On-Line Fuel Tracking by Advanced Flame Monitoring

OBJECTIVES

Increasingly, power plants are burning a diverse range of coals (indigenous and imported) under tighter economic and environmental constraints. On-line coal analysers have been investigated in the past, but these are expensive and do not provide a practical solution to the problem. To improve the efficiency of the process, utilities are turning to optimisation packages to assist operation staff. Experience has shown that these optimisation packages can help to optimise the process, but are limited by the wide variation imposed on the system by the constantly changing coal diet. It is therefore desirable to identify the coal being burnt on an on-line, continuous basis to improve the performance of the optimisation packages.

Specific objectives are:

- to develop an advanced, cost-effective system capable of identifying the fuel burn on on-line continuous basis
- to establish quantitative relationships between the 'finger-prints' of flames and their corresponding fuel types such that an on-line fuel-tracking system could be integrated into a power station control system
- to evaluate the performance of the system for a broad range of fuels at University of Greenwich's Combustion Research Laboratory and at Innogy's 0.5MW Combustion Test Facility
- to conduct full-scale demonstration trials on a coal fired power plant

SUMMARY

This project aims to develop a low-cost, fuel tracking system for the identification of coals being burnt at any one time. The approach is to extract the dynamic 'finger prints' of the flame and hence the fuel type by processing the output signal of an improved flame-eye using digital signal processing and soft-computing techniques. A prototype will be design, implemented and evaluated first on a combustion test rig under a laboratory environment and then on a 500kW coal fired combustion test facility at Innogy. Quantitative relationships between the dynamic characteristics of flames and their corresponding fuel types will be identified such that the on-line fuel-tracking system could be integrated into a power station control system. Full scale demonstration trials will be conducted on a coal fired power station.

As the system aims to utilise existing flame monitoring locations, if successful, this approach would provide a cost-effective solution to this difficult problem. It is envisaged that a successful application of the new system would allow optimisation packages to reduce carbon-in-ash by about 3-5%, or NO_x by 50mg/NM3 etc. This would lower CO_2 emissions or greenhouse gas emissions significantly, and help to keep the position of coal competitive with gas. Additionally, the system will also provide a continuous, quantitative indication of flame stability, which would enable the safe combustion of a wider range of coals including low-quality coals and blends of coals. Other benefits include establishment of advanced low-cost flame stability monitoring techniques, in-depth understanding of combustion and pollutant formation processes, and provision of ample experimental data for the validation of mathematical/CFD models concerning fuel types, flames and furnaces.

Innogy's 0.5MW Combustion Test Facility on which experimental tests will be carried out during the project

COST

The total cost of the project is £220 000 with a contribution of £110 000 from the DTI

DURATION

36 months – January 2002 to December 2004

CONTRACTOR

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Further information on the Cleaner Coal Technology Programme, and copies of publications, can be obtained from:
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