COURSE OVERVIEW PE0865
Gas Compression & Expansion
Compressors & Turbines Certification

Course Title

Gas Compression & Expansion: Compressors & Turbines Certification

Course Date/Venue

Session 2: January 12-16, 2025/Boardroom 1, Elite Byblos Hotel Al Barsha, Sheikh Zayed Road, Dubai, UAE

Session 2: September 14-18, 2024/Al Khobar Meeting Room, Hilton Garden Inn, Al Khobar, KSA

Course Reference

PE0865

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 gas compression and expansion. It covers the turbomachinery and fluid basics; the ideal gas law and practical application covering isentropic, polytropic compression, mass and volume capacity; the practical compression laws on discharge temperature and power of compression; the velocities triangle comprising of impulse, reaction and type of blades; and the classifications, types, basic characteristics, applications and standards of compressors.

This course will also discuss the theory of operation and applications of centrifugal compressors; the primary centrifugal compressor elements, impeller types, splitter, diffuser and volute design exploration; the applications, theory of operation, design, main components and functional description of axial compressions; and the surge and surge protection, IGV and valves.

During this interactive course, participants will learn the principle of operation and components of dry gas seals; the seal support systems, API 682 reference guide and gas barriers seal technology; the compressors operation and control; the compressors failure mechanisms; the major components and functional description of gas and steam turbines including its operation and control, failure mechanisms, failure modes, maintenance and troubleshooting; and the lube oil system, hydraulic oil system, couplings and bearings.

Course Objectives

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

- Apply and gain a comprehensive knowledge on gas compression and expansion
- Discuss turbomachinery and fluid basics
- Identify the ideal gas law and practical application covering isentropic, polytropic compression, mass and volume capacity
- Apply practical compression laws on discharge temperature and power of compression
- Illustrate velocities triangle comprising of impulse, reaction and type of blades
- Discuss compressors covering classifications, types, basic characteristics, applications and standards
- Explain theory of operation and applications of centrifugal compressors
- Recognize the primary centrifugal compressor elements, impeller types, splitter, diffuser and volute design exploration
- Identify the applications, theory of operation, design, main components and functional description of axial compressors
- Discuss surge and surge protection, IGV and valves
- Recognize the principle of operation and components of dry gas seals
- Determine seal support systems, API 682 reference guide and gas barriers seal technology
- Employ compressors operation and control as well as compressors failure mechanisms
- Identify gas turbines major components and their functional description
- Carryout gas turbines operation and control, gas turbines failure mechanisms, failure modes, maintenance and troubleshooting
- Discuss steam turbines major components and their functional description
- Illustrate steam turbines operation and control and steam turbines failure mechanisms
- Recognize lube oil system, hydraulic oil system, couplings and bearings

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, sample video clips of the instructor's actual lectures & practical sessions during the course conveniently saved in a **Tablet PC**.*

Who Should Attend

This course provides an overview of all significant aspects and considerations of gas compression for process engineers and mechanical engineers working in the petroleum and petrochemical industry, plant supervisors, senior gas engineers, gas compressor engineers and designers, compression equipment sales engineers and fresh graduate engineers with petroleum and industrial engineering degrees. The course is a must for all technical staff working in gas plant and natural gas feedstock function.

Training Methodology

This interactive training course includes the following training methodologies as a percentage of the total tuition hours:-

30% Lectures
20% Workshops & Work Presentations
30% Case Studies & Practical Exercises
20% Software, Simulators & Videos

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

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
Al Khobar	**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.

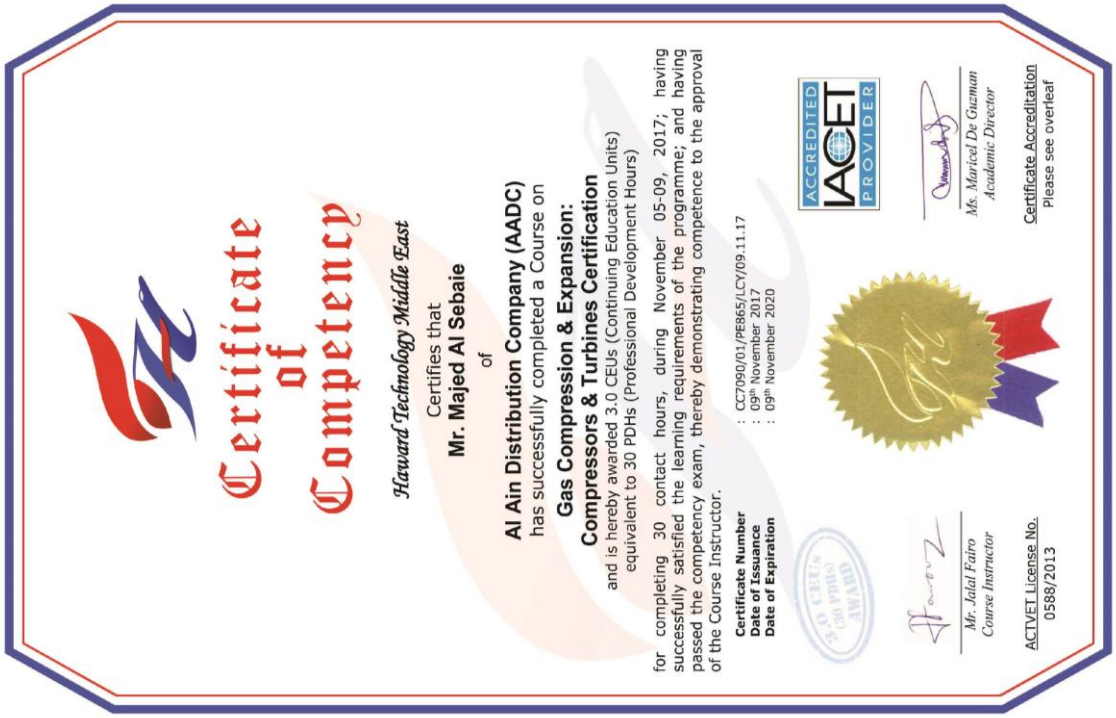
Course Certificate(s)

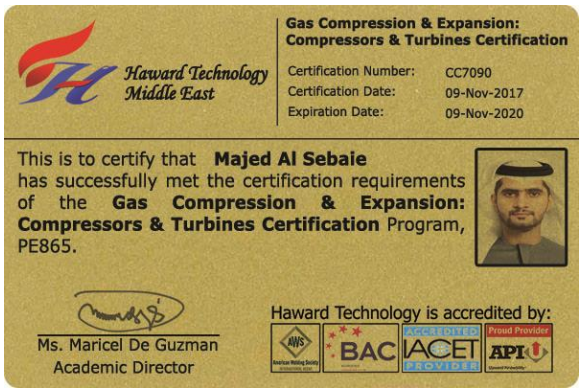
(1) Internationally recognized Wall Competency Certificates and Plastic Wallet Card Certificates will be issued to participants who completed a minimum of 80% of the total tuition hours and successfully passed the exam at the end of the course. Certificates are valid for 5 years.

Recertification is FOC for a Lifetime.

Sample of Certificates

The following are samples of the certificates that will be awarded to course participants:-





(2) Official Transcript of Records will be provided to the successful delegates with the equivalent number of ANSI/IACET accredited Continuing Education Units (CEUs) earned during the course.

* Haward Technology * CEUs * Haward Technology * CEUs * Haward Technology * CEUs * Haward Technology *

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Haward Technology Middle East

Continuing Professional Development (HTME-CPD)

CEU Official Transcript of Records

TOR Issuance Date: 09-Nov-17

HTME No. PAR25217

Participant Name: Majed Al Sebaie

Program Ref.	Program Title	Program Date	No. of Contact Hours	CEU's
PE865	**Gas Compression & Expansion: Compressors & Turbines Certification**	November 05-09, 2017	30	3.0

Total No. of CEU's Earned as of TOR Issuance Date **3.0**

TRUE COPY

Maricel De Guzman
Academic Director

Haward Technology has been approved as an Authorized Provider by the International Association for Continuing Education and Training (IACET), 1760 Old Meadow Road, Suite 500, McLean, VA 22102, USA. In obtaining this approval, Haward Technology has demonstrated that it complies with the ANSI/IACET 1-2013 Standard which is widely recognized as the standard of good practice internationally. As a result of their Authorized Provider membership status, Haward Technology is authorized to offer IACET CEUs for programs that qualify under the ANSI/IACET 1-2013 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 Association 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 is accredited by

P.O. Box 26070, Abu Dhabi, United Arab Emirates | Tel.: +971 2 3091 714 | Fax: +971 2 3091 716 | E-mail: info@haward.org | Website: www.haward.org

Certificate Accreditations

Certificates are accredited by the following international accreditation organizations: -

- 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.

- 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.

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. Karl Thanasis (**Athanasios Karalis**), PEng, MSc, MBA, BSc, is a **Senior Process & Mechanical Engineer** with **45 years** of extensive industrial experience within the **Oil & Gas**, **Refinery** and **Petrochemical** industries. His wide expertise includes **Control Valve** Maintenance & Testing, Advanced **Operational Skills**, **Process Equipment** Design & Troubleshooting, **Process Plant** Optimization & Continuous Improvement, **Production Process** Optimization, **Operations Planning** Optimization, **Process Equipment** Design, **Process Plant** Performance & Efficiency, **Process** Integration & Optimization, Root Cause Analysis (**RCA**) Methods, **Root Cause Analysis**, **Process Equipment & Piping** System, **Rotating Equipment Reliability** Optimization & Continuous Improvement, **Material Cataloguing**, **Mechanical & Rotating Equipment** Troubleshooting & Maintenance, **Rotating Equipment** for Process Industry, **Rotating Machinery** Best Practices, **Centrifugal Pumps** Operation, **Positive Displacement Pumps** Repair, **Pump** Maintenance & Troubleshooting, **Pressure Vessels**, **Heat Exchanger** Maintenance & Repair, **Heat Exchanger** Inspection & Troubleshooting, **Fin-fan Coolers**, Fundamentals of **Engineering Drawings**, **Codes & Standards**, **P&ID Reading Interpretation & Developing**, **Boiler Design**, **Boiler** Inspection & Maintenance, **Boiler** Operation & Control, **Boiler** Troubleshooting & Inspection, **Boiler Instrumentation & Control**, **Steam Boiler** Maintenance, **Boiler & Steam Generation System**, **Boiler** Failure Analysis & Prevention, **Boiler** Burner Management, **Boiler** Water Treatment Technology, **Machinery Failure Analysis**, **Preventive & Predictive Maintenance**, **Condition Monitoring**, Root Cause Analysis (**RCA**), Root Cause Failure Analysis (**RCFA**), Reliability Centred Maintenance (**RCM**), Risk Base Inspection (**RBI**), **Metallurgical Failure Analysis**, **Corrosion Failure Analysis**, **Steam Generation**, **Steam Turbines**, **Power Generator Plants**, **Gas Turbines**, **Combined Cycle Plants**, **Boilers**, **Process Fired Heaters**, Air Preheaters, Induced Draft Fans, All Heaters Piping Work, Refractory Casting, Heater Fabrication, Thermal & Fired Heater Design, Heat Transfer, Coolers, **Pumps**, Turbo-Generator, Turbine **Shaft Alignment**, **Lubrication**, **Mechanical Seals**, **Packing**, **Blowers**, **Bearings**, **Couplings**, **Clutches** and **Gears**. Further, he is also versed in **Wastewater Treatment Technology**, **Networking System**, **Water Network Design**, **Industrial Water Treatment** in Refineries & Petrochemical Plants, **Piping System**, **Water Movement**, **Water Filtering**, **Mud Pumping**, **Sludge Treatment** and **Drying**, **Aerobic Process** of **Water Treatment** that includes **Aeration**, **Sedimentation** and **Chlorination Tanks**. His strong background also includes **Design** and **Sizing** of all **Waste Water Treatment Plant Associated Equipment** such as **Sludge Pumps**, **Filters**, **Metering Pumps**, **Aerators** and **Sludge Decanters**.

Mr. Thanasis has acquired his thorough and practical experience as the **Project Manager**, **Plant Manager**, **Area Manager**, **Maintenance Manager**, **Engineering Manager**, **Technical Consultant & Trainer**, **Head of Capital Projects**, **Refractory Specialist**, **Construction Superintendent**, **Maintenance Supervisor**, **Project Engineer**, **Maintenance Engineer** and **Thermal Design Engineer** of various companies worldwide in the **USA**, **Germany**, **England** and **Greece**.

Mr. Thanasis is a **Registered Professional Engineer** in the **USA** and **Greece** and has **Master's** and **Bachelor's** degree in **Mechanical Engineering** with **Honours** from the **Purdue University** and **Southern Illinois University** (**USA**) respectively as well as an **MBA** from the **University of Phoenix** (**USA**). Further, he is a **Certified Instructor/Trainer**, **Certified Internal Verifier/Trainer/Assessor** by the **Institute of Leadership & Management** (**ILM**), a member of the **American Society of Heating, Refrigeration and Air-Conditioning Engineers** and delivered various trainings, courses, seminars and workshops worldwide.

Course Program

The following program is planned for this course. However, the course instructor(s) may modify this program before or during the course 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 – 0900	***Introduction to Turbomachinery & Fluid Basics***
0900 – 0930	***Ideal Gas Law & Practical Application*** *Isentropic • Polytropic Compression • Mass • Volume Capacity*
0930 – 0945	*Break*
0945 – 1100	***Practical Compression Laws*** *Discharge Temperature • Power of Compression*
1100 – 1215	***Velocities Triangle*** *Impulse • Reaction • Type of Blades*
1215 – 1230	*Break*
1230 – 1330	***Compressors Overview*** *Introduction to Compressors • Classifications, Types, Basic Characteristics of Compressor Types, Applications & Standards • Illustrating Video*
1330 – 1400	***Centrifugal Compressors*** *Theory of Operation & Applications • Primary Centrifugal Compressor Elements, Impeller Types, Splitter, Diffuser & Volute Design Exploration • Multistage Compressor Design Considerations • Illustrating Video*
1400 – 1420	***Discussion & Exercises***
1420 – 1430	***Recap***
1430	*Lunch & End of Day One*

Day 2

0730 – 0900	***Axial Compressors*** *Applications & Theory of Operation • Axial Compressors Design, Main Components & Functional Description • Surge & Surge Protection, IGV & Valves • Illustrating Video*
0900 – 0930	***Compressors Shaft Seals*** *Dry Gas Seals Principle of Operation & Components • Seal Support Systems (Dual Sealing Systems & Flushing Plans) • API 682 Reference Guide • Gas Barrier Seal Technology • Illustrating Video*
0930 – 0945	*Break*
0945 – 1100	***Compressors Operation & Control***
1100 – 1215	***Compressors Failure Mechanisms*** *Failure Modes • Maintenance • Troubleshooting*
1215 – 1230	*Break*
1230 – 1420	***Discussion & Exercises***
1420 – 1430	***Recap***
1430	*Lunch & End of Day Two*

Day 3

0730 – 0900	***Gas Turbines Overview*** *Introduction to Gas Turbines • Cycles • Classifications • Applications • Factors Affecting GTs Performance • Key Terms • Designation • Gas Turbines Standards • Illustrating Video*
0900 – 0930	***Gas Turbines Major Components & their Functional Description*** *Combustors Design, Arrangement, Main Components, Functional Description & Combustion Process • Power Turbines Design, Components, Function Description & Operation*
0930 – 0945	*Break*
0945 – 1100	***Gas Turbines Operation & Control***
1100 – 1215	***Gas Turbines Failure Mechanisms, Failure Modes, Maintenance & Troubleshooting***
1215 – 1230	*Break*
1230 – 1420	***Discussion & Exercises***
1420 – 1430	***Recap***
1430	*Lunch & End of Day Three*

Day 4

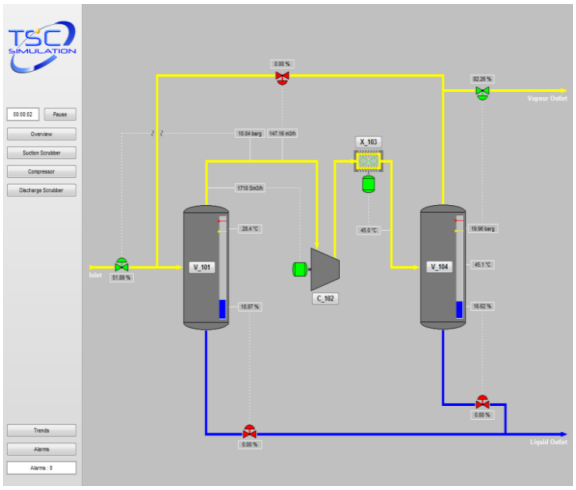
0730 – 0930	***Steam Turbines Overview***
0930 – 0945	*Break*
0945 – 1100	***Steam Turbines Major Components & their Functional Description***
1100 – 1215	***Steam Turbines Operation & Control***
1215 – 1230	*Break*
1230 – 1420	***Steam Turbines Failure Mechanisms*** *Failure Modes • Maintenance • Troubleshooting*
1420 – 1430	***Recap***
1430	*Lunch & End of Day Four*

Day 5

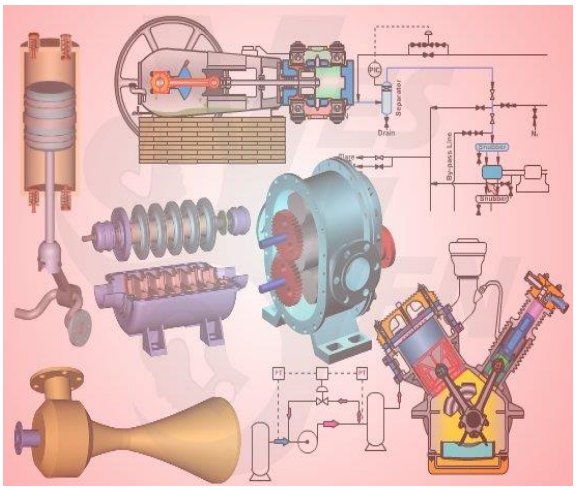
0730 – 0930	***Lube Oil System*** *Functional Description • Components • Failure Modes • Lube Oil Properties • Testing • Sampling*
0930 – 0945	*Break*
0945 – 1100	***Hydraulic Oil System*** *Functional Description • Components*
1100 – 1215	***Couplings*** *Functional Description • Components • Failure Mechanisms • Failure Modes • Maintenance • Troubleshooting*
1215 – 1230	*Break*
1230 – 1300	***Bearings*** *Hydrodynamic Bearing • Design • Theory of Operation • Failure Mechanisms • Failure Modes • Maintenance • Troubleshooting*
1300 – 1315	***Course Conclusion***
1315 – 1415	***COMPETENCY EXAM***
1415 – 1430	*Presentation of Course Certificates*
1430	*Lunch & End of Course*

Simulator (Hands-on Practical Sessions)

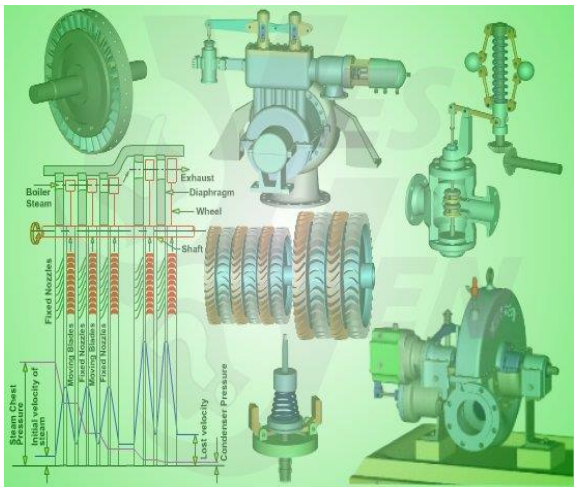
Practical session will be organized during the course for delegates to practice the theory learnt. Delegates will be provided with an opportunity to carryout various exercises using the state-of-the-art simulators “SIM 3300 Centrifugal Compressor”, “CBT on Compressors” and “Steam Turbines & Governing System CBT” “Single Shaft Gas Turbine Simulator”, “Two Shaft Gas Turbine Simulator” and “ASPEN HYSYS” simulator.



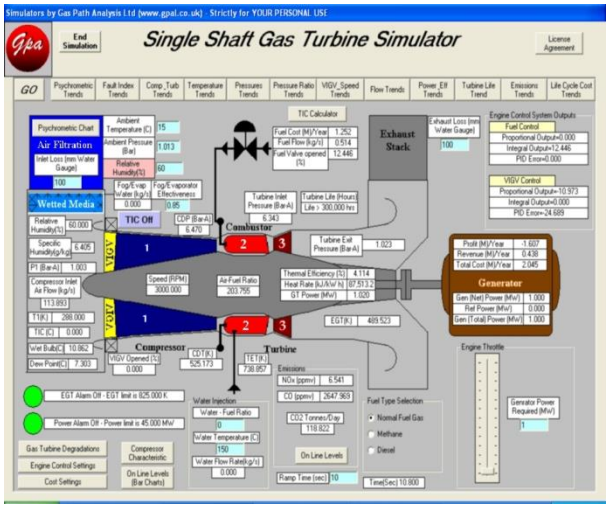
SIM 3300 Centrifugal Compressor Simulator



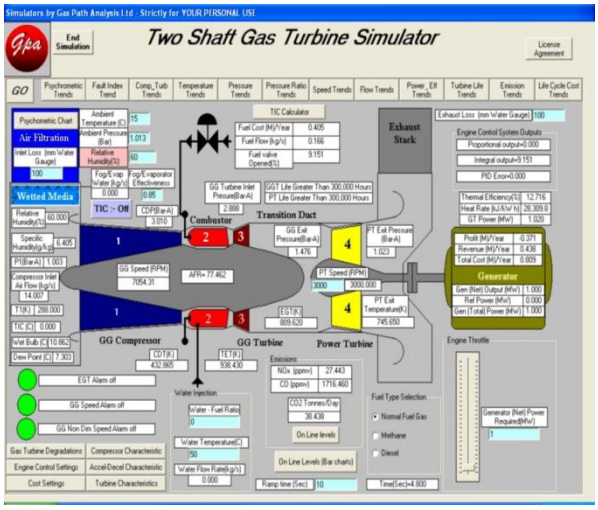
CBT on Compressors



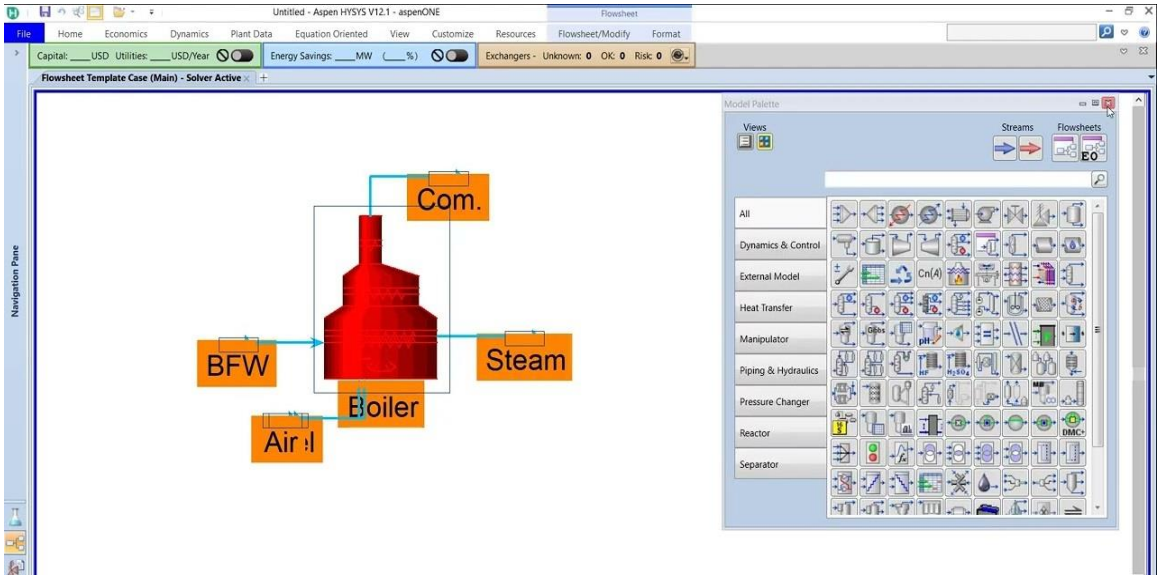
Steam Turbines & Governing System CBT



Single Shaft Gas Turbine Simulator



Two Shaft Gas Turbine Simulator



ASPEN HYSYS V12.1 Simulator

Course Coordinator

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