Hybrid Solar-Diesel Power 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 Solar-Diesel Power Systems Training Course provides practical, industry-focused knowledge for professionals involved in the design, installation, operation, maintenance, and optimization of hybrid renewable energy systems. As organizations increasingly seek energy resilience, fuel-cost reduction, decarbonization, energy efficiency, and reliable power, hybrid systems combining solar PV, diesel generators, battery energy storage, smart controllers, and advanced power management are becoming an important solution for commercial, industrial, institutional, telecom, agricultural, and remote power applications. The course develops practical competence in solar-diesel hybrid system architecture, photovoltaic generation, generator integration, battery storage, load management, power quality, energy monitoring, and intelligent control systems.

Participants will learn how to evaluate energy demand, size system components, develop hybrid power system designs, coordinate solar generation with diesel generation and energy storage, and implement effective operation and maintenance strategies. Through practical exercises and real-world case studies, learners explore applications such as remote mini-grids, telecom towers, commercial facilities, healthcare centers, construction sites, and off-grid communities. The program emphasizes fuel savings, renewable-energy integration, lifecycle cost optimization, system reliability, predictive maintenance, emissions reduction, digital energy management, and resilient power infrastructure, enabling participants to make technically sound and economically viable decisions when deploying modern hybrid power solutions.

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 the principles and architecture of solar-diesel hybrid power systems and their role in energy transition.
2. Assess electrical loads and develop accurate energy-demand profiles for hybrid system design.
3. Perform preliminary solar PV system sizing using irradiation, load, and performance data.
4. Select and integrate diesel generators, PV arrays, batteries, inverters, and hybrid controllers.
5. Apply battery energy storage system (BESS) principles for improved reliability and fuel reduction.
6. Develop effective energy management strategies for solar, diesel, battery, and grid interactions.
7. Optimize generator operation through fuel-efficiency, load-sharing, and dispatch strategies.
8. Analyze power quality, voltage, frequency, harmonics, and system stability in hybrid installations.
9. Apply preventive and predictive maintenance techniques to improve equipment availability.
10. Evaluate CAPEX, OPEX, lifecycle cost, fuel savings, ROI, and total cost of ownership (TCO).
11. Identify opportunities for decarbonization, emissions reduction, renewable integration, and energy efficiency.
12. Apply remote monitoring, IoT, SCADA, smart controls, and digital energy-management technologies.
13. Develop practical solutions for resilient, scalable, reliable, and economically optimized hybrid power infrastructure.

Target Audience

1. Electrical engineers and power-system professionals
2. Renewable-energy and solar PV engineers
3. Operations and maintenance technicians
4. Diesel generator and power-plant personnel
5. Energy managers and facility managers
6. Project managers and EPC professionals

7. Utilities, mini-grid, telecom, and off-grid energy professionals
8. Consultants, contractors, entrepreneurs, and technical decision-makers

Course Modules

Module 1: Fundamentals of Hybrid Solar-Diesel Power Systems

- Hybrid energy architecture
- Operating principles
- System configurations
- Key performance indicators
- Case Study: Analysis of a remote facility transitioning from diesel-only generation to a solar-diesel hybrid microgrid.

Module 2: Solar PV Resource Assessment and System Design

- Solar irradiation, weather data, PV performance ratios, shading, and site assessment.
- PV module technologies, array configuration, mounting systems, and DC protection.
- PV capacity sizing based on load demand and renewable-energy targets.
- Inverter selection, DC/AC ratio, system losses, and expected energy yield.
- Case Study: Designing a PV subsystem to reduce daytime diesel-generator operation at a commercial facility.

Module 3: Diesel Generator Integration and Optimization

- Diesel-generator fundamentals, sizing, efficiency curves, and operating characteristics.
- Generator loading, minimum-load considerations, synchronization, and load sharing.
- Fuel consumption optimization through intelligent generator dispatch.
- Generator start/stop logic and coordination with solar PV and battery storage.
- Case Study: Reducing annual diesel consumption through optimized hybrid dispatch at a remote industrial site.

Module 4: Battery Energy Storage and Power Electronics

- Battery Energy Storage Systems (BESS)
- State of charge, depth of discharge, battery degradation, thermal management, and lifecycle considerations.
- Inverter/charger technologies and bidirectional power conversion.
- Battery safety, protection, monitoring, and energy storage management systems (EMS).
- Case Study: Using battery storage to absorb excess solar energy and minimize evening diesel-generator runtime.

Module 5: Hybrid System Control, Energy Management and Microgrids

- Energy Management Systems (EMS) and intelligent power dispatch.
- Priority-based control of solar, battery, diesel, and grid sources.
- Load management, demand response, peak shaving, and renewable-energy curtailment.
- Microgrid control, synchronization, automatic transfer, and system resilience.
- Case Study: Developing a control strategy for a critical facility requiring 24/7 resilient power.

Module 6: System Installation, Commissioning and Safety

- Electrical installation practices, cabling, earthing, protection, and equipment interfaces.
- Commissioning procedures for PV arrays, generators, batteries, inverters, and controllers.
- Electrical safety, battery safety, arc-flash awareness, isolation, and lockout/tagout principles.
- Testing, verification, documentation, and commissioning checklists.
- Case Study: Commissioning a hybrid system while maintaining uninterrupted power to a critical load.

Module 7: Operations, Maintenance and Digital Monitoring

- Preventive, corrective, and predictive maintenance for hybrid power assets.
- Diesel-generator maintenance, PV inspection, battery health assessment, and inverter diagnostics.
- Remote monitoring using IoT, SCADA, cloud platforms, sensors, and digital dashboards.
- Fault detection, alarms, performance benchmarking, and troubleshooting.
- Case Study: Applying remote monitoring and predictive maintenance to reduce downtime at geographically dispersed power sites.

Module 8: Financial Optimization, Sustainability and Project Implementation

- CAPEX, OPEX, ROI, payback period, LCOE, TCO, and lifecycle financial analysis.
- Fuel-saving calculations and economic comparison of diesel-only versus hybrid operation.
- Carbon-emission reduction, renewable penetration, and decarbonization strategies.
- Project planning, procurement, EPC coordination, risk management, and scalability.
- Case Study: Business-case development for a solar-diesel-battery system targeting major fuel and emissions reductions.

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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