COURSE OVERVIEW PE1060
Combined Cycle Plant Modelling

Course Title
Combined Cycle Plant Modelling

Course Date/Venue
Session 1: June 29-July 03, 2025 /Tamra Meeting Room, Al Bandar Rotana Creek, Dubai, UAE
Session 2: November 02-06, 2025/Meeting Plus 9, City Centre Rotana, Doha, Qatar

Course Reference
PE1060

3.0 CEUs (30 PDHs) AWARD

H-STK© INCLUDED

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 Combined Cycle Plant Modelling. It covers the combined cycle power plants (CCPPs), thermodynamic cycles in CCPPs and key components of CCPP; the performance parameters and efficiency metrics, plant layout and piping design basics and plant modelling tools; the gas turbine modelling, fuel system modelling, and heat recovery steam generator (HRSG) modelling, steam system modelling and auxiliary systems modelling; and the integration of GT and HRSG models covering heat transfer coupling, mass and energy balance check, boundary conditions and control links and effect of GT part-load on HRSG;

During this interactive course, participants will learn the steam turbine modelling, condenser and deaerator modelling and balance of plant (BOP) integration; the plant-wide control strategies, energy and exergy analysis and dynamic modelling fundamentals; the load change and grid response, model calibration and validation and heat integration and optimization; the environmental performance, emissions and NOx and CO2 modelling; the selective catalytic reduction (SCR) modeling, water and air usage impacts and compliance with regulations; the fuel cost sensitivity, revenue from power sales, O&M cost modeling and payback and NPV of upgrades; and the concept of digital twin for CCPP, integration with real-time sensors and predictive analytics for maintenance.

Course Objectives

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

- Apply and gain an in-depth knowledge on combined cycle plant modelling
- Discuss combined cycle power plants (CCPPs), thermodynamic cycles in CCPPs and key components of CCPP
- Identify performance parameters and efficiency metrics, plant layout and piping design basics and plant modelling tools
- Recognize gas turbine modelling, fuel system modelling, heat recovery steam generator (HRSG) modelling, steam system modelling and auxiliary systems modelling
- Carryout integration of GT and HRSG models covering heat transfer coupling, mass and energy balance check, boundary conditions and control links and effect of GT part-load on HRSG
- Illustrate steam turbine modelling, condenser and deaerator modelling and balance of plant (BOP) integration
- Carryout plant-wide control strategies, energy and exergy analysis and dynamic modelling fundamentals
- Apply load change and grid response, model calibration and validation as well as heat integration and optimization
- Interpret environmental performance and emissions covering NOx and CO2 modelling, selective catalytic reduction (SCR) modeling, water and air usage impacts and compliance with regulations
- Discuss fuel cost sensitivity, revenue from power sales, O&M cost modeling and payback and NPV of upgrades
- Recognize the concept of digital twin for CCPP, integration with real-time sensors and predictive analytics for maintenance

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 combined cycle plant modelling for power plant engineers, design and project engineers, energy analysts and performance engineers, operations and maintenance (O&M) personnel, consultants and EPC contractors, regulatory and planning authorities and other technical staff.

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

Haward's 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**. Haward's certificates are internationally recognized and accredited by the British Accreditation Council (BAC). 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:

Mr. Manuel Dalas, PEng, MSc, BSc, is a **Senior Process Engineer** with almost **30 years** of industrial experience within the **Oil & Gas**, **Refinery**, **Petrochemical** and **Refinery** industries. His expertise widely includes in the areas of **Process Plant** Troubleshooting & Engineering Problem Solving, **Process Plant** Operations, **Mass & Material Balance**, **Oil & Gas Processing**, **Process Plant** Performance & Efficiency, **Process Engineering & Systems Failure** Analysis, **Equipment & Mechanical Integrity**, **Process Failure** Prevention, **Engineering Modifications & Systems Failures**, Root Cause Failure Analysis (**RCFA**) Techniques, **Methodology Selection** based on Specific Scenarios, **Process Plant** Optimization, **Revamping & Debottlenecking**, **Crude Distillation** Process Saturated Gas Process Technology, **Crude Dehydration & Desalting**, **Crude** Stabilization Operations, **Heat Exchangers & Fired Heaters** Operation & Troubleshooting, **Pressure Vessels** Maintenance & Operation, **Piping Support**, **Ironworks**, **Rotating & Static Equipment** (**Pumps**, **Valves**, **Boilers**, **Pressure Vessels**, **Tanks**, **Bearings**, **Compressors**, **Pipelines**, **Motors**, **Turbines**, **Gears**, **Seals**), **Hydrogen Sulphide Stripping**, **Crude Oil De Salting** Process, **Gas Conditioning**, **NGL Recovery & NGL Fractionation**, **Flare** Systems, Pre-Fabrication of **Steel Structure**, Alloy Piping Pre-Fabrication, **Vertical Columns/Pressure Vessels**, **Distillation Column**, **Steel Structures**, **Construction** Management, **Building** Structures and **Electrical-Mechanical Equipment**. Currently, he is the **Technical Consultant** of the **Association of Local Authorities** of **Greater Thessaloniki** wherein he oversees mechanical engineering services while focusing on system reviews and improvements. His role involves a strategic approach to enhancing operational efficiencies and implementing robust solutions in complex engineering environments.

During his career life, Mr. Dalas has gained his practical and field experience through his various significant positions and dedication as the **Technical Manager**, **Construction Manager**, **Senior Process Engineer**, **Process Safety Engineer**, **Process Design Engineer**, **Project Engineer**, **Production Engineer**, **Construction Engineer**, **Consultant Engineer**, **Technical Consultant**, **Safety Engineer**, **Mechanical Engineer**, **External Collaborator**, **Deputy Officer** and **Senior Instructor/Trainer** for various companies including the Alpha Astika, Anamorfosis Technical Firm, EKME, ASTE, Elof Consulting and Hypergroup.

Mr. Dalas is a **Registered Professional Engineer** and has a **Master's** degree in **Energy System** from the **International Hellenic University** and a **Bachelor's** degree in **Mechanical Engineering** from the **Mechanical Engineering Technical University**, **Greece** along with a **Diploma** in **Management & Production Engineering** from the **Technical University** of **Crete**. Further, he is a **Certified Internal Verifier/Assessor/Trainer** by the **Institute of Leadership and Management** (**ILM**), a **Certified Project Manager Professional** (**PMI-PMP**), a **Certified Instructor/Trainer**, a **Certified Energy Auditor** for **Buildings**, **Heating & Climate Systems**, a **Member** of the **Hellenic Valuation Institute** and the **Association of Greek Valuers** and a **Licensed Expert Valuer Consultant** of the **Ministry of Development and Competitiveness**. He has further delivered numerous trainings, courses, seminars, conferences and workshops internationally.

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.

Accommodation

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

Course Fee

Dubai	**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.
Doha	**US$ 6,000** per Delegate. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

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	***Introduction to Combined Cycle Power Plants (CCPPs)*** *Configuration and Operating Principles • Comparison with Simple Cycle Plants • Advantages in Efficiency and Emissions • Applications in Modern Power Systems*
0930 – 0945	*Break*
0945 – 1030	***Thermodynamic Cycles in CCPPs*** *Brayton Cycle Overview (Gas Turbine) • Rankine Cycle Overview (Steam Turbine) • Cycle Integration Strategies • Energy Flow and Heat Recovery Concepts*
1030 – 1130	***Key Components of CCPP*** *Gas Turbine (GT) Types and Characteristics • Heat Recovery Steam Generator (HRSG) • Steam Turbine Stages • Condensers and Auxiliary Systems*
1130 – 1215	***Performance Parameters & Efficiency Metrics*** *Thermal Efficiency Calculations • Heat Rate and Specific Fuel Consumption • Power Output Balance (GT vs ST) • Loss Analysis and Sankey Diagrams*

1215 – 1230	Break
1230 – 1330	***Plant Layout and Piping Design Basics*** *One-Line Diagrams and PFDs • Integration of GT, HRSG, ST • Main and Auxiliary Piping Arrangements • Flow and Pressure Considerations*
1330 – 1420	***Basics of Plant Modelling Tools*** *Overview of Simulation Platforms (EBSILON, Aspen HYSYS, GateCycle, Thermoflex) • Selection Criteria for Modeling Tools • Model Setup Principles • Data Requirements and Standard Inputs*
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	***Gas Turbine Modelling*** *Compressor and Turbine Stage Modeling • Combustion Chamber Dynamics • GT Performance Maps • Ambient Temperature and Load Effects*
0830 – 0930	***Fuel System Modelling*** *Natural Gas Composition and Flow Control • Fuel Heating and Pressurization • Combustion Efficiency • Emissions Modeling*
0930 – 0945	*Break*
0945 – 1100	***Heat Recovery Steam Generator (HRSG) Modelling*** *Water/Steam Circuits • Heat Exchange Surface Configurations • Pinch Point and Approach Temperature • Pressure Drop and Fouling Effects*
1100 – 1215	***Steam System Modelling (Low/Mid/High Pressure)*** *Pressure Staging and Turbine Matching • Control Valves and Desuperheaters • Drum vs Once-Through Designs • Steam Quality and Moisture Concerns*
1215 – 1230	*Break*
1230 – 1330	***Auxiliary Systems Modelling*** *Cooling Water Systems • Lube Oil and Seal Oil Systems • Compressed Air and Fuel Handling • Instrumentation Systems*
1330 – 1420	***Integration of GT & HRSG Models*** *Heat Transfer Coupling • Mass and Energy Balance Check • Boundary Conditions and Control Links • Effect of GT Part-Load on HRSG*
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	***Steam Turbine Modelling*** *Expansion Stages (HP, IP, LP) • Isentropic Efficiency Calculations • Extraction Steam Modelling • Moisture Content Limits*
0830 – 0930	***Condenser & Deaerator Modelling*** *Surface and Ejector Type Condensers • Vacuum System and Pressure Dynamics • Deaeration Process and Control • Heat Exchange Performance*
0930 – 0945	*Break*
0945 – 1100	***Balance of Plant (BOP) Integration*** *Pumps and Fans • Cooling Towers and Air-Cooled Condensers • Feedwater*

	Heaters and Economizers • Electrical Generators and Switchgear
1100 – 1215	***Plant-Wide Control Strategies*** *Load-Following and Base-Load Operation • GT-ST Coordination • Pressure and Temperature Control Loops • Alarm and Trip Logic*
1215 – 1230	*Break*
1230 – 1330	***Energy & Exergy Analysis*** *First and Second Law Assessments • Component-Wise Exergy Destruction • Exergy Efficiency Improvement Scope • Integration with Economic Performance*
1330 – 1420	***Case Study: Steady-State Model Implementation*** *Define Assumptions and Boundary Conditions • Build Steady-State Model Using Software • Validate Model with Design Data • Sensitivity Analysis*
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	***Dynamic Modelling Fundamentals*** *Transient vs Steady-State Modeling • Importance of Dynamic Models • Time Steps and Solver Options • Dynamic Boundary Conditions*
0830 – 0930	***Startup & Shutdown Simulation*** *Cold, Warm, and Hot Startup Models • Ramp-Up/Down Logic • Thermal Stresses and Transient Behavior • Emissions During Startup*
0930 – 0945	*Break*
0945 – 1100	***Load Change & Grid Response*** *Frequency Control Requirements • Inertia and Governor Action • Fast Load Changes and Limitations • GT/HRSG Ramp Coordination*
1100 – 1215	***Fault & Emergency Scenarios*** *Simulation of Turbine Trip • HRSG Tube Rupture • Loss of Feedwater or Fuel • System Protection Response*
1215 – 1230	*Break*
1230 – 1330	***Model Calibration & Validation*** *Comparison with Plant Historical Data • Error Analysis and Tuning Methods • Iterative Refinement Process • Reporting Accuracy and Uncertainty*
1330 – 1420	***Hands-On Simulation Exercises*** *Build Dynamic Model in Chosen Software • Simulate 3 Operating Scenarios • Analyze and Interpret Outputs • Document Simulation Result*
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*

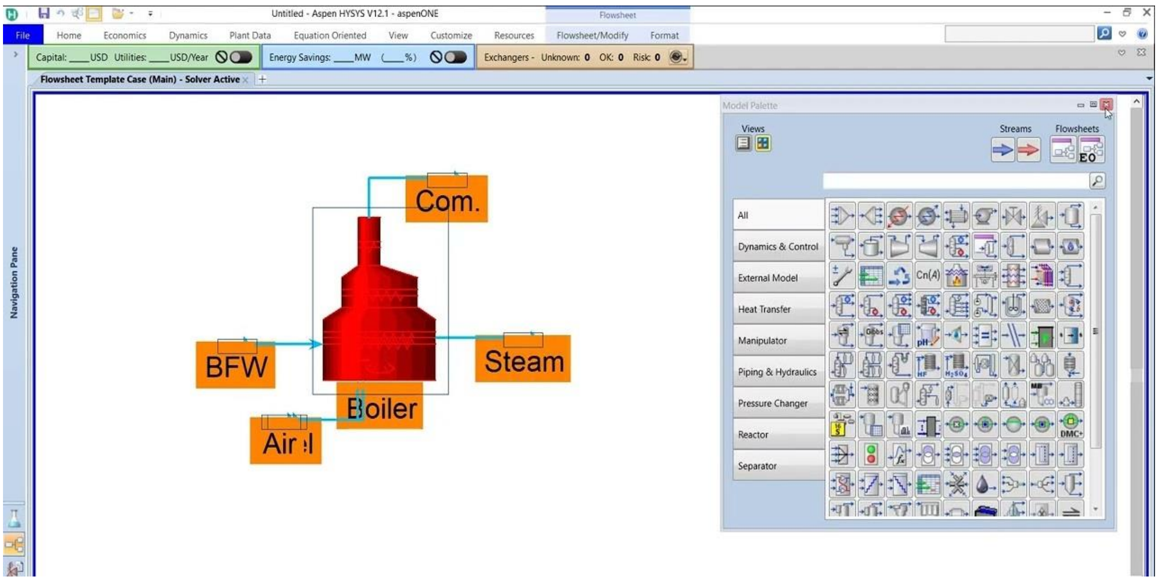
Day 5

0730 – 0830	***Heat Integration & Optimization*** *Combined Heat and Power (CHP) Modelling • Pinch Analysis for Heat Recovery • Multi-Objective Optimization (Efficiency vs Cost) • Thermal Energy Storage Considerations*
0830 – 0930	***Environmental Performance & Emissions*** *NOx and CO2 Modelling • Selective Catalytic Reduction (SCR) Modeling • Water and Air Usage Impacts • Compliance with Regulations*

0930 – 0945	*Break*
0945 – 1100	***Economic & Financial Modelling*** *Fuel Cost Sensitivity • Revenue from Power Sales • O&M Cost Modeling • Payback and NPV of Upgrades*
1100 – 1230	***Digital Twin & Predictive Modelling*** *Concept of Digital Twin for CCPP • Integration with Real-Time Sensors • Predictive Analytics for Maintenance • Software Architecture Overview*
1230 – 1245	*Break*
1245 – 1345	***Troubleshooting & Case Studies*** *Common Modeling Pitfalls • Troubleshooting Convergence Issues • Real-World Problem Examples • Plant Optimization Recommendations*
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 state-of-the-art simulators "ASPEN HYSYS" simulator.



ASPEN HYSYS V12.1 Simulator

Course Coordinator

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