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Renewable Energy Grid Integration

View Course Details

COURSE DATES AND TIMES

April 28-29 , 2026

10:00 am - 4:30 pm ET

This intensive 12-Hour (2 day) course offers participants a deep dive into the transformation from traditional power structures to modern, smart grids that are rapidly incorporating renewable energy sources.

Day 1 starts with an exploration of how electric grids have evolved over the years, highlighting the mounting significance of renewables. It then transitions into a detailed analysis of intermittent renewable resources, such as solar and wind, discussing their variability and reliability. Participants will gain insight into the critical aspects of grid stability and reliability, emphasizing the necessity for frequency and voltage control, inertia, and ancillary services. The day wraps up by addressing the growing importance of grid storage solutions, from batteries to pumped hydro, and the emergence of demand response and distributed energy resources in grid stability.

On Day 2, the course pivots to the hardware and software technologies enabling smooth grid integration of renewables. Participants will familiarize themselves with advanced inverters, FACTS, PMUs, and the indispensable software technologies guiding grid management. A special segment is dedicated to microgrids, presenting their diverse use-cases and their potential in a renewables-heavy grid system. The day also delves into the crucial aspects of policy, regulations, and market mechanisms that shape renewable integration globally. Concluding the course, we cast our gaze forward, identifying future trends and research areas, from electric vehicle grid impacts to AI's role in grid management.

This course is tailored for electric utility planning engineers, electrical engineers, and professionals engaged in integrating renewables into the contemporary smart grid. Engage in captivating sessions, insightful discussions, and a holistic learning experience.

LEARNING OUTCOMES

1. Understanding of Modern Grid Evolution: Gain a comprehensive understanding of the transformation from traditional power systems to contemporary smart grids, especially with the increasing integration of renewable energy.
2. Proficiency in Intermittent Renewables: Achieve a solid grasp of the characteristics, variability, and reliability of intermittent renewable resources like solar and wind, and the challenges they pose to grid integration.
3. Insight into Grid Stability and Reliability: Understand key concepts related to maintaining grid frequency, voltage control, the importance of inertia, and the need for ancillary services to ensure grid stability.
4. Knowledge of Storage Solutions: Acquire a deep understanding of various energy storage technologies, their roles in the grid, and the economic dynamics governing their implementation.
5. Familiarity with Demand Response and DER: Learn about the crucial role of demand response in mitigating intermittency, and gain knowledge about different types of distributed energy resources and their impact on grid stability.
6. Proficiency in Grid Integration Technologies: Understand the hardware and software solutions, from advanced inverters to energy management systems, that facilitate the seamless integration of renewables into the grid.
7. Comprehensive Knowledge of Microgrids: Gain insights into microgrid operations, their diverse applications, and their importance in supporting grids with a high penetration of renewables.
8. Understanding of Policy and Regulatory Landscape: Learn about the policies, regulations, and market mechanisms that influence renewable integration and gain exposure to global best practices.
9. Awareness of Future Trends: Gain foresight into the imminent shifts in the energy sector, including the integration of electric vehicles, decentralized energy markets, and the application of AI in grid management.
10. Holistic View of Grid-Renewable Dynamics: Develop a well-rounded perspective on how renewables interact with the grid, encompassing technical, economic, policy, and future-oriented aspects.

WHO SHOULD ATTEND

Electric Utility Planning Engineers: Those who design and strategize the layout and future developments of electric utilities.

Electrical Engineers: Professionals involved in the design, development, and maintenance of electrical systems and equipment.

Grid Integration Specialists: Experts focused on integrating various energy sources, especially renewables, into the main grid.

Energy Policy Makers: Individuals involved in crafting and implementing energy policies, especially those concerning renewable energy sources.

Renewable Energy Consultants: Those who provide advisory services in the field of renewable energy implementation and grid connection.

Microgrid Developers: Professionals designing and developing smaller, localized energy grids that can operate both independently or in conjunction with the main grid.

Energy Storage Solution Providers: Experts in energy storage technologies like batteries, pumped hydro, and flywheels.

Regulatory Professionals: Individuals from agencies that oversee and regulate power generation, distribution, and grid integration.

Utility Managers and Operators: Those responsible for the daily operations, management, and long-term planning of utilities.

Research and Academic Professionals: Academics and researchers focusing on renewable energy, grid technologies, and related fields.

Project Developers in Renewable Energy: Professionals involved in setting up renewable energy projects like wind farms, solar parks, and more.

Smart Grid Technology Providers: Companies and their representatives offering technologies and solutions for modernizing and making grids "smarter."

Energy Economists: Those analyzing the economics of energy generation, distribution, and consumption.

Stakeholders in Renewable Energy Projects: Investors, landowners, and others with a vested interest in the success of renewable energy projects.

This course provides invaluable insights and knowledge beneficial to a wide spectrum of professionals in the energy sector, particularly those focusing on the modern evolution of the grid with an emphasis on renewables.

COURSE OUTLINE

Renewable Energy Grid Integration Training - Course Outline

Day 1

Introduction to Modern Electric Grids

- Traditional vs. Modern Power Systems
- Role of Renewables in Today's Power Grid
- Challenges with High Penetration of Renewables
- Evolution of Smart Grids and their Benefits
- Distributed Energy Resources (DERs) and their Impact on the Grid

Basics of Intermittent Renewable Resources

- What are intermittent resources? (Solar, Wind, etc.)
- Factors affecting their variability
- The capacity factor and reliability

- Integration challenges of intermittent resources
- Impact of climate and geographical factors on generation

Understanding Grid Stability & Reliability

- Grid Frequency & Voltage Control
- Concepts of Inertia and Grid Resilience
- Need for Ancillary Services
- Impact of Renewable Energy on Grid Operations
- Measures to Enhance Grid Resilience with Renewables

Grid Storage Solutions

- Types of energy storage (Batteries, Pumped Hydro, Flywheels)
- Storage for short-term vs. long-term needs
- Economic considerations & Market dynamics
- Grid Integration of Storage Systems
- Impacts and Challenges of Multi-storage Systems

Demand Response & Distributed Energy Resources

- Role of DR in mitigating intermittency
- Types of DR programs and their impact
- Distributed generation and its role in grid stability
- Benefits and challenges of implementing DR
- Emerging Technologies in DR

Day 2

Grid Integration Technologies: Hardware

- Advanced Inverters for renewable integration
- Grid-following and Grid-forming inverters
- FACTS (Flexible AC Transmission Systems)
- Phasor Measurement Units (PMUs) & Wide-Area Monitoring Systems
- Integration of Sensor Technologies for Real-time Grid Monitoring

Grid Integration Technologies: Software

- Advanced Energy Management Systems (EMS)
- Distribution Management Systems (DMS)
- Fault Ride-Through, Voltage and Frequency Ride-Through

- Data analytics and prediction tools for renewable generation
- Cybersecurity in Grid Management

Microgrids & Resilient Grid Architectures

- Basics of Microgrid Operation
- Use-cases: From rural electrification to urban resilience
- Role in supporting a grid with high renewable penetration
- Challenges in Microgrid Design and Operation
- Energy Management in Microgrids

Policy, Regulations, and Market Mechanisms

- Role of policy in enabling renewable integration
- Market mechanisms to incentivize grid stability (Capacity markets, Ancillary services)
- Global best practices and case studies
- Impact of International Agreements on Grid Integration Policies
- Economic and Social Impacts of Renewables Policy

Future Trends & Research Directions

- Integration of electric vehicles & their grid impacts
- Transactive energy & decentralized markets
- Innovations on the horizon: Advanced grid modeling, AI in grid management, etc.
- Renewable Energy in Urban Planning and Smart Cities
- Challenges and Future Prospects of Grid Decarbonization

Course Schedule

Start: 10 a.m. Eastern Time
Finish: 4:30 p.m. Eastern Time