Training Course on Microgrid Design, Development, and Operation

Professional Development Training Course Outline

Category	Engineering	**Duration**	10 Days
Base Fee	$3,000 USD	**Delivery Mode**	Online / On-site Hybrid

Course Introduction

Introduction

As the world accelerates toward decentralized and resilient energy systems, microgrids have emerged as a transformative solution for ensuring energy access, grid independence, and sustainable development. Training Course on Microgrid Design, Development, and Operation equips participants with the technical expertise and strategic insight to plan, implement, and manage advanced microgrids. Key focus areas include renewable energy integration, energy storage systems, smart control systems, and load management tailored for diverse applications including rural electrification, campus grids, industrial parks, and urban resiliency hubs.

Participants will explore real-time simulations and hands-on case studies, learning how to model microgrids using tools like HOMER Pro, MATLAB/Simulink, PSCAD, and OpenDSS. The course delves into the latest trends in hybrid systems, peer-to-peer energy trading, energy management systems (EMS), and islanding strategies. Whether grid-connected or stand-alone, microgrids are the backbone of energy reliability and climate resilience, and this course empowers professionals to lead the transition toward smart, secure, and clean energy futures.

Programme Curriculum

Training Course on Microgrid Design, Development, and Operation

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Course duration

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Course Objectives

- Understand microgrid architectures and operational modes
- Design grid-tied and off-grid microgrid systems
- Integrate solar PV, wind, biomass, and diesel generators
- Size and simulate energy storage systems (ESS)
- Implement smart inverters and power electronics
- Develop control and energy management systems (EMS)
- Assess load profiles and demand-side management
- Ensure seamless islanding and grid synchronization
- Apply microgrid protection and fault detection systems
- Analyze financial feasibility and ROI of microgrids
- Apply standards (IEEE 2030.7, 1547) in design and compliance
- Optimize microgrids using AI and predictive analytics
- Monitor performance using IoT and SCADA systems

Organizational Benefits

- Gain expertise in decentralized energy planning
- Reduce operational costs through optimized energy use
- Enhance energy security and resilience against outages
- Empower teams with smart grid and microgrid knowledge
- Achieve sustainability and carbon-neutral goals
- Drive innovation in distributed generation systems
- Attract investment through proven technical capability
- Meet regulatory and compliance requirements
- Improve operational efficiency via real-time monitoring
- Support community development and rural electrification.

Target Participants

- Electrical and energy engineers

Utility planners and microgrid developers

Renewable energy consultants

Power systems analysts and data modelers

Government energy officers and policymakers

Academic and research institutions

Off-grid project developers and NGOs

Industrial facility managers and campus operators

Course Outline

Module 1: Introduction to Microgrids

1. Definition and classification
2. Microgrids vs traditional grids
3. Components of a microgrid system
4. Key use cases (urban, rural, commercial)
5. Case Study: Remote Island Electrification

Module 2: Microgrid Architecture and Topology

1. AC, DC, and hybrid configurations
2. Single vs multi-node systems
3. Connection to main grid
4. Load sharing and priority assignment
5. Case Study: University Campus Microgrid

Module 3: Renewable Energy Sources in Microgrids

1. Solar PV system sizing and integration
2. Wind energy applications
3. Biomass and small hydro systems
4. Hybrid system modeling
5. Case Study: Solar-Wind Hybrid in East Africa

Module 4: Energy Storage System (ESS) Design

1. Battery technologies: Li-ion, lead-acid, flow
2. Sizing and selection methods
3. Charge-discharge cycles
4. Integration with PV and DG
5. Case Study: Lithium-ion Battery in Off-grid Village

Module 5: Diesel Generators and Conventional Backup

1. Role in hybrid microgrids
2. Synchronization with renewables
3. Fuel optimization
4. Genset control logic
5. Case Study: DG + PV in Industrial Park

Module 6: Power Electronics and Smart Inverters

1. Role of inverters in power quality
2. MPPT and voltage regulation
3. Bidirectional inverters and control
4. Interconnection with the grid
5. Case Study: Inverter Malfunction Diagnosis

Module 7: Load Profiling and Demand Forecasting

1. Load categories and peak demand
2. Time-of-use energy consumption
3. Demand-side management techniques
4. Forecasting using historical data
5. Case Study: Demand Prediction for Campus Grid

Module 8: Energy Management Systems (EMS)

1. Real-time energy dispatch
2. Load prioritization algorithms
3. Cost optimization strategies
4. Forecasting and scheduling
5. Case Study: EMS for a Smart Industrial Zone

Module 9: Microgrid Control Strategies

1. Centralized vs decentralized control
2. Droop control and frequency regulation
3. Autonomous operation
4. Data acquisition and feedback
5. Case Study: Control System for a Rural Microgrid

Module 10: Protection and Safety Systems

1. Fault detection and isolation
2. Overvoltage and short-circuit protection
3. Grounding techniques
4. Relay coordination
5. Case Study: Protection Strategy in Urban Microgrid

Module 11: Islanding and Grid Synchronization

1. Intentional and unintentional islanding
2. Synchronization parameters
3. Reconnection protocols
4. Anti-islanding protection
5. Case Study: Black Start Operation Simulation

Module 12: Economic and Financial Analysis

1. CAPEX and OPEX breakdown
2. LCOE and payback period
3. Sensitivity and scenario analysis
4. Financing models and grants
5. Case Study: ROI Evaluation of a Microgrid

Module 13: Simulation Tools and Software

1. Introduction to HOMER Pro
2. MATLAB/Simulink for control systems
3. OpenDSS for load flow analysis
4. PSCAD for dynamic studies
5. Case Study: Designing a Microgrid Using HOMER

Module 14: Policy, Standards, and Regulations

1. IEEE 1547 and 2030 series
2. National electrification policies
3. Licensing and permitting
4. Environmental and social safeguards
5. Case Study: Regulatory Compliance in Kenya

Module 15: Future Trends and Innovations

1. Blockchain and P2P trading
2. Electric vehicle integration
3. AI-driven energy optimization
4. Digital twins in microgrid design
5. Case Study: Smart Microgrid in a Smart City

Training Methodology

This course employs a participatory and hands-on approach to ensure practical learning, including:

- 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	04 Dec 2026	Online	$2,000
23 Nov 2026	04 Dec 2026	Physical	$3,000
23 Nov 2026	04 Dec 2026	Physical	$6,000
23 Nov 2026	04 Dec 2026	Physical	$6,000
23 Nov 2026	04 Dec 2026	Physical	$12,000
23 Nov 2026	04 Dec 2026	Physical	$9,000
23 Nov 2026	04 Dec 2026	Physical	$12,000
23 Nov 2026	04 Dec 2026	Physical	$12,000

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