**Advanced Boiler Technology Symposium**

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| Time | Activities | Delivered by | Speaker |
| 08:15 – 08:45 | Registration |  |  |
| 08:45 – 08:50 | Opening Remark | Section Chair | Ron Chung |
| 08:50 – 09:00 | Welcome Address | Deputy Director, EMSD | Ir Tai |
| 09:00 – 09:30 | **Keynote Speech:**  **Keynote: Priorities for Advancing Boiler Technology**  Ultra-supercritical and other advanced boiler technology will help meet increasing power demands, reduce emissions, raise efficiency and lower fuel costs per megawatt. Energy consumption throughout the world, including China and India, has raised expectations that these technologies will be the impetus of major advances in boiler design within the next ten years.  Trends in new materials, advanced manufacturing methods, new testing and inspection technologies and digital integration of control systems will have major impact on advances on boiler design. Standards spur the adoption of new technologies, products, and manufacturing methods and ensure greater safety and reliable performance under more severe operating conditions.  Accommodating technological advances and also adopting best practices are increasingly important, if engineers are to solve energy global challenges. How do these trends affect design and inspection processes? Design-by- analysis, for example, is changing performance expectations for creep-fatigue conditions for complex materials. A brief look at recent additions to ASME’s Boiler and Pressure Vessel Code Section I shows new focus on the design and manufacture of power plants operating at high temperatures under cyclic loading conditions and will offer some insight on the impact of these trends. | ASME Executive Director | Tom Loughlin |
| 09:30 - 09:40 | Keynote Session Q&A | Facilitated by:  Prof Stuart Cameron |  |
| 09:40 – 09:50 | Souvenir Presentation & Group Photos |  |  |
| 09:50 – 10:00 | Tea Break |  |  |
| 10:00 – 12:20 | SESSION I |  |  |
| 10:00 – 10:30 | **A Comparison of the ASME and European Standards to achieve safe boiler operation**  Boiler plant designed and manufactured to the ASME and EN Standards have equivalent levels of safety but have a different approach in terms of the role of the Inspecting Body and the technical requirements.  ASME tends to focus on the critical safety requirements which is supported by the technical specifications of the Manufacturer whereas the EN Standard is more prescriptive.  An overview comparison of the two Codes will be presented together with an outline of the proposals for incorporation of a new Part in the ASME Code which will be applicable to ultra- supercritical boiler plant. | Governor , ASME | Stuart Cameron |
| 10:30 – 11:00 | **Design by Analysis Methods in the Modernized Code**  In general Section I of the ASME Boiler Code was originally developed for industrial boilers through to sub-critical boilers operating at relatively low temperatures and pressures under steady state conditions. Current and future boilers do and will operate at higher temperatures and pressures under cyclic loading requiring a more detailed assessment and examination to ensure safe and reliable operation.  Design by Analysis (DBA) methods will be fundamental to the assessment process for key boiler components. It is intended that the Code will incorporate several DBA methods, ranging in complexity, to allow the user some flexibility to select the method appropriate to the design conditions.  The methods currently being considered include an elastic approach based on Section VIII Division 2, a simplified inelastic approach, an inelastic approach based on the Omega method from API 579, the Section VIII Division 2 Code Case 2843 based on the Section III Part NH rules utilizing the strain deformation method and a new Section III Code Case based on the EN 13445 approach.  This presentation will look at the key aspects of the methods and highlight the limitations of each. | Chief Engineer, Doosan Babcock | David Anderson |

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| 11:00 – 11:30 | **Damage Tolerance Considerations for High Energy Components Manufactured from Creep Strength Enhanced Steels**  Tempered martensitic, creep strength enhanced ferritic (CSEF) steels are now widely used in power boiler and piping components. These steels were developed to offer benefits to component design through inherently excellent strength and ductility. However, experience has shown that these steels are susceptible to creep cracking in the heat affected zones of welds. Indeed, the weld life reduction observed is so large that design approaches have now introduced efficiency factors.  The increased thickness required by efficiency factors goes directly against the expected benefits of CSEF steels for higher strength and improved operation under cyclic conditions. The weld preparations in boilers and piping applications are typically designed on the basis of expediency of manufacture rather than improved in-service performance. Thus, with traditional approaches the main considerations are practical, i.e. easy welder access, minimal weld metal deposit, and reduced time to complete the weld. This paper describes the significant benefits available through the use of Well-Engineered, Damage Tolerant Design Methods for welds in CSEF steels. | Technical Executive, EPRI | Jonathan Parker |
| 11:30 – 12:00 | **Steam Power: Boilers and Hong Kong’s Community Life Now and Beyond**  Ever since the birth of steam boilers which helped kick start the Industrial Revolution some 150 years ago, their metaphorical steam has never run out. Boilers have undergone great advancements in design and application to cater to society’s ever-changing needs, the latest of which is the need to balance better performance and tightening emission standards with sustainable operating costs. Steam boilers in Hong Kong have traditionally played a niche role in government services, providing the heat source for daily needs in government venues such as sterilisation, cooking, laundry and ironing, just to cite a few examples. As it is everyone’s duty to protect the environment, we also apply advanced boiler technology to further control emission and raise energy efficiency. | Senior Engineer, EMSD | SAM Kai-pong, Derek |
| 12:00 – 12:20 | Session I - Q&A | Facilitated by:  Ir Dr CW Tso |  |
| 12:20 – 13:20 | Lunch Break |  |  |

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| 13:20 – 15:40 | SESSION II |  |  |
| 13:20 – 13:50 | **Water-Tube Boiler Pressure Part Design – Comparisons between ASME and Chinese Design Codes**  In the last 15 years, China has added over 3000 coal fired steam/power generation units to its domestic fleet of utility stations. They range from 300MW to 1000MW in unit capacity with steam parameters reaching 32.9MPa and 600°C for the main steam, and 620°C for the reheat steam. Many of these station boilers were designed and constructed based on the relevant Chinese design and safety codes. The design calculations of pressure parts were based on the Chinese code “GB/T 16507 – Water Tube Boilers (Parts 1-8) - 2013” or its predecessor “GB/T 9222 Water-Tube Boiler Pressure Part Strength Calculations”. This presentation will compare and discuss the similarities and differences between ASME and Chinese codes for the purpose of pressure part strength calculations, including the determination of design conditions, material allowable strengths, and calculation methods. The use of non-Chinese materials is permitted by GB/T 16507 and this presentation will also discuss the many ASME and EN code specified materials which have been used in the design and construction of boilers supplied by Chinese boiler makers. | Specialist Consultant,  Harbin Boiler Company Ltd. | Dr Dong Mei Finch |
| 13:50 – 14:20 | **Advanced Boiler Design**  As per the Paris Agreement on climate change, improvement on energy efficiency is vital to curb out CO2 emissions. According to IEA, coal fueled 2/5 of electricity around the world in 2014 and it will still play a significant role in 2040. To achieve the target on the Paris Agreement, the development of technologies for improving the efficiency of coal fired power generation and environmental technology are critical to alleviating the problem of global warming. Mitsubishi Hitachi Power Systems (MHPS) has engaged in the development of state-of-the-art coal fired power plant, air quality control system and clean coal technology in a long term basis. This presentation shows operation results of latest coal fired power plants and air quality control system, along with technical trends and development history. This presentation also elaborates the updated information regarding advanced clean coal technology by introducing Integrated Coal Gasification Combined Cycle (IGCC). | Executive Vice President, Deputy Head of Engineering Headquarters, Senior General Manager, Boiler Technology Integration Division, MHPS | Yoshiyuki Wakabayashi |
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| 14:20 – 14:50 | **Aspects of boiler tube material selection from a designer’s perspective**  The boiler designer needs to take into consideration a number of factors in order to arrive at an optimum tube material selection for a particular application. This presentation aims to provide a high level insight into the main topics considered. Some of these topics are already detailed within the ASME Boiler and Pressure Vessel Code, while others are expected to be incorporated to some extent in the near future.  Tube mid-wall metal temperature is of prime importance when selecting a suitable material and boiler suppliers employ various methods in order to keep these temperatures within a close tolerance band during all operational scenarios.  The external surfaces of tubes are exposed to the flue gases produced from combustion of the fuel in the furnace section of the boiler. The issue of fireside corrosion and erosion are mentioned. Similarly, the internal surfaces of tubes may be subject to steam side oxidation and examples of this are provided.  This paper presents an overview enabling decision makers to be better informed with regard to the key technical aspects associated with boiler tube material selection, while at the same time keeping material costs and overall economics in mind. | Chief Process Engineer, Doosan Babcock | Mark Upton |
| 14:50-15:20 | **Application of advanced ultra-supercritical technology in Fangchenggang phase II units**  2×660MW ultra-supercritical units of CLP Guangxi Fangchenggang (FCG) power station phase II project are equipped with DongFang once-through boiler. This is a Π type outdoor boiler with single reheating, variable pressure operation, single furnace, balanced draught, solid slag, opposed wall fired. The structure is suspended from a steel grid, which in turn suspended on further sling rods attached to the main structural steelwork. The design coal is Indonesia lignite coal. The main steam pressure/temperature is 26.26MPa.a/605℃, while the reheat steam temperature is 603℃. The maximum continuous evaporation capacity of the boiler is 2060t/h.  Since the commercial operation of two FCG phase II units in November and December 2016, the major parameters, including boiler efficiency, NOx emissions and minimum combustion stable load rate meet the design requirements.  In this paper, the design philosophy, characteristics and operating condition of the boiler in CLP Guangxi FCG phase II project will be introduced. | Dongfang Boiler Group of Dongfang Electric Corporation, China | Liang Fahua, Huang Yilong |
| 15:20 – 15:40 | Session II - Q&A | Facilitated by:  Ir Chris Cheung |  |
| 15:40- 15:50 | Tea Break |  |  |
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| 15:50 – 17:40 | SESSION III |  |  |
| 15:50 – 16:20 | **GE’s Advanced Boiler Technologies - State-of-the-Art & New Developments**  The proven long term availability and affordability of coal, make it a critical fuel in a world that is striving to meet the energy needs of tomorrow. Coal-fired steam power plants are well positioned to deliver additional capacity and support growth in various regions of the world. If we utilise the best available technologies in both New and Existing power plants, we lessen the related environmental impact and improve the value of the asset. To do this, it is necessary to increase power plant efficiency, improve operational flexibility and at the same time reduce emissions. The boiler is a key component in the steam power plant and plays an essential role in technical development. This paper describes recent improvements in the plant design and covers current and future developments in the Ultra-Supercritical (USC) technology, 700 °C boiler design, advanced materials development and clean coal technologies. | Senior Technical Expert - Boiler, GE Power Wuhan | Dr. Qiurong CHEN |
| 16:20 – 16:50 | **Heat Transfer Restoration in HRSG**  The HRSG units in BPPS have been commercially available for over 15 years, and many of the 8 units have over 75,000 operating hours, over half of their designed life. In an effort to restore the heat transfer performance of the HRSG units, the Station Overhaul Team conducted tubeside acid clean using hydrofluoric acid (HF), and the finned tubes of the HRSG is blasted with solid carbon dioxide which was produced on-site. This paper outlines the technical background, planning and execution of the project, and also the safety practices adopted for the restoration project. | Engineer II, CLP Power HK | YU Chung Man, Victor |
| 16:50 – 17:20 | **Safety in Design and Installation of HRSG**  The paper outlines the risk-based safety considerations and practices in design, engineering, shop fabrication, site erection and testing & commissioning of Heat Recovery Steam Generator (HRSG) in Lamma Power Station (LPS). Basic design elements such as statutory requirements, design codes, materials, geometry, operating principles and conditions, common failure mechanisms, and quality control inspections and controls for shop fabrication and site erection, risk assessment for erection works, etc., are discussed in the paper. Trends of technology development for utility-scale HRSGs such as once-through design of high pressure section, cyclic capability, supplementary firing, Selective Catalytic Reduction (SCR) system, water chemistry and comparison between vertical and horizontal flow HRSGs, etc., are highlighted. Safety practices adopted in testing and commissioning works of HRSG are also discussed. | Engineer, Hong Kong Electric | KWONG Kwing Lam, Johnny |
| 17:20 – 17:35 | Session III Q&A | Facilitated by:  Ir Nelson Yu |  |
| 17:35 – 17:40 | Closing Remark | ASME HK Section Vice Chair | Thomas Cheong |