COURSE OVERVIEW EE1114
CCGT Technology

Course Title
CCGT Technology

Course Date/Venue
Session 1: August 18-22, 2025/Glasshouse Meeting Room, Grand Millennium Al Wahda Hotel, Abu Dhabi, UAE
Session 2: December 22-26, 2025/Glasshouse Meeting Room, Grand Millennium Al Wahda Hotel, Abu Dhabi, UAE

Course Reference
EE1114

Course Duration/Credits
Five days/3.0 CEUs/30 PDHs

Course Description

This practical and highly-interactive course includes various practical sessions and exercises. Theory learnt will be applied using our state-of-the-art simulators.

This course is designed to provide participants with a detailed and up-to-date overview of CCGT Technology. It covers the CCGT systems, gas turbine and steam turbine fundamentals, combined cycle operation and fuel types and considerations; the key safety concerns in CCGT operations, monitoring and control systems, system reliability and maintenance requirements and emergency shutdown procedures; the key design factors for CCGT plants and layout and spatial requirements; and the integration of gas and steam turbines and power output and efficiency targets.

Further, the course will also discuss the function and types of HRSGs and its design principles for efficiency; the gas and steam cycle efficiency optimization, advanced turbine configurations and performance enhancement technologies; the cooling systems in CCGT, electrical systems and integration and automation and control systems; the detailed thermodynamic analysis of CCGT cycles and key performance indicators (KPIs) for operational efficiency; and the calculation of heat rate, performance monitoring techniques and analyzing heat rate improvements.

During this interactive course, participants will learn the environmental impact of CCGT technology, NOx and CO2 emissions reduction, compliance with environmental regulations and carbon capture and storage technologies; the flexibility and load following capabilities and maintenance strategies for CCGT systems including performance testing and optimization and advanced CCGT configurations; the modernization techniques for older gas turbines, upgrading to improve efficiency and performance, retrofitting with advanced control and monitoring systems and cost-benefit analysis of turbine upgrades; the combined heat and power (CHP) in CCGT, CCGT in district heating and cooling, turbine performance analysis and digitalization and smart CCGT plants; the CCGT in a low-carbon future and energy storage systems; and the emerging technologies in gas turbines and digital transformation.

Course Objectives

Upon the successful completion of this course, each participant will be able to:-

- Apply and gain an in-depth knowledge on CCGT technology
- Discuss CCGT systems, gas turbine and steam turbine fundamentals, combined cycle operation and fuel types and considerations
- Recognize key safety concerns in CCGT operations, monitoring and control systems, system reliability and maintenance requirements and emergency shutdown procedures
- Identify the key design factors for CCGT plants, layout and spatial requirements, integration of gas and steam turbines and power output and efficiency targets
- Discuss the function and types of HRSGs and its design principles for efficiency as well as apply gas and steam cycle efficiency optimization, advanced turbine configurations and performance enhancement technologies
- Recognize cooling systems in CCGT, electrical systems and integration and automation and control systems
- Carryout detailed thermodynamic analysis of CCGT cycles, key performance indicators (KPIs) for operational efficiency, calculation of heat rate, performance monitoring techniques and analyzing heat rate improvements
- Discuss environmental impact of CCGT technology, NOx and CO2 emissions reduction, compliance with environmental regulations and carbon capture and storage technologies
- Interpret flexibility and load following capabilities and apply maintenance strategies for CCGT systems including performance testing and optimization and advanced CCGT configurations
- Employ modernization techniques for older gas turbines, upgrading to improve efficiency and performance, retrofitting with advanced control and monitoring systems and cost-benefit analysis of turbine upgrades
- Discuss combined heat and power (CHP) in CCGT, CCGT in district heating and cooling, turbine performance analysis and digitalization and smart CCGT plants
- Recognize CCGT in a low-carbon future, energy storage systems and CCGT, emerging technologies in gas turbines and CCGT and the digital transformation

Exclusive Smart Training Kit - H-STK®

*Participants of this course will receive the exclusive "Haward Smart Training Kit" (**H-STK®**). The **H-STK®** consists of a comprehensive set of technical content which includes **electronic version** of the course materials conveniently saved in a **Tablet PC**.*

Who Should Attend

This course provides an overview of all significant aspects and considerations of CCGT technology for engineers, supervisors, operations and maintenance personnel, operational support and other technical staff.

Training Methodology

All our Courses are including **Hands-on Practical Sessions** using equipment, State-of-the-Art Simulators, Drawings, Case Studies, Videos and Exercises. The courses include the following training methodologies as a percentage of the total tuition hours:-

30% Lectures
20% Practical Workshops & Work Presentations
30% Hands-on Practical Exercises & Case Studies
20% Simulators (Hardware & Software) & Videos

In an unlikely event, the course instructor may modify the above training methodology before or during the course for technical reasons.

Course Fee

US$ 5,500 per Delegate + **VAT**. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

Accommodation

Accommodation is not included in the course fees. However, any accommodation required can be arranged at the time of booking.

Course Certificate(s)

Internationally recognized certificates will be issued to all participants of the course who completed a minimum of 80% of the total tuition hours.

Certificate Accreditations

Certificates are accredited by the following international accreditation organizations: -

- British Accreditation Council (BAC)

  Haward Technology is accredited by the **British Accreditation Council** for **Independent Further and Higher Education** as an **International Centre**. BAC is the British accrediting body responsible for setting standards within independent further and higher education sector in the UK and overseas. As a BAC-accredited international centre, Haward Technology meets all of the international higher education criteria and standards set by BAC.

- The International Accreditors for Continuing Education and Training (IACET - USA)

Haward Technology is an Authorized Training Provider by the International Accreditors for Continuing Education and Training (IACET), 2201 Cooperative Way, Suite 600, Herndon, VA 20171, USA. In obtaining this authority, Haward Technology has demonstrated that it complies with the **ANSI/IACET 2018-1 Standard** which is widely recognized as the standard of good practice internationally. As a result of our Authorized Provider membership status, Haward Technology is authorized to offer IACET CEUs for its programs that qualify under the **ANSI/IACET 2018-1 Standard**.

Haward Technology's courses meet the professional certification and continuing education requirements for participants seeking **Continuing Education Units** (CEUs) in accordance with the rules & regulations of the International Accreditors for Continuing Education & Training (IACET). IACET is an international authority that evaluates programs according to strict, research-based criteria and guidelines. The CEU is an internationally accepted uniform unit of measurement in qualified courses of continuing education.

Haward Technology Middle East will award **3.0 CEUs** (Continuing Education Units) or **30 PDHs** (Professional Development Hours) for participants who completed the total tuition hours of this program. One CEU is equivalent to ten Professional Development Hours (PDHs) or ten contact hours of the participation in and completion of Haward Technology programs. A permanent record of a participant's involvement and awarding of CEU will be maintained by Haward Technology. Haward Technology will provide a copy of the participant's CEU and PDH Transcript of Records upon request.

Course Instructor(s)

This course will be conducted by the following instructor(s). However, we have the right to change the course instructor(s) prior to the course date and inform participants accordingly:

Dr. Karam Mohamed, PhD, MSc, BSc, is a **Senior Electrical Engineer** with over **20 years** of extensive industrial experience. His expertise covers **Power Generation**, **Steam Power Plants**, **Co-Generation**, **Transformers**, **Combined Cycle Plants**, **Electrical Power System Protection** & **Control**, Electrical **Distribution System**, Electrical **Power System Installations**, **Design of Electric** Services for Projects, **Relays**, **System Earthing**, **Protective Earthing** and Power System Protection Equipment. Further, his experience includes electric circuits, power system analysis, electrical machines and digital power system protection. He is currently the Senior Professor of one of the leading universities in the Middle East.

During his career life, Dr. Karam has been a main consultant of multiple projects in the Middle East, where he was in-charge of strategic planning, infrastructure design of electrical work for new cities and villages, internal and external lighting systems earthing, LV & MV panels and networks, transformer, switchgears and standby generator selection.

Dr. Karam has a **PhD** in **Electrical Power** and **Machines Engineering** and **Master** and **Bachelor** degrees in **Power Engineering & Electrical Machines**. Further, he is a **Certified Instructor/Trainer** and has published numerous books such as "IEEE Transaction on Power Delivery", "A New Protection Scheme for Short Transmission Lines" and "Electricity Today" just to name a few. Furthermore, he is an active member of the Institute of Electrical and Electronics Engineers (**IEEE**) and has delivered numerous conferences, trainings, courses and workshops in the **USA**, **Canada** and **Middle East**.

Course Program

The following program is planned for this course. However, the course instructor(s) may modify this program before or during the workshop for technical reasons with no prior notice to participants. Nevertheless, the course objectives will always be met:

Day 1

0730 – 0800	*Registration & Coffee*
0800 – 0815	*Welcome & Introduction*
0815 – 0830	***PRE-TEST***
0830 – 0930	***Overview of CCGT Systems*** *History & Development of CCGT Technology • Components of a Combined Cycle Power Plant • Basic Working Principle of CCGT • Key Benefits & Challenges of CCGT Systems*
0930 – 0945	*Break*
0945 – 1030	***Gas Turbine Fundamentals*** *Gas Turbine Components & Types • Working Principle of a Gas Turbine • Performance Characteristics of Gas Turbines • Efficiency & Fuel Consumption*

1030 – 1130	***Steam Turbine Fundamentals*** *Basic Steam Cycle & Thermodynamics • Components of Steam Turbines • Role of Steam Turbines in CCGT • Efficiency Improvement via Steam Cycles*
1130 – 1215	***Combined Cycle Operation*** *How CCGT Integrates Gas & Steam Turbines • Heat Recovery Steam Generators (HRSG) • Operational Principles of CCGT • Load & Output Variations in Combined Cycles*
1215 – 1230	*Break*
1230 – 1330	***Fuel Types & Considerations*** *Types of Fuels Used in CCGT Systems (Natural Gas, Oil, etc.) • Fuel Selection Criteria for CCGT Plants • Emissions Control & Environmental Impacts • Fuel Efficiency & Cost Considerations*
1330 – 1420	***Safety & Reliability of CCGT Systems*** *Key Safety Concerns in CCGT Operations • Monitoring & Control Systems • System Reliability & Maintenance Requirements • Emergency Shutdown Procedures*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day One*

Day 2

0730 – 0830	***Plant Design Considerations*** *Key Design Factors for CCGT Plants • Layout & Spatial Requirements • Integration of Gas & Steam Turbines • Power Output & Efficiency Targets*
0830 – 0930	***HRSG Design & Operation*** *Function & Types of HRSGs • HRSG Design Principles for Efficiency • Heat Recovery in CCGT Systems • Maintenance & Operational Challenges*
0930 – 0945	*Break*
0945 – 1100	***Power Cycle Optimization*** *Optimization of Gas & Steam Cycle Efficiency • Advanced Turbine Configurations • Role of Condenser & Cooling Systems • Performance Enhancement Technologies*
1100 – 1215	***Cooling Systems in CCGT*** *Types of Cooling Systems (Once-Through, Cooling Towers, etc.) • Thermal Efficiency in Cooling Systems • Environmental Considerations for Cooling Methods • Water Use & Management in CCGT Plants*
1215 – 1230	*Break*
1230 – 1330	***Electrical Systems & Integration*** *Electrical Generation & Distribution in CCGT • Grid Integration & Synchronization • Electrical Power Quality in CCGT Plants • Protection & Fault Detection Systems*
1330 – 1420	***Automation & Control Systems*** *Control Systems Architecture for CCGT • SCADA & Distributed Control Systems (DCS) • Instrumentation & Monitoring Tools • Automated Plant Operations & Troubleshooting*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day Two*

Day 3

0730 – 0830	***Thermodynamic Cycle & Efficiency*** *Detailed Thermodynamic Analysis of CCGT Cycles • Efficiency Gains Through Combined Cycles • Performance Curves for CCGT Systems • Key Performance Indicators (KPIs) for Operational Efficiency*
0830 – 0930	***Heat Rate & Performance Monitoring*** *Definition & Calculation of Heat Rate • Performance Monitoring Techniques • Analyzing Heat Rate Improvements • Fuel-to-Electricity Conversion Efficiency*
0930 – 0945	*Break*
0945 – 1100	***Emissions & Environmental Considerations*** *Environmental Impact of CCGT Technology • NOx & CO2 Emissions Reduction • Compliance with Environmental Regulations • Carbon Capture & Storage Technologies*
1100 – 1215	***Flexibility & Load Following Capabilities*** *Load Following in CCGT Operations • Impact of Fluctuating Demand on Performance • Modulating Steam & Gas Turbine Operation • Strategies for Increasing Operational Flexibility*
1215 – 1230	*Break*
1230 – 1330	***Maintenance Strategies for CCGT Systems*** *Preventative versus Corrective Maintenance • Condition Monitoring & Diagnostics • Maintenance Scheduling & Downtime Reduction • Spare Parts Management & Inventory Control*
1330 – 1420	***Performance Testing & Optimization*** *Testing Methods for CCGT Efficiency • Performance Benchmarks & Best Practices • Data Collection & Analysis for Optimization • Case Studies of Optimized CCGT Plants*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day Three*

Day 4

0730 – 0830	***Advanced CCGT Configurations*** *Advanced Combined Cycle Designs • Integration with Renewable Energy Sources • Hybrid CCGT Systems (Solar, Wind, etc.) • Multi-Shaft versus Single-Shaft Configurations*
0830 – 0930	***Gas Turbine Upgrades & Retrofitting*** *Modernization Techniques for Older Gas Turbines • Upgrading to Improve Efficiency & Performance • Retrofitting with Advanced Control & Monitoring Systems • Cost-Benefit Analysis of Turbine Upgrades*
0930 – 0945	*Break*
0945 – 1100	***Combined Heat & Power (CHP) in CCGT*** *Integration of CHP with CCGT Systems • Benefits of Combined Heat & Power • Applications in Industrial & Residential Sectors • Efficiency Improvements Through CHP Systems*
1100 – 1215	***CCGT in District Heating & Cooling*** *Role of CCGT in District Energy Systems • Thermal Storage & Demand Management • Benefits of CCGT for Urban Energy Needs • Environmental Advantages of District Heating Systems*
1215 – 1230	*Break*

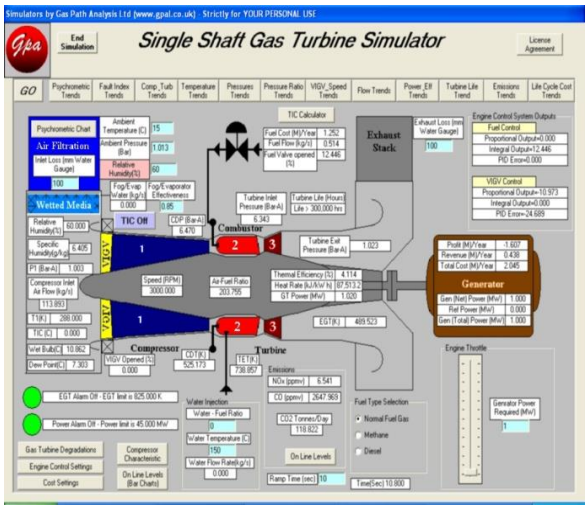
1230 – 1330	***Turbine Performance Analysis*** *Methods for Turbine Performance Analysis • Real-Time Performance Monitoring • Analyzing Efficiency Losses & their Causes • Tools for Optimizing Turbine Performance*
1330 – 1420	***Digitalization & Smart CCGT Plants*** *Role of IoT in CCGT Plant Operation • Data Analytics for Predictive Maintenance • Digital Twin Technologies in CCGT Plants • Smart Grid Integration with CCGT Systems*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day Four*

Day 5

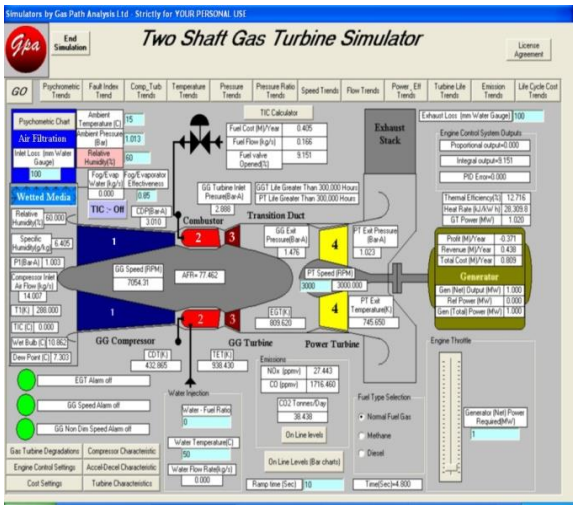
0730 – 0830	***CCGT in a Low-Carbon Future*** *Role of CCGT in Decarbonization Strategies • Integration of Green Hydrogen with CCGT • Carbon Capture & Storage Technologies • The Future of CCGT in a Renewable Grid*
0830 – 0930	***Energy Storage Systems & CCGT*** *Role of Energy Storage in CCGT Plants • Integration with Battery Energy Storage Systems (BESS) • Technologies for Enhancing Energy Storage in CCGT • Economic Considerations for Energy Storage*
0930 – 0945	*Break*
0945 – 1100	***Emerging Technologies in Gas Turbines*** *Next-Generation Turbine Designs • Advanced Materials & Coatings • Improvements in Fuel Efficiency • Carbon-Neutral & Low-Emission Turbine Technologies*
1100 – 1230	***CCGT & the Digital Transformation*** *Digitalization Trends in CCGT Plants • Role of AI & Machine Learning in Operations • The Impact of Blockchain on Energy Systems • Future of Smart Grids & CCGT Integration*
1230 – 1245	*Break*
1245 – 1300	***Financial & Operational Challenges*** *Financial Modeling for CCGT Projects • Return on Investment (ROI) & Life-Cycle Costs • Risk Management in CCGT Investments • Regulatory & Policy Considerations*
1300 - 1345	***Case Studies & Best Practices*** *Real-World Case Studies of Successful CCGT Plants • Lessons Learned from Plant Failures & Optimizations • Best Practices in CCGT Design & Operation • Future Outlook for CCGT Technology*
1345 – 1400	***Course Conclusion*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Course Topics that were Covered During the Course*
1400 – 1415	***POST-TEST***
1415 – 1430	*Presentation of Course Certificates*
1430	*Lunch & End of Course*

Simulator (Hands-on Practical Sessions)

Practical session will be organized during the course for delegates to practice the theory learnt. Delegates will be provided with an opportunity to carryout various exercises using the "Single Shaft Gas Turbine" and "Two Shaft Gas Turbine simulators".



Single Shaft Gas Turbine Simulator



Two Shaft Gas Turbine

Course Coordinator

Mari Nakintu, Tel: +971 2 30 91 714, Email: mari1@haward.org