Combined Cycle Power Plant Operations and Control Training Course



19 - 23 Oct 2026

Cape town

4600 € (Per Person)

Ref: #ERE5649_273658

Course Introduction / Overview:

This comprehensive training course provides an in-depth exploration of the principles, operations, and control systems of Combined Cycle Power Plants (CCPP). As the global energy landscape shifts towards higher efficiency and lower emissions, the role of CCPP technology has become increasingly critical. This program is designed to cover the entire operational spectrum, from fundamental thermodynamics and component functions to advanced control strategies and performance optimization. Participants will gain a robust understanding of the intricate interplay between the gas turbine, heat recovery steam generator (HRSG), and steam turbine. Drawing on principles outlined by leading experts like Dr. Meherwan P. Boyce in his seminal work, the "Gas Turbine Engineering Handbook," the course bridges theoretical knowledge with practical, real-world applications. BIG BEN Training Center has developed this curriculum to empower professionals with the skills needed to enhance plant reliability, improve thermal efficiency, and ensure safe, compliant operations in a dynamic and competitive energy market.

Target Audience / This training course is suitable for:

- Power Plant Operators and Technicians.
- Control Room Engineers and Supervisors.
- Maintenance Engineers and Planners.
- Plant Managers and Operations Superintendents.
- Commissioning and Project Engineers.
- Performance and Efficiency Analysts.
- Technical Staff involved in power generation.
- Energy sector professionals seeking to specialize in CCPP technology.

Target Sectors and Industries:

- Power Generation and Utilities.
- Independent Power Producers (IPPs).
- Oil and Gas Industry (Upstream and Downstream).
- Heavy Industrial Manufacturing with co-generation facilities.
- Petrochemical and Chemical Processing Plants.
- Governmental bodies, energy ministries, and regulatory agencies.
- Engineering, Procurement, and Construction (EPC) companies.

Target Organizations Departments:

- Operations Department.
- Maintenance and Reliability Department.
- Engineering and Technical Services.
- Control and Instrumentation Department.
- Health, Safety, and Environment (HSE) Department.
- Asset Management and Planning.
- Project Management and Commissioning Teams.

Course Offerings:

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

- Analyze the thermodynamic principles governing combined cycle efficiency.
- Identify the functions and interactions of all major CCPP components.
- Execute standard operating procedures for plant startup, shutdown, and load changes.
- Interpret and manage Distributed Control System (DCS) interfaces and alarms.
- Implement strategies for optimizing plant performance and heat rate.
- Develop effective troubleshooting techniques for common operational issues.
- Apply best practices for plant safety and environmental compliance.
- Understand the principles of predictive and preventive maintenance for CCPP equipment.
- Evaluate the impact of fuel quality and ambient conditions on plant output.
- Grasp the fundamentals of grid integration and ancillary services.

Course Methodology:

The training methodology at BIG BEN Training Center is designed to be highly interactive and participant-centered, ensuring a deep and practical understanding of CCPP operations. The course moves beyond traditional lectures by integrating a blended learning approach. Expert-led presentations will establish the theoretical foundation, which is then reinforced through detailed case studies of real-world operational scenarios, incidents, and optimization successes. Participants will engage in collaborative group discussions and problem-solving workshops to analyze complex operational challenges and develop effective solutions. Interactive sessions, including conceptual simulations of plant processes and control logic, will provide a hands-on feel for managing a CCPP. A significant emphasis is placed on practical application, with exercises designed to build skills in areas like alarm management, performance calculation, and troubleshooting. Continuous feedback and Q&A sessions are woven throughout the program to address specific queries and ensure concepts are thoroughly mastered.

Course Agenda (Course Units):

Unit One: Fundamentals of Combined Cycle Power Plants

- Introduction to CCPP technology and its role in the energy market.
- Thermodynamic principles of the Brayton and Rankine cycles.
- Detailed overview of the Gas Turbine (GT) and its auxiliary systems.
- Understanding the Heat Recovery Steam Generator (HRSG) design and operation.
- Exploring the Steam Turbine (ST) and its components.
- The role of the condenser, cooling systems, and the water-steam cycle.
- Generator principles, excitation systems, and electrical auxiliaries.

Unit Two: CCPP Operational Procedures and Strategies

- Pre-start checks and plant readiness procedures.
- Step-by-step CCPP cold, warm, and hot startup sequences.
- Normal operations, base load, and part-load performance.
- Managing load changes and grid frequency response.
- Techniques for efficient plant shutdown and preservation.
- Single-shaft versus multi-shaft configurations and operational differences.
- Emergency procedures and plant trip response protocols.

Unit Three: Instrumentation and Control Systems in CCPP

- Introduction to the Distributed Control System (DCS) architecture.
- Key control loops: fuel control, steam temperature, and drum level control.
- Understanding process instrumentation, sensors, and transmitters.
- Managing alarms, interlocks, and protective systems.
- Human-Machine Interface (HMI) navigation and interpretation.
- Automatic Generation Control (AGC) and its function.
- Introduction to SCADA systems for plant-wide monitoring.

Unit Four: Performance Optimization and Maintenance Management

- Key Performance Indicators (KPIs) for CCPP efficiency.
- Calculating and monitoring plant heat rate and thermal efficiency.
- Factors affecting GT and ST performance degradation.
- Strategies for optimizing combustion and steam cycle parameters.
- Introduction to preventive, predictive, and reliability-centered maintenance.
- Major inspection cycles for gas turbines and steam turbines.
- Water chemistry control, monitoring, and treatment programs.

Unit Five: Safety, Environmental Compliance, and Advanced Topics

- Process safety management (PSM) in a power plant environment.
- Hazard identification and risk assessment for CCPP operations.
- Environmental regulations and emissions monitoring (NOx, CO).
- Troubleshooting common CCPP operational problems.
- The impact of fuel flexibility on plant operation.
- Future trends: digitalization, AI in operations, and hydrogen co-firing.
- Economic aspects of CCPP operation and market participation.

FAQ:

Qualifications required for registering to this course?

There are no requirements.

How long is each daily session, and what is the total number of training hours for the course?

This training course spans five days, with daily sessions ranging between 4 to 5 hours, including breaks and interactive activities, bringing the total duration to 20 - 25 training hours.

Something to think about:

As renewable energy integration increases grid volatility, how must the operational philosophy and control strategies of combined cycle power plants evolve to ensure both profitability and grid stability?

What unique qualities does this course offer compared to other courses?

This training course distinguishes itself by offering a holistic and deeply practical perspective on combined cycle power plant management, moving far beyond a purely theoretical or component-based overview. Its primary distinction lies in the integration of operational strategy with technical knowledge. While other courses may focus separately on turbines or control systems, this program emphasizes the intricate synergy between all plant components and how their collective operation impacts overall efficiency, reliability, and profitability. The curriculum is built around real-world case studies, enabling participants to analyze actual plant events, troubleshoot complex faults, and devise optimization strategies in a structured learning environment. Furthermore, the course is forward-looking, addressing not just current best practices but also emerging challenges and technologies such as operational flexibility in renewable-heavy grids, digitalization, and advanced predictive analytics. It provides a strategic framework for decision-making, empowering attendees to return to their roles not just with technical facts, but with the critical thinking skills required to enhance plant performance in a competitive and evolving energy market.