Real-Time Efficiency Measurements for Utility Boilers

OBJECTIVES

Pulverised coal-fired utility plant is under increasing pressure to operate at the highest possible efficiency, while remaining within the limits set by regulatory bodies on environmental pollutants. Because fuel costs are the single largest factor in power station operations, even small savings made here are highly desirable in real terms. It is for this reason that utility companies world-wide are investing in control strategies that maximise the efficiency of boiler operation through the control of important boiler variables in, or as near to, real-time as possible. In the UK, the recent introduction of Integrated Pollution Prevention and Control (IPPC) mandates plant operators to operate at the highest practicable efficiency, and this provides an additional impetus to achieve improvements to operating practice that result in efficiency gains.

Specific objectives are:

- To demonstrate that on-line Polycyclic Aromatic Hydrocarbons (PAH) concentration measurements can be used as quantitative indicators of utility boiler efficiency
- To establish the methodology for using PAH detecting instruments to tract changes in boiler efficiency and the combustion environment to enable better boiler management

SUMMARY

For the best control over boiler operation, it is necessary to utilise easily measured boiler parameters that respond quickly to the changes in the combustion environment. This is usually done by the continuous monitoring of excess oxygen and carbon monoxide concentrations. An additional and valuable measurement of boiler combustion efficiency is the carbon-in-fly-ash concentration. However, this requires an extractive sampling technique, and even the latest generation of carbon-in-ash analysers operates on a semi-batch basis, and so cannot give real-time data.

There is clearly a need for an on-line technique that is robust, relatively simple to operate and maintain, and that gives high-quality validated information on a combustion efficiency. Such a technique could be readily utilised in existing control systems and the development of a real-time combustion efficiency analyser is the focus of this proposal.

The combustion products that have been selected as the basis of the proposed technique are PAHs. Studies undertaken on plant in the United States suggest that PAH formation is sufficiently sensitive to changes in the combustion environment to give better quality information then oxygen, carbon monoxide, or even carbon-in-ash measurements.

Recent developments in photoelectric aerosol sensors (PAS) have led to instruments capable of real-time analysis of total particle-bound PAHs. The best of these can undertake measurements in parts per trillion and are capable of determining PAHs which contain three or more things.

It is proposed to develop a methodology based on PAS technology for obtaining quantitative data on combustion efficiency through a programme of work at laboratory-, pilot reg- and fill-scale testing.

PAS Measurement on a Test Boiler Facility

COST

The total cost of the project is £220 010 of which the DTI's contribution is £11 005

DURATION

2 years – January 2002 to December 2003

CONTRACTOR

EMC Environment Engineering Ltd

In collaboration with

Alsthom
University of Leeds

For further information on technology transfer and export promotion matters please contact:
Dr Keith Burnard, Programme Manager, DTI Technology Transfer & Export Promotion Programme
Tel: +44 (0) 0123543 2120 Fax: +44 (0) 0123543
E-mail: keith.burnard@aeat.co.uk

For Research & Development matters please contact:
Mr James Felton, Programme Manager,
DTI Research & Development Programme
Tel: +44 (0) 012273 365157 Fax: +44 (0) 012273 365100
E-mail: jf2@mm-brig.mottmac.com
The DTI web site address is: www.dti.gov.uk/cct/

dti
Department of Trade and Industry

JULY 2002

DTI/Pub URN 02/1020

CLEANER COAL TECHNOLOGY PROGRAMME

Project Profile 327