Hybrid Renewable Energy and Storage Systems 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

Hybrid Renewable Energy and Storage Systems Training Course provides a practical, industry-focused foundation for designing, integrating, operating, and optimizing modern hybrid renewable energy systems that combine solar PV, wind power, battery energy storage systems (BESS), diesel/gas backup generation, smart inverters, microgrids, and advanced energy management systems (EMS). As organizations accelerate energy transition, decarbonization, electrification, grid modernization, and renewable-energy deployment, professionals need the ability to develop resilient systems that maximize renewable penetration while maintaining reliability, power quality, energy security, and cost efficiency. The course explores the complete project lifecycle from resource assessment and system sizing to battery technologies, hybrid system architecture, controls, protection, monitoring, commissioning, and lifecycle optimization.

Participants will develop practical capabilities relevant to distributed energy resources (DERs), grid-connected and off-grid applications, renewable microgrids, energy storage integration, peak shaving, load shifting, demand response, backup power, and energy arbitrage. Through technical exercises and real-world case studies, learners examine how hybrid systems can reduce fuel consumption, stabilize renewable generation, improve resilience, and support net-zero and low-carbon energy strategies. The program is suitable for professionals seeking advanced knowledge in renewable power systems, battery energy storage, smart grids, microgrids, energy management, and clean-energy project development.

Programme Curriculum

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Course Duration

5 days

Course Objectives

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

1. Explain the principles and architecture of hybrid renewable energy systems and their role in the global energy transition.
2. Evaluate solar PV, wind, battery storage, and conventional generation resources for hybrid-system applications.
3. Design appropriate hybrid system configurations for grid-connected, off-grid, and microgrid environments.
4. Apply BESS sizing, battery selection, state-of-charge (SOC), state-of-health (SOH), and degradation concepts.
5. Develop effective energy management strategies (EMS) for renewable generation and storage assets.
6. Analyze load profiles, renewable variability, peak demand, energy arbitrage, and demand-response opportunities.
7. Understand smart inverter, power-conversion, grid-forming, and grid-following technologies.
8. Apply principles of microgrid control, synchronization, protection, islanding, and grid integration.
9. Evaluate system performance using energy yield, renewable penetration, round-trip efficiency, reliability, and availability metrics.
10. Assess CAPEX, OPEX, lifecycle cost, LCOE, LCOS, ROI, and techno-economic feasibility.
11. Identify key battery safety, thermal management, fire protection, cybersecurity, and operational risks.
12. Develop strategies for predictive maintenance, condition monitoring, digital energy management, and asset optimization.
13. Recommend technically and economically viable solutions supporting decarbonization, energy resilience, net-zero targets, and sustainable power systems.

Target Audience

1. Renewable Energy Engineers and electrical engineers.

2. Energy Managers and sustainability professionals.
3. Solar PV and Wind Energy Project Developers.
4. Battery Energy Storage and BESS Professionals.
5. Microgrid, Smart Grid, and Power Systems Engineers.
6. Facility, Utility, and Industrial Energy Managers.
7. Project Managers, Consultants, and Energy Auditors.
8. Government, Utility, EPC, Research, and Clean-Tech Professionals seeking advanced hybrid-energy expertise.

Course Modules

Module 1: Hybrid Renewable Energy Systems Fundamentals

- Hybrid energy architecture.
- Renewable-energy intermittency, variability, reliability, resilience, and renewable penetration.
- Grid-connected, off-grid, islanded, and microgrid configurations.
- Distributed Energy Resources (DERs) and their role in modern power systems.
- Case Study: Designing a renewable hybrid system for a remote community requiring reliable 24/7 electricity.

Module 2: Solar PV, Wind and Renewable Resource Integration

- Solar irradiation, PV technologies, performance ratios, and energy-yield assessment.
- Wind-resource assessment, turbine characteristics, capacity factor, and generation forecasting.
- Renewable-generation forecasting and management of intermittency.
- Resource complementarity and hybridization strategies between solar and wind.
- Case Study: Optimizing a solar-wind portfolio to reduce renewable curtailment and improve annual energy production.

Module 3: Battery Energy Storage Systems BESS

- Lithium-ion, LFP, sodium-ion, flow batteries, and emerging storage technologies.
- Battery sizing using energy capacity, power rating, SOC, SOH, C-rate, depth of discharge, and degradation.
- Battery management systems (BMS) and thermal management.
- Round-trip efficiency, cycle life, degradation modeling, and lifecycle performance.
- Case Study: Selecting and sizing a BESS for peak shaving, backup power, and renewable-energy time shifting at an industrial facility.

Module 4: Hybrid System Design, Sizing and Optimization

- Load-profile analysis and demand forecasting.
- Optimal sizing of PV, wind, BESS, backup generation, and grid connection.
- Techno-economic optimization using CAPEX, OPEX, LCOE, LCOS, ROI, and payback.
- Renewable penetration, reliability targets, loss-of-load probability, and system resilience.
- Case Study: Developing a cost-optimized hybrid solar-plus-storage system for a commercial facility with high peak demand.

Module 5: Energy Management Systems and Advanced Controls

- Energy Management Systems (EMS) and supervisory control architectures.
- Dispatch strategies-load following, peak shaving, energy arbitrage, backup, and renewable priority.

- Smart inverters, grid-forming, grid-following, and virtual power plant (VPP) concepts.
- Forecast-based control, AI-enabled energy optimization, and digital monitoring.
- Case Study: Implementing an EMS that coordinates solar PV, BESS, grid imports, and backup generation to minimize operating costs.

Module 6: Microgrids, Grid Integration and Power Quality

- AC, DC, and hybrid microgrid architectures.
- Grid synchronization, islanding, reconnection, and black-start capabilities.
- Voltage, frequency, harmonics, power factor, and power-quality management.
- Protection coordination and integration of distributed energy resources.
- Case Study: Designing a resilient renewable microgrid for a critical facility requiring uninterrupted power during grid outages.

Module 7: Safety, Operations, Maintenance and Digitalization

- BESS safety, thermal runaway prevention, fire detection, suppression, and emergency response.
- Electrical safety, isolation, grounding, protection, and operational procedures.
- Condition monitoring, predictive maintenance, remote diagnostics, and asset-health management.
- Digital twins, IoT sensors, cloud monitoring, data analytics, and AI-driven predictive insights.
- Case Study: Developing an operational-risk and predictive-maintenance program for a utility-scale battery storage project.

Module 8: Project Development, Economics and Future Energy Trends

- Hybrid renewable project feasibility, site assessment, bankability, procurement, and EPC considerations.
- Financial modelling-CAPEX, OPEX, LCOE, LCOS, NPV, IRR, ROI, and sensitivity analysis.
- Carbon reduction, renewable-energy certificates, decarbonization, and net-zero strategies.
- Emerging technologies: long-duration energy storage, green hydrogen, V2G, VPPs, AI, and digital energy platforms.
- Case Study: Evaluating a utility-scale solar-plus-BESS project designed to provide renewable energy, grid flexibility, and long-duration resilience.

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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