**Objectives**

Design, fabricate, test and demonstrate in a commercial scale bituminous coal-fired boiler a miniaturized high temperature multi-process, high-spatial-resolution monitoring system (mMPMS) for boiler condition management.

**mMPMS**

Real-time indication of tube surface conditions at key locations in the radiant section of a coal-fired boiler based on electrochemical sensor that can provide metal loss rates, heat flux, metal surface temperature, and deposit thickness.

**Boiler Condition Monitoring using mMPMS**

A system of non-intrusive real-time sensors providing quantitative insight into several key indicators of boiler performance/maintenance will save individual plants tens of millions of dollars. Future efforts will include utilization of additional sensors throughout convective sections and backpass equipment as well as integration with advanced control approaches.

**Project Organization**

**Prime Recipient**
- Project Management
- mMPMS Development
- Mechanism Derivation
- Computational Modeling
- Signal Conditioning and Data Communication Module Development
- Boiler Control Logic Development

**Sub-Awardees**
- Pilot-scale Testing
- Full-scale Demonstration
- Technical Consultant

**REI Team’s Previous Work**
- Electrochemical sensing system has been applied to low and high temperature zones of the boiler to assess corrosion behavior in the boiler and waste-to-energy system, improve thermal efficiency of the boiler, and compare tube materials under ultra-supercritical steam condition and oxy-firing combustion
- EN-based system provides high sensitivity, real-time, on-line monitoring technology
- REI has developed corrosion rate correlations through EPRI and KEPRI projects that can assess the impacts of planned changes in combustion environment on fire-side corrosion

**Benefits & Future Work**

**Approaches**

- Re-design and Construct Prototype Sensor Body
- Re-design and Fabrication of Data Processing Unit
- Construction of Power and Cooling Unit
- Additional Development of Data Processing Software
- Validation of Multi-Process Sensor in Pilot-scale Unit
- Full-scale Demonstration of System

**Demonstration Site**

Hunter station located near Caste Dale, Utah

Three bituminous coal fired units with total generating capacity 1,320 MW

Plant is interested in combustion optimization while avoiding tube failure and reducing NOx

**Project Schedule**

**Year 1** (Oct 2018 - Sep 2019)
- Design and construction of prototype sensor body
- Design and fabrication of data processing unit
- CFD analysis of full-scale bituminous coal-fired boiler

**Year 2** (Oct 2019 - Sep 2020)
- Construction of power and cooling unit
- Development of data processing software for bituminous fired unit
- Test and validation of multi-process sensor in a bituminous coal firing pilot-scale combustor
- CFD analysis of demonstration site’s full-scale bituminous-fired boiler
- Demonstration of multi-process sensor in a commercial scale bituminous-coal-fired boiler

**Year 3** (Oct 2020 - Sep 2021)
- Develop control logic for automated control of bituminous coal-fired boiler

**Project Status**

Prototype mMPMS has been developed and heat transfer calculation will assist to finalize the design prior to pilot- and full-scale testing

**Acknowledgements**

U.S. Department of Energy - National Energy Technology Laboratory (DOE/NETL) through DOE Cooperative Agreement No. DE-FC03-1682 DOE/NETL Project Manager: Mr. Richard Dunst