Introduction:

This course is designed to address the challenges and solutions associated with integrating renewable energy power systems—such as solar power, wind turbines, energy storage, and demand response—into modern electrical distribution and transmission systems.

Participants will explore technical, economic, and regulatory barriers to renewable energy utilization. The program will highlight the development of strategies for incorporating renewable energy sources into grid operations, capacity planning, and demand-side management, ensuring alignment with Renewable Portfolio Standards and reducing carbon emissions.

Through practical demonstrations and case studies, the course equips professionals to tackle operational issues and establish business models for integrating renewable energy technologies into the grid effectively.

Electrical Engineering – Power and Renewable Energy

Participants will examine the challenges and solutions related to designing, operating, and managing renewable energy systems, ensuring these align with traditional electrical engineering principles. Emphasis is placed on the interplay between renewable sources and conventional grids, paving the way for sustainable and resilient energy infrastructures.

Targeted Groups

This course is ideal for:

- Electrical engineers.
- Electrical supervisors.
- Power engineers.
- Managers overseeing electrical installations.
- Project engineers involved in renewable energy systems.

Course Objectives

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

1. Understand the role of grid flexibility in renewable energy integration.
2. Identify various types of renewable energy and energy storage systems.
3. Differentiate between types of solar panels and wind farms.
4. Explore strategies to reduce carbon emissions and other air pollutants.
5. Develop methods to integrate distributed systems and customer loads to reduce peak loads and electricity costs.

Targeted Competencies

Participants will develop skills in:

- Supporting renewable portfolio standards for energy efficiency.
- Enhancing the reliability and resiliency of microgrids in constrained electric grids.
- Facilitating plug-in electric vehicle (PHEV) grid integration.
- Understanding the dynamics of wind, solar, and energy storage systems.

Course Content

Unit 1: Renewable Energy Generation – Present, Future, and Integration Challenges

- Drivers of renewable energy development.
- State-of-the-art integration capacities for renewable power stations.
- Transmission and operation technologies and practices.
- Wind power generation.
- Photovoltaic and concentrated solar power generation.

Unit 2: Technical Solutions for Large-Capacity Renewable Energy Integration

- Wind turbines and grid-friendly systems.
- Enhancing flexibility in conventional generation.
- Developments in transmission expansion.
- Electrical energy storage technologies for large capacities.
- Roles and standards for energy storage in renewable systems.

Unit 3: Grid Flexibility – The Key to Renewable Energy Integration

- Wind and solar power impacts on energy demand.
- Flexibility in power plants.
- Demand response and forecasting techniques.
- Managing variabilities in wind and solar power.
- Addressing the impact on fossil-fueled generators.

Unit 4: Integrating Renewable Energy into Transmission and Distribution Systems

- Analytical approaches to renewable energy integration.
- Distributed generation and renewable power systems integration.
- Power quality impacts on transmission and distribution systems.
- Optimization and sensitivity analysis for photovoltaics and wind systems.

Unit 5: Renewable Energy Integration in Smart Grids and Microgrids

- Attributes of smart grids and their role in renewable energy.

- Operation and benefits of microgrids.
- The future of intelligent microgrids in renewable energy integration.

Conclusion

This course equips professionals with the knowledge and tools to address the complex challenges of renewable energy integration. Participants will gain valuable insights into modern solutions, ensuring sustainable, cost-effective, and efficient renewable energy systems that contribute to a cleaner energy future.