# COURSE OVERVIEW ME0180
# Boiler & Steam System Management
*Performance, Efficiency, Troubleshooting, Tune-Up, Heat Recovery & Optimization*

**Course Title**
Boiler & Steam System Management: *Performance, Efficiency, Troubleshooting, Tune-Up, Heat Recovery & Optimization*


**Course Date/Venue**
February 01-05, 2026/TBA Meeting Room, Dusit D2 Salwa, Doha, Qatar

**Course Reference**
ME0180

**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 Boiler & Steam System Management: Performance, Efficiency, Troubleshooting, Tune-Up, Heat Recovery & Optimization. It covers the boiler types, design and operating principles, boiler components and steam system layout; the combustion fundamentals, fuel characteristics and boiler performance indicators and KPIs; the steam properties and thermodynamics and common boiler operational challenges; the boiler efficiency measurement methods; and the major boiler heat losses covering dry flue gas losses, moisture and hydrogen losses, radiation and convection losses and blowdown heat losses.

Further, the course will also discuss the combustion air and draft system optimization, burner operation, flame characteristics, flue gas analysis and performance diagnosis; the energy efficiency improvement opportunities and steam distribution system design and losses; the proper selection, operation and maintenance of steam traps; the condensate recovery, feedwater management and boiler blowdown management; the economizers and waste heat recovery and advanced heat recovery options; and the boiler operational troubleshooting.

During this interactive course, participants will learn the water-side problems, chemistry control and fire-side problems and inspection; the boiler tube failures, root causes, boiler safety systems and interlocks; the preventive and predictive maintenance strategies, boiler tune-up procedures, integrated steam system optimization and advanced control and automation; the energy audits and performance benchmarking; and the environmental performance and emissions control.

## Course Objectives

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

- Apply and gain an in-depth knowledge on boiler and steam system management covering performance, efficiency, troubleshooting, tune-up, heat recovery and optimization
- Recognize boiler types, design and operating principles including boiler components and steam system layout
- Discuss combustion fundamentals, fuel characteristics and boiler performance indicators and KPIs
- Identify steam properties and thermodynamics and common boiler operational challenges
- Apply boiler efficiency measurement methods and identify major boiler heat losses covering dry flue gas losses, moisture and hydrogen losses, radiation and convection losses and blowdown heat losses
- Carryout combustion air and draft system optimization, burner operation and flame characteristics and flue gas analysis and performance diagnosis
- Discuss energy efficiency improvement opportunities and steam distribution system design and losses
- Apply proper selection, operation and maintenance of steam traps including condensate recovery and feedwater management and boiler blowdown management
- Illustarate economizers and waste heat recovery, advanced heat recovery options and boiler operational troubleshooting
- Recognize water-side problems and chemistry control, fire-side problems and inspection, boiler tube failures and root causes as well as boiler safety systems and interlocks
- Employ preventive and predictive maintenance strategies, boiler tune-up procedures, integrated steam system optimization and advanced control and automation
- Apply energy audits and performance benchmarking including environmental performance and emissions control

## 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 boiler and steam system management for facilities engineers, operating engineers, energy engineers, managers, supervisory personnel, designers, inspectors, consultants and other technical staff who are involved in the performance, efficiency, troubleshooting, tune-up, heat recovery and optimization of boiler and steam system. The course will provide a clear and refreshing examination of boilers and their systems. It covers a range from very large to small boiler systems and is not specifically oriented toward utility plants.

## 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. Karl Thanasis**, PEng, MSc, MBA, BSc, is **Senior Mechanical & Maintenance Engineer** with over **30 years** of extensive industrial experience. His wide expertise includes **Boiler** Inspection & Maintenance, **Boiler** Systems, **Boiler** instrumentation & Controls, **Boiler** Start-up & Shutdown, **Boiler** Operation & Steam System Management, **Piping & Pipeline**, Maintenance, Repair, **Shutdown**, **Turnaround & Outages**, **Maintenance & Reliability** Management, **Mechanical Maintenance** Planning, Scheduling & Work Control, Advanced Techniques in **Maintenance** Management, **Predictive & Preventive** Maintenance, **Maintenance & Operation Cost Reduction** Techniques, Reliability Centered Maintenance (**RCM**), **Machinery Failure** Analysis, **Rotating Equipment Reliability** Optimization & Continuous Improvement, **Material Cataloguing**, **Mechanical & Rotating Equipment** Troubleshooting & Maintenance, **Root Cause Analysis & Reliability** Improvement, **Condition** Monitoring, **Root Cause Failure Analysis** (RCFA), **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 Exchangers**, Heat Transfer, Coolers, **Power Plant** Performance, Efficiency & Optimization, **Storage Tank** Design & Fabrication, **Thermal Power Plant** Management, **Boiler & Steam** System Management, **Pump** Operation & Maintenance, **Chiller & Chiller Plant** Design & Installation, **Pressure Vessel**, **Safety Relief Valve** Sizing & Selection, **Valve** Disassembling & Repair, Pressure Relief Devices (**PSV**), **Hydraulic & Pneumatic** Maintenance, Advanced **Valve** Technology, **Pressure Vessel** Design & Fabrication, **Pumps**, Turbo-Generator, Turbine **Shaft Alignment**, **Lubrication**, Mechanical **Seals**, Packing, **Blowers**, **Bearing** Installation, **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 - Equipment Construction**, **Construction Superintendent**, **Project Engineer** and **Design Engineer**. His duties covered **Plant Preliminary Design**, **Plant Operation**, **Write-up** of **Capital Proposal**, **Investment Approval**, **Bid Evaluation**, **Technical Contract Write-up**, **Construction** and **Sub-contractor Follow up**, **Lab Analysis**, **Sludge Drying** and **Management** of **Sludge Odor** and **Removal**. He has worked in various companies worldwide in the **USA**, **Germany**, **England** and **Greece**.

Mr. Thanasis is a **Registered Professional Engineer** in the **USA** and **Greece** and has a **Master's** and **Bachelor's** degree in **Mechanical Engineering** with **Honours** from the **Purdue University** and **SIU** in **USA** respectively as well as an **MBA** from the **University of Phoenix** in **USA**. Further, he is a **Certified Internal Verifier/Trainer/Assessor** by the **Institute of Leadership & Management** (**ILM**) a **Certified Instructor/Trainer** and has delivered numerous trainings, courses, seminars, workshops and conferences worldwide.

## 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

**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:*** ***Sunday, 01st of February 2026***

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| *0730 – 0800* | *Registration & Coffee* |
| *0800 – 0815* | *Welcome & Introduction* |
| *0815 – 0830* | ***PRE-TEST*** |
| *0830 – 0930* | ***Boiler Types, Design & Operating Principles***<br>*Fire-Tube versus Water-Tube Boilers • Packaged Boilers versus Field-Erected Boilers • Natural versus Forced Circulation Systems • Pressure, Temperature, and Capacity Classifications* |
| *0930 – 0945* | *Break* |
| *0945 – 1030* | ***Boiler Components & Steam System Layout***<br>*Boiler Drum, Tubes, Headers and Furnace • Burners, Fans and Draft Systems • Steam Headers, Mains and Branch Lines • Condensate Return and Feedwater Systems* |
| *1030 – 1130* | ***Combustion Fundamentals & Fuel Characteristics***<br>*Combustion Chemistry and Stoichiometric Air • Fuel Types: Gas, Oil, Coal, Biomass • Excess Air and Flue Gas Composition • Impact of Fuel Quality on Performance* |
| *1130 – 1215* | ***Boiler Performance Indicators & KPIs***<br>*Boiler Efficiency Definitions and Types • Evaporation Ratio and Steam-to-Fuel Ratio • Heat Rate and Specific Fuel Consumption • Availability, Reliability and Load Factor* |
| *1215 – 1230* | *Break* |

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| *1230 – 1330* | ***Steam Properties & Thermodynamics***<br>*Saturated versus Superheated Steam • Pressure–Temperature Relationships • Enthalpy, Entropy, and Steam Tables • Practical Steam Calculations for Operators* |
| *1330 – 1420* | ***Common Boiler Operational Challenges***<br>*Load Variation and Cycling Problems • Low Efficiency Symptoms • Unstable Flame and Combustion Issues • Early Warning Signs of Poor Performance* |
| *1420 – 1430* | ***Recap***<br>*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:*** ***Monday, 02nd of February 2026***

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| *0730 – 0830* | ***Boiler Efficiency Measurement Methods***<br>*Direct (Input–Output) Method • Indirect (Heat Loss) Method • Comparison of Efficiency Methods • Field Efficiency Testing Practices* |
| *0830 – 0930* | ***Major Boiler Heat Losses***<br>*Dry Flue Gas Losses • Moisture and Hydrogen Losses • Radiation and Convection Losses • Blowdown Heat Losses* |
| *0930 – 0945* | *Break* |
| *0945 – 1100* | ***Combustion Air & Draft System Optimization***<br>*Forced, Induced and Balanced Draft • Air–Fuel Ratio Optimization • Impact of Excess Air on Efficiency • Fan Control and Damper Tuning* |
| *1100 – 1215* | ***Burner Operation & Flame Characteristics***<br>*Burner Types and Design Principles • Flame Stability and Shape Analysis • Ignition Systems and Safety Interlocks • Burner Adjustment and Tuning Basics* |
| *1215 – 1230* | *Break* |
| *1230 – 1330* | ***Flue Gas Analysis & Performance Diagnosis***<br>*$O_2$, $CO_2$, CO and NOx Measurement • Interpreting Flue Gas Analyzer Data • Combustion Efficiency Calculations • Identifying Incomplete Combustion* |
| *1330 – 1420* | ***Energy Efficiency Improvement Opportunities***<br>*Operational Best Practices • Load Matching and Turndown Optimization • Fuel Switching Considerations • Short-Term versus Long-Term Efficiency Gains* |
| *1420 – 1430* | ***Recap***<br>*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:*** ***Tuesday, 03rd of February 2026***

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| *0730 – 0830* | ***Steam Distribution System Design & Losses***<br>*Steam Piping Layout and Sizing • Pressure Drop and Velocity Limits • Steam Leakage Identification • Insulation Requirements and Heat Losses* |
| *0830 – 0930* | ***Steam Traps: Selection, Operation & Maintenance***<br>*Types of Steam Traps and Applications • Failure Modes: Open, Closed, Leaking • Trap Testing and Inspection Methods • Impact of Trap Failures on Efficiency* |
| *0930 – 0945* | *Break* |

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| *0945 – 1100* | ***Condensate Recovery & Feedwater Management***<br>*Benefits of Condensate Recovery • Condensate System Components • Flash Steam Recovery Principles • Water and Chemical Cost Savings* |
| *1100 – 1215* | ***Boiler Blowdown Management***<br>*Continuous versus Intermittent Blowdown • Blowdown Rate Optimization • Heat and Water Losses from Blowdown • Blowdown Heat Recovery Systems* |
| *1215 – 1230* | *Break* |
| *1230 – 1330* | ***Economizers & Waste Heat Recovery***<br>*Economizer Design and Operation • Feedwater Temperature Improvement • Flue Gas Temperature Reduction Limits • Corrosion and Fouling Considerations* |
| *1330 – 1420* | ***Advanced Heat Recovery Options***<br>*Air Preheaters • Condensing Economizers • Heat Recovery from Exhaust and Drains • Integration with Process Heating Systems* |
| *1420 – 1430* | ***Recap***<br>*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:*** ***Wednesday, 04th of February 2026***

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| *0730 – 0830* | ***Boiler Operational Troubleshooting***<br>*Low Steam Pressure Problems • Poor Load Response and Instability • Flame Failure and Trips • High Stack Temperature Diagnosis* |
| *0830 – 0930* | ***Water-Side Problems & Chemistry Control***<br>*Scale Formation and Heat Transfer Loss • Corrosion Mechanisms • Carryover and Foaming Issues • Boiler Water and Feedwater Chemistry Control* |
| *0930 – 0945* | *Break* |
| *0945 – 1100* | ***Fire-Side Problems & Inspection***<br>*Soot Formation and Fouling • Tube Overheating and Flame Impingement • Refractory Damage • Fire-Side Inspection Best Practices* |
| *1100 – 1215* | ***Boiler Tube Failures & Root Causes***<br>*Overheating and Creep Failures • Corrosion and Erosion Mechanisms • Thermal Stress and Fatigue • Failure Analysis and Prevention* |
| *1215 – 1230* | *Break* |
| *1230 – 1330* | ***Boiler Safety Systems & Interlocks***<br>*Pressure Relief Valves • Flame Scanners and Safety Trips • Low-Water Cutoff Systems • Operator Response to Emergencies* |
| *1330 – 1420* | ***Preventive & Predictive Maintenance Strategies***<br>*Inspection Planning and Scheduling • Condition Monitoring Techniques • Maintenance KPIs and Documentation • Reliability-Centered Maintenance (RCM)* |
| *1420 – 1430* | ***Recap***<br>*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: Thursday, 05th of February 2026**

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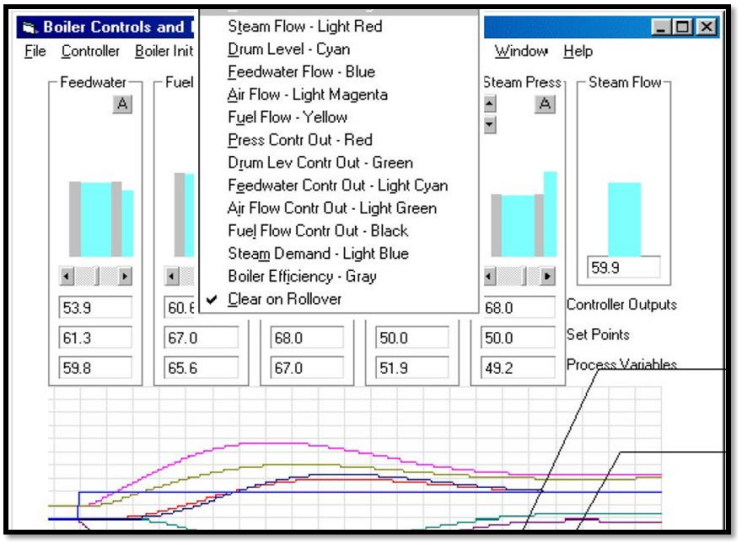
| 0730 – 0830 | ***Boiler Tune-up Procedures***<br>*Pre-Tune-up Inspection Checklist • Burner and Air Damper Adjustments • Fuel Valve Calibration • Post-Tune-Up Performance Verification* |
| 0830 – 0930 | ***Integrated Steam System Optimization***<br>*Boiler–Process Matching • Pressure Level Optimization • Demand-Side Management • Steam System Balancing* |
| 0930 – 0945 | *Break* |
| 0945 – 1100 | ***Advanced Control & Automation***<br>*Boiler Master Control Concepts • Oxygen Trim and Combustion Control • Variable Frequency Drives (VFDs) • Digital Monitoring and Analytics* |
| 1100 – 1215 | ***Energy Audits & Performance Benchmarking***<br>*Boiler and Steam System Energy Audits • Identifying Savings Opportunities • Performance Benchmarking Methods • Cost–Benefit Analysis of Improvements* |
| 1215 – 1230 | *Break* |
| 1230 – 1300 | ***Environmental Performance & Emissions Control***<br>*NOx, CO and Particulate Emissions • Combustion Optimization for Emissions Reduction • Regulatory Compliance Considerations • Sustainable Boiler Operation Strategies* |
| 1300 – 1345 | ***Best Practices, Case Studies & Action Planning***<br>*Industry Best Practices and Lessons Learned • Case Studies on Efficiency Improvement • Developing Site-Specific Action Plans • Continuous Improvement Roadmap* |
| 1345 – 1400 | ***Course Conclusion***<br>*Using this Course Overview, the Instructor(s) will Brief Participants about t 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)**

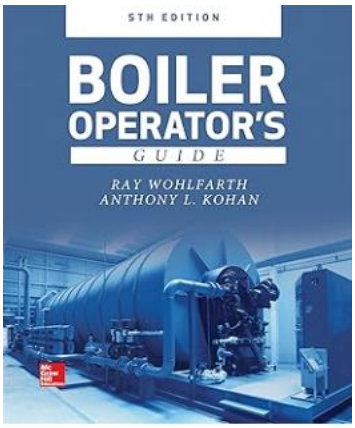
Practical session will be organized during the course for delegates to practice the theory learnt. Delegates will be provided with an opportunity to carryout various exercises using the simulator "Win Boiler Sim".




**Win Boiler Sim**

**Book(s)**

As part of the course kit, the following e-book will be given to all participants:




**Title** : Boiler Operator's Guide
**ISBN** : 978-1260026993
**Author** : Ray Wohlfarth and Anthony L. Kohan
**Publisher** : McGraw-Hill
**Pages** : 752 pages

**Course Coordinator**

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