



Adjustment of IACM equipment prior to measuring.

Measurement technology - a vital element of problem solving

From time immemorial, people have sought to understand and explain the world around them, whether this relates to the origin of the universe or to the structure of the atom. A common denominator in all the processes where the desire has been to increase understanding and acquire new knowledge is measurement technology - the art of detecting a state or phenomenon and assessing its dimensions, "to measure is to know".

Combustion processes are complex and the theoretical framework for these processes has still not been fully formulated. In order for biofuel, for example, to become a competitive, environment-friendly and sustainable energy source, it is important to gather new knowledge on areas such as the causes of corrosion and coating problems, which require a lot of maintenance, and the origin of environmentally-damaging substances

in flue gases. This is where measurement technology comes in. On the basis of various measurements, conclusions can be drawn on the action that should be taken to improve the characteristics of a boiler.

A combustion process is a harsh environment from the point of view of measurement technology. High temperatures, a corrosive environment, tight spaces and large quantities of dust make carrying out measurements a technically complicated process.

Vattenfall has long and sound experience of performing measurements in boiler environments and has developed several measuring instruments and methods. We have methods for the analysis of everything from the input fuel to the ash and flue gases in the stack. We are constantly developing our know-how concerning which methods are useful in the field and how they can be adapted to the difficult environment.

Fuel

The properties of the fuel and the way it is fed into the boiler are fundamental factors in the combustion process. Important criteria that govern combustion include the humidity content of the fuel and mass flow. Vattenfall is working to develop methods for the continuous determination of these parameters which, among other things, can provide a high degree of control of the output of the fuel fed into the boiler.

Combustion chamber

The combustion chamber is the heart of the boiler. It is here that the composition and aggressiveness of the flue gases are largely determined. All combustion requires a good mixture of fuel and air at the correct temperature and for the correct period of time. Vattenfall works with a number of measuring instruments for the optimal control of combustion parameters such as fuel feed-in and air supply in order to achieve a complete mixture of the fuel and air.

The profile measurement of the composition of the flue gases reveals bands of uncombusted gases that can give rise to aggressive flue gas locally.

In these contexts we use, for example, lambda probes to quickly measure oxygen content. Oxymap is a useful instrument in which lambda probes are combined with suction pyrometers for the simultaneous measurement of temperature and oxygen content. Each probe can be used to measure at six different points at the same time. By using several probes, an online profile of the temperature and oxygen content in a cross-section of a hearth can be obtained.

Heat-transferring surfaces

In areas surrounding superheaters, boiler walls and other heat-transferring surfaces there are often problems with corrosion and coating. This was a minor problem with coal-fired boilers but has accelerated in pace with the increased use of biofuels. Most of the co-generation plants where more than 70 per cent of the fuel used consists of wood fuels have this problem today.

It appears that the problem is due to an increase in the formation of chlorides, mainly potassium chloride (KCl), when a high percentage of wood is burned.

Vattenfall has focused on the measurement of corrosive alkali chlorides and has developed and patented an instrument, the IACM (In Situ Alkali Chloride Monitor), for this purpose. The IACM is used to measure the KCl content at superheaters and usually forms part of the so-called ChlorOut concept. This is based on measuring KCl and using a sulphate-based additive to reduce the corrosive alkali chlorides. Vattenfall also holds a patent for the ChlorOut additive.

Other in situ measuring methods (measuring in the boiler

itself) for metal and alkali metal chlorides that Vattenfall has developed are:

SOAM (Selective Optical Alkali Measuring) - measures the percentage of alkali metals (potassium and sodium) deposited on a heat-transferring surface.

Deposit probes - Vattenfall has developed various tried and tested concepts that use three test rings cooled to different temperatures to measure the substances that have a tendency to form deposits on a heat-transferring surface.

FTIR (Fourier Transform Infra-Red Spectroscopy) - measures flue gas components using IR-absorption, for example around heat-transferring surfaces, and acts as a complement to other methods for understanding why and when problems arise. The use of FTIR in this environment is unique and requires special sampling probes. FTIR can reveal almost all of the contents of the flue gases and is used by Vattenfall for two main purposes: first, to detect hydrogen chloride (HCl), sulphur dioxide (SO₂), carbon monoxide (CO) and water in superheater environments and, secondly, to measure ammonium (NH₃), nitrous oxide (N₂O) and nitric oxide (NO) in connection with various NO_x reduction methods (SNCR and SCR). It is also used to specify hydrocarbons and to detect special acids.

In addition, a Vattenfall-developed measuring instrument based on UV detection is used to detect NH₃, NO and SO₂.

Stack measurements

Vattenfall Power Consultant measures emissions in connection with periodic inspections and performs a number of other measurements required by the authorities. These activities are certified by SWEDAC. Analysis instruments mounted in mobile air laboratories are available for continuous measurements. Apart from these continuous measurements, the sampling and analysis of HCl, NH₃, heavy metals and organic pollutants such as PAH, PCB, chlorophenols, chlorobenzenes and dioxins are carried out.

- Research and development is an integral part of the effort that Vattenfall is making to achieve its vision of becoming a leading European energy company.
- We ensure that the systems we use today for the generation, production and distribution of electricity and heat are as efficient and safe as possible.
- We participate in the development of the energy solutions of the future and ensure that they comply with demands relating to the environment, acceptance and economic viability.