



Evolving Power Generation: Gas
Turbines, Combined Cycle, Wind, &
Solar Technologies



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Introduction

This power generation in the gas, wind, solar, and combined cycle program provides a detailed understanding of steam power plants, gas turbines, cogeneration, combined-cycle plants, and wind and solar power generating plants. Each of the components, such as compressors, gas and steam turbines, heat recovery steam generators, deaerators, condensers, lubricating systems, instrumentation, control systems, transformers, and generators, are covered.

The design, selection considerations, operation, maintenance, and economics of cogeneration plants and combined cycles, as well as emission limits, reliability, monitoring, and governing systems, will also be covered.

The power generation in the gas, wind, solar, and combined cycle course is significant improvements that were made to cogeneration, combined-cycle plants, and wind- and solar-power-generating plants during the last two decades will also be explained.

Enhancing the Understanding of Power Systems

The evolution of power plants and the integration of modern technologies such as cogeneration, combined-cycle systems, and renewable energy sources have significantly improved the creation of electricity.

This power generation in the gas, wind, solar, and combined cycle course aims to provide comprehensive power system training and power generation training, specifically targeting those involved in power plant operation and electricity course methodologies. Particular emphasis is placed on power plant maintenance training and power plant fundamentals training to equip participants with the necessary skills to handle modern industrial power generation challenges.

Participants of this power generation training course will have the opportunity to enroll in a power plant training program that delves into the power plant certificate course material, ensuring that they emerge with a firm grasp of power generation equipment and power generation systems. Learning outcomes are focused on practical applications such as power plant training, enabling participants to contribute effectively to the optimization of power generation system operations.

Targeted Groups

- Power Station Operators, Technicians, Engineers, and Managers.
- Electrical and Mechanical Engineers of Different Competency Levels.
- Project Engineers and Project Managers.
- Power Station Maintenance Crew.

Course Objectives

At the end of this power generation in the gas, wind, solar, and combined cycle course, the participants will be able to:

- Learn about the components and subsystems of the various types of gas turbines, steam power plants, cogeneration, combined-cycle plants, wind turbines and generators, wind turbine farms, and solar power generation.
- Examine the advantages, applications, performance, and economics of cogeneration, combined-cycle plants, wind turbines and generators, wind turbine farms, and solar power generation.
- Learn about various equipment, including compressors, turbines, governing systems, combustors, deaerators, feedwater heaters, transformers, generators and auxiliaries, wind turbines and generators, wind turbine farms, and solar power generating plants.
- Discover the maintenance required for gas turbines, steam power plants, combined cycles, generators, wind turbines, and wind turbine farms to minimize their operating cost and maximize their efficiency, reliability, and longevity.
- Learn about the monitoring and control of environmental emissions.
- Discover instrumentation and control systems of gas turbines and combined cycles.
- Increase your knowledge of predictive and preventive maintenance, reliability, and testing.
- Gain a thorough understanding of the selection considerations and applications of cogeneration, combined-cycle plants, wind turbines and generators, wind turbine farms, and solar power generation.

Targeted Competencies

At the end of this power generation in the gas, wind, solar, and combined cycle course, the target competencies will be able to:

- Power generation theory.
- Understand power plant types and their features.
- Learn about industrial plants, processes, and control measures.
- Understand thermal, gas, and diesel generator power plant operations and selection criteria.
- Learn about the fundamentals of electric machines, drives, and control devices.

Course Content

Unit 1: Steam Power Plants

- Review of thermodynamics principles.
- Steam power plants.
- The fire-tube boiler.
- The water-tube boiler.
- The steam drum.
- Superheaters and reheaters.
- Steam turbines.
- Reheaters.
- Condensers.
- Feedwater heaters.
- Learn about efficiency and heat rate.
- Supercritical plants.
- Cogeneration plants.
- Arrangement of cogeneration plants.
- Economics of cogeneration plants.

Unit 2: Steam Turbines and Auxiliaries

- Turbine types.
- Compound turbines.
- Turbine control systems.
- Steam turbine maintenance.
- Understand steam generators, heat exchangers, and condensers.
- Power station performance monitoring.
- The turbine governing systems.
- Steam chests and valves.
- Turbine protective devices.
- Turbine instrumentation.
- Lubrication systems.
- Gland sealing system.
- Learn about frequently asked questions about turbine-generator balancing, vibration analysis, and maintenance.
- Features Enhancing The Reliability and Maintainability of Steam Turbines.

Unit 3: Gas Turbines and Compressors

- Gas turbine fundamentals.
- Overview of gas turbines.
- Gas turbine design.
- Gas turbine calculations.
- Gas turbine compressors.
- Combined cycles.
- Single-shaft combined cycle power generating plants.
- What are the economic and technical considerations for combined cycle performance enhancement options?
- Dynamic compressors technology.
- Understand compressors auxiliaries, off-design performance, stall, and surge.
- Learn about centrifugal compressors - components, performance characteristics, balancing, surge prevention systems, and testing.
- Dynamic compressors performance.
- Compressor seal systems.
- Learn about dry seals, advanced sealing mechanisms, and magnetic bearings.

Unit 4: Cogeneration Plants, Wind, and Solar Power Generation

- Learn about applications of cogeneration and combined cycle plants.
- Understand selection considerations of combined cycles and cogeneration plants.
- Cogeneration application considerations.
- Learn about the University of Toronto's central steam, cogeneration, and district heating plant.
- What is the Economics of combined cycles cogeneration plants?
- Wind power generation.
- Economics of wind power.
- Wind power turbine generators - brushless double-feed generators.
- Solar power.
- Solar photovoltaic technologies.
- Economics of solar power systems.

Unit 5: Transformers and Generators

- Fundamentals of electric systems.
- Introduction to machinery principles.
- Transformers.
- Transformers components and maintenance.
- AC machine fundamentals.
- Synchronous generators.
- Understand generator components, auxiliaries, and excitation.
- Understand generator testing, inspection, and maintenance.