COURSE TITLE

Combustion Technology for Steam Generators Course

Training Date:	As per schedule	**Training Venue:**	Kuala Lumpur, Malaysia.
Basic Fee:	RM4,600.00 + SST per participant (this includes course materials, meals, refreshment, and attendance certificate)		

DURATION

28 hours (Four (4) Days)

TARGET GROUP

O&M operators, Field engineers, Process engineers, Efficiency Engineers, Reliability Engineers

TARGETED INDUSTRY/INDUSTRIES

Oil & Gas, Petrochemicals, Power Plant, Refineries, Renewal Energy Plant, Co-Generation Plant and all industries that using fired machinery such as boilers, fired heaters and flares.

CERTIFICATION

This course can be certified for the Continuing Professional Development (CPD) Program by the Board of Engineers, Malaysia (BEM).

COURSE OVERVIEW

Broadly speaking, steam generators are static equipment that offer very little field adjustments for operator. Critical parameters like heating surfaces, tube pitching, flue gas passage sections etc. are all fixed before the boiler is put into operation.

If everything is already pre-fixed and static, how do operation engineers optimize and improve the performance of a steam generator? Do they have something to trim, adjust or tune to improve the overall system performance? Yes they do. They have the fuel burner system which provides scope for fine live settings and adjustments. That requires deep understanding and experience of the construction, configuration and working of burners. It is not wrong to say that burner troubleshooting and tuning is an art rather than a science.

Contrary to its static appearance, the burner is highly dynamic operating equipment; releasing millions of kilocalories of heat every hour by burning highly explosive fuel on a continuous basis. A well-tuned burner system can bring significant improvement of load response, stability and fuel efficiency of the boiler. Well-tuned fuel firing systems also contribute to control stack emissions. Effective combustion is key to several aspects including safety of plant and personnel, reliability of operating systems, optimization of fuel cost and compliance to emission regulation. Thus, operating profits for the plant depends heavily on the quality of combustion by the burner system.

This training module focuses on oil and gas burners and takes the audience through basic concepts of combustion and the way oil & gas burners can be continuously monitored to ensure their best performance levels.

COURSE OBJECTIVE

This course provides a deep concept of the combustion process and its application in boiler furnaces. This includes understanding of analyses and significance of each component of the fuel, initiation of ignition, flow dynamics and flame formation from liquid and gaseous fuels. Knowledge gained from this course will help manage real life problems occurring with fuel burners and improve plant reliability, efficiency and OPEX.

COURSE OUTCOMES

At the end of the course, the participants should be able to:

- Familiarize with different types of oil/ gas burners
- Understand principles of burner operation
- Understand combustion theory
- Apply knowledge for burner troubleshooting and technology upgrade projects

TRAINING METHODOLOGY

The course will use a combination of the following methods

- Lecture assisted by slide presentations, videos as required
- Classroom discussions (participants will be encouraged to share their experience and problems and try to find solutions for the benefit of all)
- Case studies

COURSE CONTENTS

Understanding of Fuels Suitable for Steam Generation

- Overview, History, Pros & Cons, Outlook
- Classification of fuels used for steam generation
- Challenges of fuel combustion in boiler furnaces

Principles of Combustion

- Understanding Flame as an entity
- Fuel burners and their features for adaptation to different fuels
- Liquid and Gaseous fuel burners for boiler/furnace application

Fuel Assessment, Handling, Preparation and Firing

- Assessment of fuels in relevance to combustion in boiler furnace
- Fuel preparation to meet safe and controlled combustion requirements
- Comparison between burners for fired boilers and HRSG supplementary firing
- Basic safeties in fuel handling, preparation and firing

Flame Formation, Propagation & Sustenance

- Distribution of fuel and combustion air in burners
- Air-fuel mixing: Importance and mechanism
- Flame ignition, formation, propagation & self-sustenance

Types of Burners and their Application

- Oil burners vs Gas burners
- Circular burners, STS burners for oil/ gas/ mixed firing in boilers
- Flat flame burners for reformers

Hazards of Fuel Combustion in Boilers

- Hazards & Protections required for burning fuels in boiler furnace
- Explosive Limits for gas and liquid fuels
- Mechanism of hazard mitigation
- NFPA-85 codes - overview

Flame Scanners

- Flame sighting as an important safety measure
- Placement of flame scanners in oil & gas burners
- Flame scanners – types, applications and selection based on fuels
- Safety features in flame scanners

Single vs Multi-burner Configurations – Concerns and Solutions

- Burner turndown, load swing, peak load and excess air capability
- Excess air – significance for safety, impact on combustion & thermal efficiency
- Flame impingement, clinker formation
- Shaping of flames for safe passage through furnace and for good heat distribution
- Clinker formation on burners and tubes – what is it? Causes and remedies
- Case Study – SH failure due to heat mal-distribution solved by burner flame shaping

Lox NOx Burners

- Mechanism of NOx and CO formation in oil & gas burners
- ABN, FBN, Air staging, FGR - overview
- Low NOx burners – concepts and applications
- NOx reduction systems – SCR, SNCR

Combustion Control System (CCS)

- Combustion control system - overview
- Parallel vs Lead-Lag combustion control
- Excess air control, Oxygen trim control
- Impact on emissions and quality of combustion

Combustion Efficiency vs Boiler Efficiency

- Appreciation of the two terms as different entities
- Parameters affecting combustion efficiency and boiler efficiency
- Measurement of efficiency, direct and indirect methods, ASME code
- Actionable points for improvement of combustion efficiency and boiler efficiency

Burner Management System

- BMS vs CCS
- Functions of BMS
- Safety Protection Logics and their rationale – Open Discussion
- Understanding of 3 circuits in boilers – steam-water, air-flue gas & fuel
- Relevance of BMS to the three boiler circuits
- 4 sections of BMS – purge control, start-up, operation & shut-down of burners
- Explanation of BMS logics in each section of BMS
- Important guidelines under NFPA-85 on configuration of instrumentation

Combustion of Solid Fuels – Brief Overview (Open Discussion)

- Comparison – solid fuels vs liquid & gas fuels
- Grate, fluidized bed, suspension firing (wall firing, tangential firing)
- Heat input – volumetric vs gravimetric feed measurement
- Issues with solid fuels used for steam generation

Self-Assessment test, discussion on test Q&A

BAYUBALI LEARNING SOLUTIONS

ABOUT THE INSTRUCTOR



Mr. Sanjay Jumde has been with the steam generator industry for 4 decades with seamless experience in engineering, commissioning, operation, trouble-shooting and improvement of boilers and HRSGs.

Throughout his career with best-in-industry boiler OEMs he has been an acclaimed trainer, coach and mentor for engineers and managers associated with steam generation & distribution. His training sessions are based on his own hands-on problem solving experiences not found in routine course books. He has delivered several lectures, seminars and webinars in the Asia Pacific region.

Broad Experience Profile:
Since graduation in engineering in 1981, he has accumulated hands-on field experience with top-in-industry organization viz; Bharat Heavy Electricals Ltd (India), Thermax Babcock & Wilcox Ltd (India), PETRONAS (Malaysia) and General Electric (Malaysia). His career began with engineering, commissioning, stabilization of large power utility and industrial boilers. Later he established a niche business of developing troubleshooting and improvisation solutions for steam generators of various capacities and configurations. Several boiler users in India and SE asia benefitted from this very specialised service.

Accreditations, Recognitions:

- Corporate Member of The Institution of Engineers (India)
- Chartered Engineer certified by The Institution of Engineers (India)
- Advisor Member of Boiler Community of Practice at PETRONAS (Malaysia)
- Member of Energy Loss Management and Value Improvement Program at PETRONAS
- Coach at Accelerated Career Development program for O&M staff at PETRONAS
- Technical guide for pre-acquisition co-ordination with APAC regional customers at GE

A few select papers authored & presented in seminars and webinars:

- 2-day online Webinar from India for Institution of Engineers (Malaysia) on “Fuels and Fuel Burners for Steam Generators” – Jul 2021
- 10-day GE customer training in boiler O&M to Cambodia Energy Ltd – May-June 2019
- Guest speaker on “Evolution of Ultra-Supercritical (USC) Steam Technology” at the Conference of the Electric Power Supply Industry (CEPSI) at Kuala Lumpur - Sep 2018
- Training programs on boilers at Doha (Qatar) for O&G companies in Qatar – 2011-2012
- Guest Speaker - “Best Practices in Plant Operation” held by PETRONAS - Feb 2010
- “Steam System Management & Improvement” for PETRONAS O&M - June 2008
- “Steam System Performance Monitoring in Complex Utility Plants” in PETRONAS Plant Managers’ Forum – April 2008
- “Superheater metal temperature balancing in large boilers - a case study” - June 2007
- “Fuel Firing System R&M in Steam Generators” Energy Conservation Conference, Mumbai Dec 2000. Awarded first prize and cash award based on audience rating
- “Steam Generator R&M Technology” at Boiler Congress 2001 at Chennai (India)
- “Steam Generator Renovation as a Business Proposition” at Boiler Engineering Technology (BET) Seminar at Cochin (India) - Nov 2004
- Lecture on boiler R&M at National Power Training Institute, Nagpur (India) – Nov 2003
- Speaker on “PIP- the answer to Asia’s Capital Cost/ Inefficiency Problems” at PowerGen Asia – Sept 1999 at Singapore