



# FTIR Monitors Renewable Energy Plant Emissions

## AIR MONITORING

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Quantitech Ltd has recently installed a multi-component FTIR gas analyser at the world's first poultry litter fuelled power station in Eye, Suffolk, England. A portable FTIR that uses exactly the same technology has also been supplied as a back up for Eye and its sister plants.

The Eye Power Station is owned and operated by EPR Ltd, the leading renewable energy generator in the UK. The station consumes 160,000 tonnes p.a. of chicken litter, which is sourced from a large number of farms in the region.

The plant also takes 11% of its fuel input in the form of feathers that is a gate fee fuel (suppliers pay EPR a small fee to collect the material). Approximately 12% of fuel burn is supplied from other agricultural residues such as animal bedding, seed husks and greenwood.

EPR operates five renewable energy power plants in total; three burning poultry litter, one burning meat and bone meal and one burning straw.



The Eye station generates around 11.4 MW of power, which is sufficient for 11,400 homes – more than enough to supply nearby Diss and surrounding areas.

The UK Government has introduced an incentive mechanism, the Renewables Obligation (RO), which results in a premium being paid for renewable electricity generation. Each renewable generator issues certificates (ROC's), which are sold to electricity supply companies in order that they can meet their obligation for the proportion of supplied electricity generated from renewable sources. The obligation increases annually in line with the Government's target for the UK to generate 10% of electricity from renewable sources by 2010 increasing to 15% by 2015. There is a further target of 20% to be achieved by 2020. Currently renewables represent around 3% of electricity generation so the targets will be very challenging to meet. All of EPR's electrical generation is eligible for ROC's.

Since the Eye plant was constructed in 1992 emissions have been tightly controlled. However, from 28th December

2005, the Waste Incineration Directive (WID) imposed lower emission limits and as a result the Eye plant made an additional £3 million investment in abatement and monitoring equipment.

Quantitech supplied the new monitoring equipment, which was configured to precisely meet the plant's new requirements. This included the measurement of CO, CO<sub>2</sub>, NOx, SO<sub>2</sub>, HCl, H<sub>2</sub>O, O<sub>2</sub> and particulates.

### **An MCERTS approved FTIR analyser was chosen because of its ability to perform continuous multiparameter measurements.**

Commenting on the decision to choose FTIR, Eye Station Manager, Kevin Williams says "We looked at other systems including extractive infrared but the FTIR from Quantitech offered us the opportunity to add further parameters in the future, such as VOCs, very simply and at minimal cost. In fact the cost of several single parameter monitors was similar to that of the multiparameter FTIR. We also liked the idea of having a portable backup system identical to the fixed installation so that we could quickly swap monitoring systems if we ever need to. We would also be able to use the portable system at our other power stations.

Prior to making the decision to use FTIR we used NPL to check stack emissions, NPL employed FTIR and reported very good results and I am pleased to say that we have also produced good quality data from over seven months of trouble-free operation."

Analysis by infrared spectroscopy involves the passing of IR radiation through a sample of gaseous molecules. Some of this radiation is absorbed by the sample and the remainder is transmitted. This produces an infrared spectrum, or "molecular fingerprint". A unique infrared spectrum is generated because each molecular structure has a unique combination of atoms. As a result, both qualitative and quantitative analysis of the gas is possible.

FTIR stands for Fourier Transform Infrared, the preferred method for infrared spectroscopy.

An FTIR spectrometer obtains infrared spectra by first collecting an 'interferogram' of a sample signal with an interferometer, which measures all infrared frequencies simultaneously to produce a spectrum.



Sample identification is possible because chemical functional groups absorb light at specific frequencies. In addition, through calibration of the spectrometer, it is possible to determine the intensity of the absorption (relative to the component concentration).

The Gasmet™ FTIR gas analyser from Quantitech can measure any gas, with the exception of the following:

- Noble (or Inert) gases
- Homonuclear diatomic gases (e.g., N<sub>2</sub>, Cl<sub>2</sub>, H<sub>2</sub>, F<sub>2</sub>, etc)
- H<sub>2</sub>S (detection limit too high)

The majority of FTIR analysers are used for process control, exhaust monitoring, emissions monitoring, workplace/industrial hygiene monitoring and research.

As a multicomponent gas analyser, the Gasmet™ FTIR from Quantitech is ideal for customers that need to:

- 1) Analyse several components, or
- 2) Analyse hot/wet gas (e.g., hot humid applications for HCN, NH<sub>3</sub> or HCl etc)
- 3) Analyse any gas in complicated gas mixtures

Quantitech's Dominic Duggan says that in comparison with multiple analyser CEMS, the FTIR is "Extremely easy to operate" adding "Zero point calibration with Nitrogen (background) just



takes a few minutes and is required once a day. Water vapour calibration must be performed after every major maintenance operation and at least once per year. Under normal circumstances no other calibration is required which saves our customers a great deal of time, effort and money.

Absorptivity is a physical constant specific to each gas, and the reference spectra (or calibrations) can be transferred from analyser

to analyser. As a consequence we are able to add measurement parameters to installed CEMS as and when required”

The Gasmet™ library of reference spectra consists of reference files of gas spectra measured to date with different Gasmet™ gas analysers. The library contains hundreds of spectra and each reference spectrum contains both quantitative and qualitative information about the component.

### **High levels of accuracy and low levels of maintenance**

High levels of accuracy and low levels of maintenance are achieved as a result of continuous calibration with a He-Ne laser, which provides a stable wavenumber scale. In addition, high spectral signal to noise ratio and high wavenumber precision are characteristic of the FTIR method. This yields high analytical sensitivity, accuracy and precision.

At Eye Power Station the cost of the new monitoring equipment was relatively small in comparison with the cost of new abatement equipment, which included the construction of a new bag filter house to reduce particulates, sorbent (NaHCO<sub>3</sub>) injection to reduce acid gases and Ecotubes to reduce CO and NOx.

Quantitech has configured the monitoring system to enable the Eye station to closely manage the level of sorbent that is employed in the abatement process. This ensures that sufficient sorbent is employed to maintain emission levels below the prescribed limits, and prevents the expensive and wasteful use of a natural resource.

### **Logged data enables plant operators to optimise plant efficiency**

The monitoring system logs all data and provides staff with ongoing average emission levels coupled with target levels for the remainder of the day. This enables the plant operators to optimise plant efficiency by varying output and sorbent usage. The plant also has the facility to add hydrated lime when necessary.

Under WID the plant is obliged to provide the Environment

Agency with daily average data for each of the prescribed parameters. Each daily average must be derived from at least 43 half-hour averages within a twenty-four hour period. Kevin Williams was therefore pleased to note that Quantitech was able to conduct a routine 6-monthly water vapour calibration in less than two hours.

Weekly calibration (part of QAL 3) takes no more than twenty minutes, which does not interfere with the provision of valid data because it is undertaken between 10 minutes to the hour and ten minutes after, and since half-hour averages must include 20 valid (1 minute) readings the validity of the data is unaffected by the calibration activity.

QAL 3 is the third quality assurance level defined under the Standard EN14181. QAL 3 assesses instrument precision and drift, providing the opportunity to check that instruments are performing within the required specification and to identify any assignable causes of variation.

### **The data management regime helps to ensure that we remain constantly within the emission limits**

Summarising his experience with the Quantitech monitoring system, Kevin Williams says “The reliability and accuracy of the monitoring equipment are vitally important for the environmental performance of the power station. However, the data management regime that Quantitech has created not only helps us to ensure that we remain constantly within the emission limits, but also helps us to operate the plant as efficiently as possible.

#### **We are very happy with the FTIR monitoring technology for two important reasons.**

1. As a multi-component measurement technique it saves us from the extra costs that would be incurred with the addition of new parameters such as VOCs.
2. The availability of a portable FTIR that exactly mimics our on-line version means that we have a highly effective back-up system, so we do not have to worry about loss of data if a problem occurs.”