.
3. Evaluate BESS architecture, including battery racks, BMS, PCS, EMS, transformers, and grid interconnection systems.
4. Apply principles of energy-storage sizing, capacity planning, duration selection, and performance optimization.
5. Analyze battery degradation, state of charge (SOC), state of health (SOH), efficiency, and lifecycle performance.
6. Evaluate long-duration energy storage (LDES) solutions for renewable integration and grid resilience.
7. Understand grid-forming and grid-following inverter technologies and their role in grid stability.
8. Assess storage applications including frequency regulation, voltage support, peak shaving, energy arbitrage, and capacity services.
9. Conduct introductory techno-economic analysis (TEA) and assess LCOS, CAPEX, OPEX, ROI, and total cost of ownership.
10. Identify best practices for BESS safety, thermal runaway prevention, fire protection, emergency response, and risk management.
11. Explore digitalization, AI-driven energy management, predictive analytics, and smart-grid optimization.

12. Examine recycling, battery second-life applications, circular economy principles, and ESG considerations.
13. Develop practical strategies for deploying bankable, resilient, scalable, and sustainable energy-storage projects.

Target Audience

1. Utility and grid operators.
2. Renewable-energy developers.
3. Energy-storage project developers and investors.
4. Electrical, power, and energy engineers.
5. Energy consultants and analysts.
6. Operations and maintenance professionals.
7. Government, regulators, and policymakers
8. Corporate energy managers and sustainability professionals

Course Modules

Module 1: Grid-Scale Energy Storage Fundamentals

- Energy-storage principles, applications, terminology, and technology landscape.
- Role of storage in renewable integration, grid flexibility, and decarbonization.
- Centralized versus distributed storage architectures.
- frequency response, voltage support, capacity, arbitrage, and peak shaving.
- Case Study: Utility-scale solar-plus-storage project providing evening peak capacity.

Module 2: Battery Energy Storage Systems (BESS)

- Lithium-ion, LFP, NMC, sodium-ion, and advanced battery technologies.
- Battery cells, modules, racks, containers, and system-level architecture.
- BMS, PCS, EMS, transformers, HVAC, and auxiliary systems.
- SOC, SOH, C-rate, round-trip efficiency, and degradation mechanisms.
- Case Study: LFP BESS deployment for renewable-energy firming and grid services.

Module 3: Long-Duration & Alternative Storage Technologies

- Flow batteries for long-duration and high-cycle applications.
- Pumped hydro, compressed-air energy storage, thermal storage, and hydrogen.
- Technology selection based on duration, geography, scalability, and lifecycle.
- Emerging LDES technologies and their role in high-renewable grids.
- Case Study: Long-duration storage supporting a high-renewables electricity system.

Module 4: BESS Design, Sizing & Grid Integration

- Energy and power requirements for utility-scale BESS sizing.
- Grid interconnection, transformers, switchgear, and protection systems.
- Grid-forming inverters and advanced power-electronics controls.
- EMS optimization, dispatch strategies, and operational constraints.
- Case Study: Sizing a solar-plus-BESS project for peak-demand reduction.

Module 5: Energy Storage Economics & Project Development

- CAPEX, OPEX, LCOS, ROI, NPV, IRR, and total cost of ownership.
- Revenue stacking and energy arbitrage business models.
- Capacity markets, ancillary services, and storage market participation.
- Project bankability, procurement, warranties, and performance guarantees.
- Case Study: Techno-economic comparison of short- versus long-duration storage.

Module 6: BESS Safety, Reliability & Lifecycle Management

- Thermal runaway, battery fire prevention, detection, and mitigation.
- Safety-by-design, emergency response, ventilation, and fire suppression.
- Reliability engineering, predictive maintenance, and condition monitoring.
- Battery degradation, augmentation, repowering, and lifecycle planning.
- Case Study: Lessons learned from a utility-scale BESS safety incident.

Module 7: Digital Energy Storage, AI & Smart Grids

- AI-driven energy management and predictive analytics.
- Machine learning for battery health, degradation, and fault prediction.
- Digital twins, remote monitoring, automation, and IoT-enabled BESS.
- Cybersecurity considerations for connected energy-storage infrastructure.
- Case Study: AI-assisted BESS dispatch optimization for renewable-energy integration.

Module 8: Sustainability, Recycling & Future Storage

- Battery recycling, second-life batteries, circular economy, and ESG.
- Critical minerals, supply-chain resilience, and sustainable procurement.
- Environmental impact assessment and end-of-life management.
- Future technologies including solid-state, sodium-ion, hydrogen, and advanced LDES.
- Case Study: Second-life EV batteries repurposed for stationary grid storage.

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	27 Nov 2026	Online	$1,000
23 Nov 2026	27 Nov 2026	Physical	$1,500
23 Nov 2026	27 Nov 2026	Physical	$3,000
23 Nov 2026	27 Nov 2026	Physical	$3,000
23 Nov 2026	27 Nov 2026	Physical	$6,000
23 Nov 2026	27 Nov 2026	Physical	$4,500
23 Nov 2026	27 Nov 2026	Physical	$6,000
23 Nov 2026	27 Nov 2026	Physical	$6,000

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