HRSG DESIGN, OPERATIONS & UNDERSTANDING, CONTROLLING of HRSG DAMAGE MECHANISMS

23 – 25 JUNE 2014, SINGAPORE

TOPICS COVERED

Deterioration of the HRSG - Overview
Waterside Mechanisms
Controlling Waterside Damage
HRSG Water Chemistry Programs
Fatigue Damage
Creep Degradation
Gas-side Fouling
Other Forms of Damage
Diagnosing Degradation Mechanisms
Case Histories

Expert Course Faculty Leader
James W. Malloy
About This Training Course

The course is primarily intended for O&M staff at all levels of experience working in combined cycle power plants, but should also be of interest to engineers and managers involved in new project development.

The 3 day course gives attendees a comprehensive yet in-depth survey of a broad range of topics relating to the design, operation and maintenance of the HRSG and certain directly associated steam-cycle systems.

Drawing on our extensive field experience working at more than 200 combined cycle power plants throughout the world, the objective is to provide attendees with clear instruction on the design features and operating issues that potentially impact HRSG reliability, efficiency and operating life.

3 Day Course Learning Outcome

- Gain a comprehensive understanding of the key systems and processes involved in the combined cycle power plant.
- Appreciate the key constraints and tradeoffs involved in designing an HRSG.
- Learn the water chemistry treatment options available for HRSG unit, their respective advantages and disadvantages.
- Get access to applied theory in real life situations through a series of worked case histories.

Who Should Attend

Engineers of all disciplines, managers, technicians, design, maintenance and operations personnel, and other technical individuals who need a comprehensive introduction to practical optimization, operation and design considerations of a major combined cycle power plant.

Unique Features with powerEDGE Training

- Pre-Course Questionnaire to help us focus on your learning objectives
- Detailed Course & Reference Manual for Continuous Learning and Sharing
- Practical Exercises & Case Examples to better understand the principles
- Limited class size to ensure One-to-One Interactivity
- Assessment at the end of the course to help you develop a Personal Action Plan
3 Day Course Outline

Day 1

Introduction
- Comparison of Different Boilers & Cycles
- HRSGs and Combined-Cycle Power Plants
- Other HRSG Applications

HRSG Design Basics
- Thermodynamics & Heat Transfer Review
- Natural and Forced Circulation
- Supplemental Firing
- Basic Construction Details
- Materials Used in Boiler Construction

HRSG Design Variations
- Types of HRSG
- Variations

Flow Path Descriptions
- Waterside Flow Paths
- Gas Side Flow Paths

Key Pressure Parts
- Preheaters & Economizers
- Evaporators
- Superheaters, Reheaters
- Drum and Deaerators
- Drains, Vents

Day 2

Others Components
- Attemperators, Key Valves
- Pipe Supports and Boiler Piping
- SCR and CO Catalysts
- Expansion Joints and Penetration Seals

Control and Instrumentation
- Drum Level
- Pressure and Temperature
- Attemperators
- Drains
- Emissions Control Systems

Day 3

Operations and Maintenance
- Operating Modes
- Impact of Cycling
- Standard Maintenance Activities
- Boiler Preservation
- Inspection Practice
- Life and Performance Monitoring
- Major Repairs and Design Modifications

Case Histories
- Inspections
- Failure Analyses
- Repairs

Day 3

Deterioration of the HRSG - Overview
- Mechanisms
- Location and Frequency
- Impact on Operation and Life

Waterside Mechanisms
- General Surface Corrosion
- Pitting
- Flow-Accelerated Corrosion (FAC)
- Erosion
- Corrosion Fatigue
- Underdeposit Attack

Controlling Waterside Damage
- Water Quality Parameters
- In-Boiler Chemistry
- Steam Purity

HRSG Water Chemistry Programs
- Volatile Treatments
- Phosphate Treatments
- Other Treatments
- Common Guidelines
Fatigue Damage
- Mechanism
- Fatigue Damage in the HRSG
- Calculating Fatigue Life
- Prevention

Creep Degradation
- Mechanism
- Interaction of Creep and Fatigue
- Creep Damage in the HRSG
- Calculating Creep Life

Gas-side Fouling
- Cold-End Corrosion
- Calculating Acid Dewpoint
- Prevention and Mitigation

Other Forms of Damage

Diagnosing Degradation Mechanisms
- Metallurgy and Chemical Analysis
- Effective Inspection Strategies
- Analytical Tools
- Root Cause Methodology

Case Histories

Your Expert Faculty – James W. Malloy

James is currently Director of European Operations of a leading engineering and inspection consultancy in the power generation sector. Activities are now concentrated on the steam cycle in combined cycle plants, but included projects for coal, oil, diesel and nuclear plants in the past. Areas of specialization are instrumentation and controls (I&C) as well as materials science.

CRE S.A., Sophia Antipolis, France
Lead Engineer, worked on the design and development of real-time systems for controlling diesel generators and turbines. One application involved the development of a complete monitoring system under subcontract to a major European diesel manufacturer, which was subsequently installed on a new black start diesel at a US nuclear plant.

Raytheon Company, Development Laboratory, Sudbury, MA. USA
Engineering and analyses to improve resistance of defense electronic systems to spatial environments and effects of nuclear radiation. This involved designing custom test circuitry and carrying out the tests at both Raytheon and US government facilities.

Combustion Engineering Inc., Nuclear Division, Windsor CT. USA
Worked in the design group responsible for the nuclear fuel reloading (enriched uranium) for the St Lucie 1 and BG&E Calvert Cliffs plants. Used radiation transport programs for simulating the physics of the reactor during a cycle.
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Courses Available

4 Pillars of Transformer Condition
Advanced Project Finance for Power
Advanced Technical Report Writing & Presentation Skills
Advanced Turnaround Shutdown & Outage Management
Ancillary Services in Competitive Electricity
Asset Management for the Power Industry
Best Practice Renewable Energy Capital & Project Management
Biomass Power Generation
CFB Combustion for Boiler Operations
Clean Development Mechanism and Carbon Markets
Coal Contracts
Combined Cycle Power Plants Operation
Combined Heat & Power (CHP) and Co-Generation Plant Operations
Competency Management System for the Power Industry
Design & Operations of Circulating Fluidized Bed Boiler
Developing & Structuring Public-Private Partnership (PPP) for Infrastructure
Effective Tender Process Management for Power & Utilities
Electrical Hazop (eHazop) Studies for the Power Industry
Electricity Demand-Side Management
Electricity Industry Design
Electricity Network Planning
Electricity Retail Contracts
Electricity Theft
Electricity Trading Essentials
Energy Efficiency
EPC Contract Management for Power & Utilities
Essentials of Coal Markets and Trading
Essentials of Power Trading
Excitation Systems
Feed-in Tariffs for PV Systems
Finance for Non-Finance Professionals in Power & Utilities
Financial Modelling for Project Finance in Power & Utilities
Fitness-For-Service AP1 579 & High Energy Piping Life Management
Fundamentals of Geothermal Energy
Fundamentals of Power Generation
Gas & LNG Contract Negotiation
Gas Turbine Generator Selection, Operation & Maintenance
Gas Turbine Hot Gas Paths, Rotors & Failure Analysis
Gas Turbine Major Inspection & Overhaul
GE Gas Turbine Operations Simulation Based
HRSG Design, Operations & Understanding, Controlling of HRSG Damage Mechanisms
HV Substation Design & Construction
IEC for Utilities
Integration of Distributed Generation
Introduction to Carbon Capture & Storage
Introduction to Clean Coal Technology
Introduction to Power Systems
Keeping Electrical Switchgear Safe
Leadership & Team Dynamics for Power & Utilities
LNG Fundamentals
LNG Markets & SPOT Trading
Maintenance Planning & Scheduling
Making IPP & Renewable Energy Projects Contract Frameworks Bankable
Managing Complex Projects for Power and Utilities Professionals
Medium Voltage & High Voltage Switchgear
Metallurgy for Engineers
Mechanical Engineering for Non-Mechanical Engineers
Mini Hydro Project Analysis
MKV Speedtronic Control System
MK VI Speedtronic Control System
Nuclear Energy Project Planning & Economics
Nuclear Power
Offshore Platforms Electrical Systems Design & Illustrations
Operations of Coal Fired Power Plants
Power Generation Commissioning, Operations & Maintenance
Power Generation Operation, Protection & Excitation Control
Power Plant Chemistry for Chemist & Chemical Engineers
Power Purchase Agreements
Process Control Methods
Programmatic CDM
Relay Protection in Power Systems
Reliability Centered Maintenance Masterclass
Reliability Engineering
Renewable Energy Development & Investment
Renewable Energy Integration
Risk Based Inspection
Risk Management in Power Markets
Root Cause Analysis
Rotating Equipment Maintenance & Reliability Excellence
SCADA & Power Systems
Smart Grid
Solar Energy & Photovoltaic Power
Spare Parts Optimisation
Supercritical and Ultra-Supercritical Coal-Fired Power Plant
Technical Report Writing & Presentation Skills for Power & Utilities Professionals
Ultra Low NOx Gas Turbine Combustion
Uninterruptible Power Supply
Vibration Analysis & Condition Monitoring
Waste to Energy Plant Operations
Water Treatment and Corrosion Control for Steam Generation and Power Production
Writing Effective Standard Operating Procedures (SOP) for Power & Utilities Professionals & Engineers

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Frequently Asked Questions (FAQs)

1. Does PowerEdge have other programmes than those listed?
We have more than 200 programmes that we are capable of running. All we need is for you to contact us and request for the preferred programme and we will able to develop it.

2. Where is PowerEdge based?
PowerEDGE is headquartered in Singapore but we run our training programmes in different venues around Asia.

3. What does PowerEdge do?
We are a Power & Utilities Training Specialist.

4. Can this course be done in our city?
It absolutely can. Get in touch with us to request for a training programme to be carried out in your city.

5. Can you reduce the price of our preferred course?
While our price has been reduced before it is even launched, we are always happy to help you with further discounts.

6. Can you change the dates of the course?
If you have a special requested date, let us know and we will arrange another session for you.

7. Who are the companies that will be participating?
This varies from a diversity of Power Operators, Regulators, Financiers, to Vendors in the Power & Utilities industry.

8. Where is the venue for the course?
We usually engage a 4 to 5 star hotel meeting room to ensure the comfort of our participants.

9. How many delegates should we expect for each course?
This varies from 15 to 20 participants. Class sizes are kept small to allow trainers to focus better on each participant.

10. What are the different payment modes?
We accept Visa/MasterCard, cheques, bank transfers and cash on site.

11. Is accommodation included when I sign up for a course?
Accommodation is not included in the course fee but we are always happy to advise on available accommodations.

12. Can I get a cheaper accommodation through PowerEdge?
We will be pleased to help you negotiate a better rate with hotels.

13. Is lunch provided during the course?
We provide lunch and 2 tea breaks every day during our training programmes.

14. Are the training materials included once I have signed up for a course?
Yes, training and course materials are included in the course fee.

15. Will there be a certificate for the course?
Yes, there will be a certificate of participation upon completion of a course.

16. Who are PowerEdge trainers?
They are expert consultants and practitioners with many years of experience in the subject matter that they deliver on.

17. Are PowerEdge trainers competent?
We have received numerous favourable feedbacks on our trainers from past participants.

18. Can PowerEdge assist with Visa travel applications?
We can assist in advising you on the relevant procedure(s) and embassies/consulates that provide Visa for travel purposes.

19. Can we purchase training materials without attending a course?
Unfortunately this option is not available as training materials are specially developed for courses.

20. Can course content be tweaked to cater to our needs?
Of course! Just let us know your request and we will get the trainer to assist in carrying it out.
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REGISTRATION FORM

<table>
<thead>
<tr>
<th></th>
<th>NORMAL PRICE</th>
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<tr>
<td>Per Participant</td>
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ATTENDEE DETAILS

Name ................................................................. Job title .................................................................
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COMPANY DETAILS

Organisation name ................................................................. Industry .................................................................
Address ........................................................................................................................................
Postcode ............................................................................... Country .................................................................
Tel ............................................................................................ Fax .................................................................

PAYMENT METHO

By Cheque/ Bank Draft: Make Payable to PowerEdge Pte Ltd.
By Telegraphic Transfer: Please quote AE1 with the remittance advise
Account Name: PowerEdge Pte Ltd.
Bank Address: 65 Chulia Street OCBC Centre, Singapore 049513
All bank charges and payment in Singapore dollars (SGD) to be borne by payer. Please ensure that PowerEdge Pte Ltd receive the full invoiced amount.

PAYMENT TERMS

Payment is due in full at the time of registration. Full payment is mandatory for event attendance. I agree to PowerEdge Pte Ltd. payment terms

CANCELLATIONS & SUBSTITUTIONS

You may substitute delegates at any time. POWEREDGE PTE LTD does not provide refunds for cancellations. For cancellations received in writing more than seven (7) days prior to the training course you will receive a 100% credit to be used at another POWEREDGE PTE LTD training course for up to one year from the date of issuance. For cancellations received seven (7) days or less prior to an event (including day 7), no credits will be issued. In the event that POWEREDGE PTE LTD cancels an event, delegate payments at the date of cancellation will be credited to a future POWEREDGE PTE LTD event. This credit will be available for up to one year from the date of issuance. In the event that POWEREDGE PTE LTD postpones an event, delegate payments at the postponement date will be credited towards the rescheduled date. If the delegate is unable to attend the rescheduled event, the delegate will receive a 100% credit

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