case study

Emission Reduction and Baghouse Optimisation through Advanced Bag Filter Management

Background

Fibrothetford Ltd is the world's third poultry litter fired Power Station based at Thetford in Norfolk. The plant burns over 400,000 tonnes of poultry litter per year, to produce 38.5MW of electricity, enough for a town of around 93,000 homes. The plant is Europe's largest producer of electricity from renewable sources, as well as the largest project to come to fruition under the UK Government's Non-Fossil Fuel Obligation which provides support for renewable electricity generation. The process has major environmental advantages over other methods of generation – it is clean and environmentally friendly. Very low levels of gaseous emissions are produced from the stack due to the "clean" chemical make-up of the fuel and are well within UK and European statutory limits.

Fibrothetford site

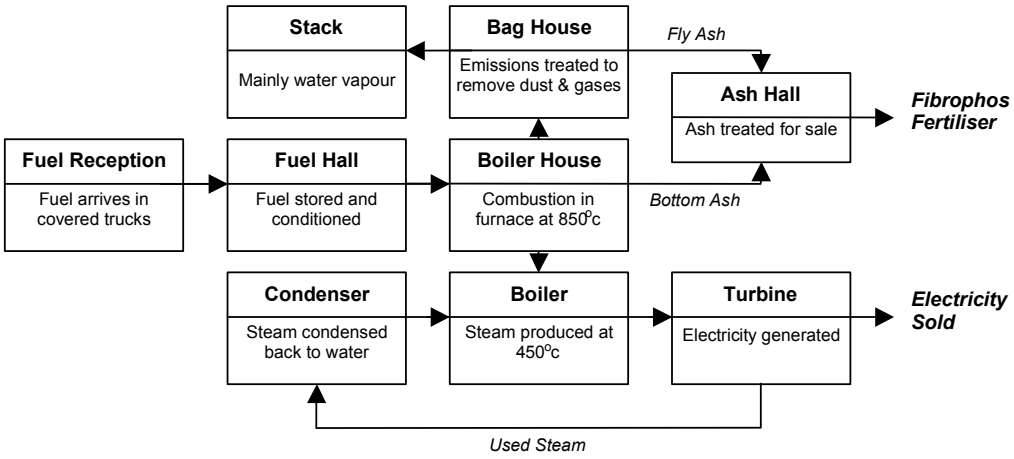
The Company is part of the Fibrowatt Group, a UK-based developer, builder, owner and operator of electricity power stations using poultry litter and related biomass as the fuel. Fibrowatt has built the world's first three poultry litter fired power stations and is working on the development of further plants in the UK, Europe and the USA.

Process Overview

At the plant, the furnace burns the poultry litter at very high temperatures (in excess of 850^{o}C) heating water in a boiler to produce steam which drives a turbine linked to an electricity generator. The electricity is exported into the local electricity supplier's grid and the steam is condensed back into water by an air-cooled condenser before being recirculated into the boiler. There are no waste products from this process. Instead a valuable by-product is produced in the form of a nitrogen-free ash, rich in potash and phosphate, which is marketed as an environmentally friendly fertiliser. The ash is recovered both from the furnace and from the exhaust flue, using up-to-date dust extraction technology.

Monitoring Requirements

Fibrothetford's decision to install filter management equipment was driven by their commitment to improve plant efficiency and in particular to ensure their baghouse (dust arrestment system) functionality could be controlled and maintained to operate at it's optimum. Fibrothetford were looking for a system which would be easy to operate, incorporating a package for remote monitoring and reporting to indicate any deterioration in filter performance to allow scheduled preventative maintenance. It was also very much in line with the Company's policy on maintaining their contribution to the environment which has been recognised by it's winning of a number of environmental awards.

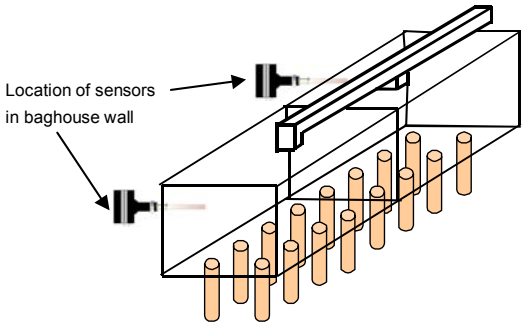


System Description

An environmental monitor had previously been installed to monitor particulate emissions from the main stack at Fibrothetford, however, it was felt that the configuration was such that it would be impractical to use to locate faults in the baghouse. Due to the unique conditions in the baghouse – around 25% humidity, it was decided to implement a system based on PCME's DM330 sensors connected together in a network. These sensors were fitted with fully insulated probes, unique to PCME, essential for use in high humidity applications.

Installation Considerations

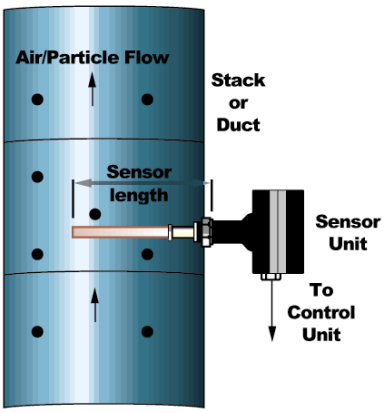
The location of the sensors proved to be particularly important to enable monitoring of the dust concentration from each chamber of the baghouse. The sensors were installed in the actual wall of the baghouse due to the configuration of the ducting ensuring penetration directly into each chamber.



Location of sensors

Measurement Technique (Electrodynamic™)

Particles in the air stream interact with the sensing rod and a charge induction effect is analysed from the probe. Distributions in the particle stream result in a frequency charge induction response which is directly proportional to the concentration of particulate. The instrument's output is an analysis of this frequency response.



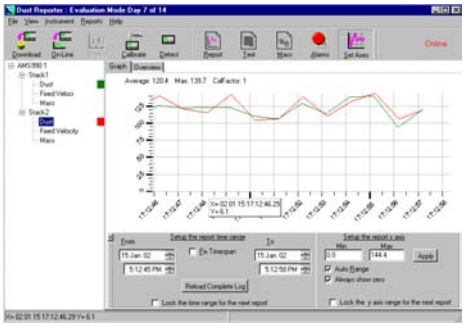
System Functionality

Power is supplied to the sensors via the network cable and Power Supply Unit. The sensors are linked to the network via spur boxes to allow for the disconnection of sensors without disturbing the network. Additional advantages of this network approach are:

- convenience of displaying information at a central location rather than reading data from individual sensors
- reduced cabling using single network cable rather than duplicating analogue cabling
- central PC controls the sensors, eliminating the need for separate control units

Software Functionality

The Windows-based software package, “Dustmanager” was used for monitoring the performance of the baghouse. The software configures and controls the network of sensors from a central PC and conveniently displays and manages data from the network. The PC screen clearly shows the status of the baghouse at a glance and enables reports to be generated. Dust data is displayed in real time for each individual sensor and easy access to historical data and maintenance logs is provided.



On-line Graph

Fibrothetford installation

Results

After 12 months of operational experience with the DM330 system, it has proved it’s value as an effective predictive maintenance tool and significantly lower operating costs have been achieved. Previously, it could take between 8 and 24 hours to find faults and up to 3 hours work on each cell to identify broken bags, however, since the installation there have been substantial time savings on fault finding. The efficiency of the baghouse has been controlled and maintained to operate at it’s optimum and having the capability to identify the suspect fabric filter down time and costs are notably reduced. It also assists in planning, both for rework and in budgeting for replacement parts.

Acknowledgements

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References

Electrodynamic Technology for Particulate Monitoring - William Averdieck (Can be downloaded in .pdf format from our website, **www.pcme.co.uk**)