Training Course on Smart Grid Technologies and Applications

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 global energy landscape transitions to a cleaner, more intelligent, and consumer-centric model, Smart Grid Technologies are at the heart of this transformation. Training Course on Smart Grid Technologies and Applications offers an in-depth exploration of digitized power systems, emphasizing real-time monitoring, data-driven decision-making, advanced metering infrastructure (AMI), demand response, cybersecurity, and renewable energy integration. Participants will gain hands-on exposure to the evolving architecture of smart grids, from IoT-enabled grid automation to AI-based analytics and predictive maintenance, learning how to design, manage, and optimize digital energy infrastructure.

This highly interactive training blends theory, simulation, and real-world case studies to empower engineers, utility professionals, and energy policymakers with skills to drive the next-generation energy ecosystem. With tools like MATLAB, OpenDSS, GridLAB-D, and Python, learners will solve practical challenges such as peak load management, distributed energy resource (DER) coordination, and power quality monitoring. Whether you're planning smart grid rollouts or optimizing existing networks, this course delivers the technical knowledge, strategic insights, and tools needed to lead in the era of smart and sustainable energy systems.

Programme Curriculum

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Course Objectives

1. Understand the architecture and layers of Smart Grid infrastructure.
2. Implement Advanced Metering Infrastructure (AMI) and IoT systems.
3. Analyze and improve demand response strategies.
4. Utilize real-time data analytics and visualization tools.
5. Integrate renewables and energy storage into the grid.
6. Apply cybersecurity protocols for critical grid infrastructure.
7. Optimize energy flow using AI and machine learning algorithms.
8. Design resilient microgrids and virtual power plants (VPPs).
9. Conduct load forecasting and energy demand prediction.
10. Apply blockchain for peer-to-peer energy trading.
11. Ensure grid stability with smart protection and automation.
12. Leverage cloud-based platforms for grid monitoring and control.
13. Understand global trends and standards in smart grid deployment.

Organizational Benefits

1. Enhancing grid reliability and real-time control.
2. Reducing energy costs through optimized operations.
3. Improving customer engagement and service delivery.
4. Enabling integration of DERs and renewable energy.
5. Strengthening cybersecurity and risk resilience.
6. Reducing technical losses and improving efficiency.
7. Empowering workforce with cutting-edge digital skills.

8. Ensuring compliance with regulatory frameworks.
9. Achieving sustainability and carbon-reduction goals.
10. Positioning as a leader in energy innovation and digitization.

Target Participants

1. Electrical and power system engineers
2. Utility managers and smart grid planners
3. Renewable energy professionals
4. ICT and IoT engineers in the energy sector
5. Government energy departments and regulators
6. Consultants and system integrators
7. Energy data analysts and researchers

Course Outline

Module 1: Smart Grid Fundamentals

1. Evolution from traditional grids to smart grids
2. Architecture and layers of smart grids
3. Benefits and challenges
4. Smart grid policy landscape
5. Case Study: Smart Grid Rollout in India

Module 2: Advanced Metering Infrastructure (AMI)

1. AMI components: Smart meters, data concentrators
2. Two-way communication networks
3. AMI protocols and standards
4. Data collection and consumer profiling
5. Case Study: AMI Deployment in Sub-Saharan Africa

Module 3: IoT and Edge Computing in Smart Grids

1. Role of IoT in power systems
2. Sensors and data acquisition
3. Edge vs cloud processing
4. Real-time fault monitoring
5. Case Study: Smart Substation Automation

Module 4: Demand Response and Load Management

1. Load curve analysis
2. DR mechanisms: price-based and incentive-based
3. Peak shaving and valley filling
4. Consumer behavior modeling
5. Case Study: Demand Response Program in California

Module 5: Renewable Energy Integration

1. Impact of wind and solar on grid stability

2. Inverter-based generation
3. Curtailment and smoothing techniques
4. DER interconnection standards
5. Case Study: Grid-Tied Solar in Nairobi County

Module 6: Smart Grid Communications

1. Communication protocols (DNP3, IEC 61850)
2. Wireless and fiber-optic networks
3. Interoperability challenges
4. Real-time data streaming
5. Case Study: Communication Infrastructure in Europe’s Smart Grids

Module 7: Power Quality and Monitoring

1. Voltage sags, swells, harmonics
2. Power quality indices
3. Monitoring equipment and software
4. Real-time event logging
5. Case Study: Power Quality Audit in Industrial Setup

Module 8: Microgrid Design and Control

1. Microgrid components and architecture
2. Grid-connected vs islanded operation
3. Load forecasting and energy balancing
4. Optimization techniques
5. Case Study: Hybrid Microgrid in Rural Kenya

Module 9: Smart Protection and Automation

1. Digital relays and IEDs
2. Self-healing grid concepts
3. Adaptive protection schemes
4. Substation automation
5. Case Study: Automated Fault Isolation in Urban Grid

Module 10: Cybersecurity in Smart Grids

1. Threat vectors and vulnerabilities
2. Intrusion detection and prevention
3. Cybersecurity standards (NERC CIP, ISO 27001)
4. Security for SCADA and AMI
5. Case Study: Cyber Attack Response in National Grid

Module 11: Big Data and AI Applications

1. Smart grid data sources
2. AI for load forecasting

3. Predictive maintenance algorithms
4. Data cleaning and preprocessing
5. Case Study: Machine Learning for Energy Theft Detection

Module 12: Blockchain for Smart Energy

1. Blockchain fundamentals
2. Peer-to-peer energy trading
3. Smart contracts in energy
4. Integration with AMI and IoT
5. Case Study: Blockchain-Based Microgrid in South Korea

Module 13: Grid Simulation and Modeling

1. 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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