Integrated Renewable Energy Systems Engineering 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

Integrated Renewable Energy Systems Engineering Training Course is designed to develop practical and strategic competence in the planning, design, integration, operation, optimization, and management of modern renewable-energy systems. As power systems move toward decarbonization, electrification, distributed energy resources (DERs), smart grids, microgrids, energy storage, digitalization, and AI-enabled energy management, engineers and technical professionals increasingly need an integrated understanding of how solar PV, wind, battery energy storage, power electronics, intelligent controls, and conventional grid infrastructure operate as one coordinated system. Current industry and research directions emphasize grid flexibility, advanced storage, renewable integration, digital twins, data-driven energy management, resilience, and grid modernization.

The course combines engineering theory, system modeling, design practice, techno-economic analysis, energy forecasting, control strategies, and real-world case studies to help participants address complex energy-transition challenges. Particular attention is given to hybrid renewable energy systems, battery and hybrid energy storage, grid-forming inverters, microgrid operation, demand response, energy management systems, AI/ML forecasting, digital twins, cybersecurity, resilience, and multi-energy integration. These areas reflect current developments in renewable-dominated power systems, where advanced storage, intelligent control, distributed generation, and resilient smart-grid architectures are becoming increasingly important.

Programme Curriculum

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Course Duration

5 days

Course Objectives

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

1. Analyze renewable energy integration challenges across modern electrical power systems.
2. Design solar PV, wind, hybrid, and distributed energy resource (DER) configurations.
3. Evaluate battery energy storage systems (BESS) and hybrid energy-storage architectures.
4. Develop microgrid architectures for grid-connected and islanded operation.
5. Apply smart-grid technologies for monitoring, automation, flexibility, and reliability.
6. Design energy management systems (EMS) for optimized renewable-energy dispatch.
7. Apply power electronics and advanced inverter control, including grid-forming concepts.
8. Use AI, machine learning, and data analytics for renewable forecasting and optimization.
9. Apply digital-twin concepts to renewable and microgrid monitoring, simulation, and control.
10. Conduct techno-economic, lifecycle, and carbon-impact assessments of integrated energy systems.
11. Develop strategies for demand response, load management, and energy efficiency.
12. Evaluate resilience, cybersecurity, power quality, and reliability in intelligent energy systems.
13. Develop integrated solutions supporting net-zero, energy transition, electrification, and sustainable infrastructure.

Target Audience

1. Renewable Energy Engineers and Electrical Engineers
2. Power Systems and Grid Engineers
3. Energy Managers and Sustainability Professionals
4. Solar PV, Wind, and BESS Project Developers
5. Microgrid and Smart-Grid Professionals
6. Utility, Transmission, and Distribution Personnel
7. Engineering Consultants and Project Managers
8. Researchers, Lecturers, Technicians, and Advanced Engineering Students

Course Modules

Module 1: Renewable Energy Systems & Energy Transition

- Solar PV, wind, hydro, geothermal, and emerging renewable technologies.
- Renewable-resource assessment, intermittency, variability, and forecasting.
- Distributed generation and **DER integration** principles.
- Grid-integration challenges, flexibility, curtailment, and congestion.
- **Case Study:** Renewable portfolio integration for a rapidly electrifying regional power system.

Module 2: Integrated Renewable Energy System Design

- System architecture for **hybrid renewable energy systems (HRES)**.
- PV–wind–battery and multi-source system configuration.
- Electrical sizing, energy yield, load profiling, and resource matching.
- Reliability, redundancy, availability, and system-performance optimization.
- **Case Study:** Design of a solar–wind–battery hybrid system for a remote community.

Module 3: Energy Storage & Advanced Battery Systems

- Lithium-ion BESS fundamentals, performance, degradation, and safety considerations.
- Hybrid energy-storage systems combining complementary storage technologies.
- State-of-charge, power-rating, energy capacity, and lifecycle considerations.
- Energy arbitrage, peak shaving, frequency support, and renewable smoothing.
- **Case Study:** Hybrid storage deployment for improving microgrid stability and renewable utilization.

Module 4: Smart Grids, Microgrids & Power Electronics

- Smart-grid architecture, distributed control, automation, and communication.
- AC, DC, and hybrid **microgrid** configurations.
- Grid-connected, islanded, and transition operating modes.
- Inverters, converters, power quality, and **grid-forming/grid-following** technologies.
- **Case Study:** PV–BESS microgrid with intelligent control and islanding capability.

Module 5: Energy Management, Optimization & Intelligent Control

- Energy Management Systems (**EMS**) and optimal renewable dispatch.
- Load forecasting, renewable forecasting, and uncertainty management.
- Demand response, load shifting, peak management, and flexibility.
- AI/ML, reinforcement learning, and data-driven optimization.
- **Case Study:** AI-assisted microgrid scheduling for minimizing operating costs while maximizing renewable utilization.

Module 6: Digital Twins, IoT & Data-Driven Energy Systems

- Digital-twin architecture for renewable plants and microgrids.
- IoT sensors, smart meters, SCADA, real-time monitoring, and data acquisition.
- Predictive maintenance and condition-based asset management.
- Digital simulation, scenario analysis, and real-time decision support.
- **Case Study:** MATLAB/Simulink-style digital-twin modeling of a PV–BESS–EV microgrid.

Module 7: Grid Resilience, Cybersecurity & Sustainable Infrastructure

- Power-system resilience against disturbances and extreme events.
- Cyber-physical security for smart grids and connected DERs.
- Power quality, voltage regulation, frequency stability, and system reliability.
- Resilient control, islanding strategies, backup supply, and restoration.
- **Case Study:** Resilient microgrid architecture for critical infrastructure during grid disruption.

Module 8: Techno-Economic Analysis, Net-Zero & Integrated Energy Systems

- Project economics, CAPEX/OPEX, LCOE, lifecycle costing, and financial assessment.
- Carbon accounting, emissions reduction, and **net-zero** pathways.
- Integration of electricity, heating, cooling, hydrogen, and other energy vectors.
- Regulatory, policy, market, ESG, and sustainability considerations.
- **Case Study:** Multi-energy system integrating renewable electricity, storage, flexible loads, and low-carbon energy technologies.

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

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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