



Electrical Engineering

Planning & Operating Electricity Grids with Variable Renewable Generation

Course Introduction

Planning & Operating Electricity Grids with Variable Renewable Generation

The development of wind- and solar-generating capacity is growing rapidly around the world, But integrating wind and solar generation into grid operations is challenging: since wind and solar generation only occur when wind and solar resources are available, their output is not controllable. Grid operators are accustomed to dealing with variability, but primarily on the load side. The challenge is that higher levels of wind and solar generation add both variability and uncertainty.

Several countries notably Denmark, Germany, Portugal, and Spain are providing real-world experience in integrating high levels of variable generation, primarily wind power. In addition, several integration studies have modeled and simulated the addition of large amounts of wind, and to a lesser extent, solar generation to the grid. Such studies provide valuable information on the expected impacts of high levels of variable energy generation and potential strategies for successfully integrating variable energy generation into the system. These course look at the technical operational impacts of integrating these resources into the systems and the potential technical and economic implications to system operations, notably short-term, reserve-related costs. Globally, variable renewable generation sources still represent mainly an energy and not a capacity resource.

While their contributions to capacity or power and associated costs are different from those of conventional power sources, variable renewable generation technologies can contribute to long-term system adequacy and security.

Target Audience

- Electrical Controls Engineer

- Electrical Design Engineer
- Electrical Engineer

Learning Objectives

- Understanding The Challenges of Integrating Wind and Solar Generation
- Understanding The Operational Challenges in Integrating Wind and Solar Generation
- Understanding Solar Integration
- Understanding Integration Strategies and Solutions

Course Outline

- **DAY 01**

- Module 01 The Challenges of Integrating Wind and Solar Generation**

- 1.1 Introduction
 - 1.2 Wind and Solar Development
 - 1.3 The Operational Challenges in Integrating Wind and Solar Generation
 - 1.4 Understanding Electricity Systems

- **Day 02**

- 1.5 Summary of Findings from Variable Generation**

- 1.6 Integration Studies and Operational Experiences
 - 1.7 Other Findings from Operational Experiences
 - 1.8 Solar Integration

- **Day 03**

Module 02 Integration Strategies and Solutions

- 2.1 Forecasting
- 2.2 Basic Description of Some Solar Technologies
- 2.3 Organizing a Grid Operational Integration
- 2.4 Simplified Methods of Estimating Impacts of Variable
- 2.5 Generation in Short-Term Reserves

• Day 04

Module 03 Contribution of Variable Power Sources to Supply

- 3.1 Adequacy
- 3.2 Definitions and Metrics for Supply Adequacy
- 3.3 Contribution of Variable Renewables to Supply Adequacy
- 3.4 A Probabilistic Approach to Estimate the Contribution of Variable Renewables to Supply Adequacy
- 3.5 Contribution of Variable Renewables to Supply Adequacy and Evidence from International Experience

• Day 05

Module 4 Country Case Studies

- 4.1 China
- 4.2 Germany
- 4.3 Spain

Confirmed Sessions

FROM	TO	DURATION	FEES	LOCATION
April 14, 2025	April 18, 2025	5 days	4250.00 \$	UAE - Dubai
Sept. 1, 2025	Sept. 5, 2025	5 days	4250.00 \$	UAE - Abu Dhabi
Nov. 3, 2025	None	None days	4950.00 \$	England - London