

T-013 Cogeneration and combined cycle plants

A comprehensive course on cogeneration and combined cycle plants that covers the design, engineering and O&M principles of all components and the associated water treatment systems.

In simple cycle gas turbine plants the stack temperature is typically between 450 and 550 °C. The net efficiency of such plants is maximum 40 % for aeroderivative gas turbines and around 35 % for heavy-duty gas turbines.

Cogeneration is a way to improve the overall fuel efficiency of a gas turbine based plant. A heat recovery steam generator downstream the gas turbine uses the hot flue gas to produce steam, which can be used directly as process steam. In a combined cycle plant the produced steam is used to drive a steam turbine. The exhaust steam can be used as process steam or the steam can be expanded further in order to produce maximum power.

This course provides a comprehensive and in-depth overview of:

- The thermodynamic design
- Hardware fundamentals
- Operation and maintenance topics

In order to draw a connection between the concepts learned in the classroom and the actual hardware in the field some installed units will be visited.

Who should attend?

The course is suitable for the following:

- Engineering staff
- Process & Operations Engineers and Supervisors
- Maintenance Engineers and Supervisors
- Technical managers

Duration

One week

Course content

0 Introduction

- Safety induction
- Course structure
- House rules

1 Overall system design

- Gas cycle
- Water/steam cycle
- Water treatment

2 Flue gas path

- Exhaust of gas turbine
- Bypass stack
- Supplementary firing

3 Heat recovery steam generator

- Economiser
- Evaporator and steam drum
- Superheater
- Blowdown system

4 Steam turbine and condenser

- Back-pressure steam turbine
- Condensing extraction steam turbine
- Condenser
- Bypass station

5 Condensate and boiler feedwater system

- Condensate pumps
- Deaerator / feed water tank
- Boiler feed water pumps

6 Water treatment systems

- Desalination plant
- CO₂ removal
- Softening
- Demineralised water plant (ion-exchanger / reverse osmosis)

7 Operation and plant control

- Instrumentation
- Main control loops
- Start-up and shutdown
- Load variations

8 Degradation mechanisms and maintenance

- Fouling
- Scaling
- Corrosion
- Creep and fatigue

Training outcome

On completion of the course, you should be able to:

- Understand the design principle of the complete cogeneration / combined cycle plant.
- Understand principles of selection, operation and maintenance of the components of these plants.

Course presenter

Chris Lappee: More than 18 years of experience in Design & Engineering or Energy & Utility systems. Chris studied Power Plant Technology at the faculty Mechanical Engineering of the University of Technology in Delft, Netherlands. He completed the post-graduate course: Master of Business in Energy systems. He worked for Akzo Nobel Engineering in the area of Energy & Utility systems for chemical plants. At Shell Global Solutions he was the utility lead technologist for an expansion project of the LNG plant in Nigeria. He participated in the project team that studied the future of oil & gas exploration and consumption in Oman. During the last 10 years he worked at Vattenfall, one of the largest European power generators. He had several positions in projects concerning combined cycle and cogeneration plants.