Solar Energy Storage Integration 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

Solar Energy Storage Integration Training Course provides a practical, industry-focused foundation for professionals seeking to understand the rapidly evolving intersection of solar PV, battery energy storage systems (BESS), smart grids, energy management, and renewable-energy flexibility. As solar penetration increases, storage is becoming a core element of power-system design rather than a simple add-on. Current industry developments emphasize solar-plus-storage, grid-forming energy storage, AI-enabled energy management, digital controls, long-duration storage, system-level integration, and grid flexibility. The course therefore connects photovoltaic generation with battery technologies, power conversion systems, battery management systems (BMS), energy management systems (EMS), microgrids, grid services, demand-side flexibility, and techno-economic optimization. Recent research also highlights MPPT, DC-DC converter topologies, optimization, and EMS strategies as important areas in PV-integrated BESS design.

Participants will develop the knowledge required to evaluate, design, integrate, operate, and optimize PV + BESS projects across residential, commercial, industrial, microgrid, EV-charging, and utility-scale applications. The program places particular emphasis on energy shifting, peak shaving, self-consumption, backup power, renewable-energy curtailment reduction, capacity optimization, ancillary services, grid stability, lifecycle performance, safety, and digital monitoring. Storage is increasingly valued for its ability to shift renewable generation into higher-value periods and provide flexibility to electricity systems. Through technical exercises and case studies, learners explore how integrated solar-storage systems can improve energy resilience, dispatchability, grid integration, and project economics while addressing real-world design and operational challenges.

Programme Curriculum

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Course Duration

5 days

Course Objectives

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

1. Understand solar PV and BESS integration architectures for modern renewable-energy systems.
2. Evaluate battery chemistries, energy density, power capacity, duration, degradation, and lifecycle performance.
3. Design appropriate PV + BESS system configurations for residential, C&I, microgrid, and utility-scale applications.
4. Apply MPPT, power electronics, DC-DC conversion, and inverter technologies to integrated systems.
5. Develop effective Energy Management System (EMS) strategies for charging, dispatch, and renewable-energy optimization.
6. Understand Battery Management Systems (BMS), state-of-charge, state-of-health, balancing, and monitoring.
7. Analyze grid-forming and grid-following inverter applications for renewable integration.
8. Optimize systems for peak shaving, load shifting, self-consumption, backup power, and demand management.
9. Assess battery degradation, thermal management, operational efficiency, and lifecycle considerations.
10. Conduct techno-economic analysis, sizing, energy-yield assessment, and storage business-case evaluation.
11. Explore AI-enabled energy management, digital twins, predictive analytics, and smart O&M.
12. Evaluate microgrids, EV charging, data-center energy systems, and other emerging solar-storage applications.
13. Apply integrated knowledge to develop bankable, resilient, scalable, and grid-compatible solar-plus-storage solutions.

Target Audience

1. Solar PV Engineers and Renewable Energy Engineers
2. Energy Storage and BESS Professionals
3. Electrical Engineers and Power Systems Engineers
4. Project Developers and EPC Professionals
5. Energy Managers and Facility Managers
6. Utility, Grid Planning, and Microgrid Professionals
7. Sustainability, Clean Energy, and Energy-Transition Managers
8. Consultants, Researchers, Entrepreneurs, and Technical Decision-Makers

Course Modules

Module 1: Solar PV and Energy Storage Fundamentals

- Solar PV generation principles and system architectures
- Energy storage fundamentals
- Solar intermittency, curtailment, and renewable-energy flexibility
- AC-coupled vs. DC-coupled solar-storage architectures
- **Case Study:** Designing a solar-plus-storage solution for a commercial facility with daytime solar surplus and evening demand

Module 2: Battery Energy Storage Technologies

- Lithium-ion, **LFP**, sodium-ion, flow batteries, and emerging storage technologies
- Battery cells, modules, racks, containers, and system-level architecture
- **State of Charge (SoC), State of Health (SoH), C-rate, cycle life, and degradation**
- Thermal management and battery performance considerations
- **Case Study:** Selecting an appropriate battery technology for a utility-scale solar-storage project

Module 3: Power Electronics and System Integration

- PV inverters, bidirectional converters, PCS, and DC-DC converters
- MPPT and PV operating-point optimization
- AC-coupled and DC-coupled integration design
- Grid-following and **grid-forming inverter** concepts
- **Case Study:** Comparing AC-coupled and DC-coupled architectures for a 100 MW-class renewable project

Module 4: Battery Management and Energy Management Systems

- **BMS architecture**, cell monitoring, balancing, and protection
- EMS functions and intelligent charge/discharge scheduling
- Forecasting solar generation, load demand, and battery availability
- AI-enabled optimization and predictive energy management
- **Case Study:** Developing an EMS strategy to maximize solar self-consumption while maintaining battery reserve capacity

Module 5: Solar + Storage Applications and Microgrids

- Residential, commercial, industrial, and utility-scale applications
- Solar-storage microgrids and resilient power systems

- **EV charging + solar + BESS** integration
- Backup power, islanding, load management, and energy resilience
- **Case Study:** Solar-plus-storage microgrid planning for a facility requiring resilient power during grid interruptions

Module 6: Grid Integration and Advanced Grid Services

- Renewable-energy integration and grid flexibility
- Frequency regulation, voltage support, and peak-demand management
- Energy shifting, capacity support, and congestion management
- Grid-forming BESS and renewable-dominated power systems
- **Case Study:** Using BESS to shift excess midday solar generation into evening peak-demand periods

Module 7: System Sizing, Economics, Safety, and Lifecycle Optimization

- PV and battery sizing methodologies
- **Techno-economic analysis, LCOE, LCOS, ROI, and project economics**
- Battery degradation, replacement planning, and lifecycle optimization
- Thermal management, protection, monitoring, and operational safety
- **Case Study:** Evaluating the economic trade-offs between a larger PV array and a longer-duration BESS

Module 8: Digitalization, AI, Future Trends, and Capstone Integration

- **AI-powered forecasting, predictive maintenance, and digital energy management**
- Digital twins, cloud monitoring, data analytics, and smart O&M
- Long-duration energy storage and emerging battery technologies
- Integrated PV + BESS optimization for grids, data centers, and energy-intensive loads
- **Case Study:** Developing an end-to-end solar + BESS concept covering sizing, architecture, EMS, economics, grid integration, and lifecycle strategy

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
21 Sep 2026	25 Sep 2026	Online	$1,000
21 Sep 2026	25 Sep 2026	Physical	$1,500
21 Sep 2026	25 Sep 2026	Physical	$0
21 Sep 2026	25 Sep 2026	Physical	$0
21 Sep 2026	25 Sep 2026	Physical	$0
21 Sep 2026	25 Sep 2026	Physical	$0
21 Sep 2026	25 Sep 2026	Physical	$0
21 Sep 2026	25 Sep 2026	Physical	$0

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