QE (Quantum Equilibrium) International Ltd

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WITNESS THE TESTING OF XPLATE™ AT THE ESKOM COMBUSTION TEST FACILITY

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XPlate mXt Technology

1 Executive Summary

The Eskom Holdings Limited in South Africa is one of the leading manufacturers of power generation in the world. Eskom currently has the electrical capacity of 38,000 MW and consumes approximate 1.7% of coal consumption in the world. One of Eskom's main overheads is the coal used in the production processes.

QE (Quantum Equilibrium) International Ltd (UK), market leader in the supply of nano-technology, has developed a product using the electrostatic neutralization technology to improve coal combustion efficiency, thus delivering significant coal savings to the power plants.

At the Eskom Combustion 1 MW Thermal Test Facility, the engineers from QE International Ltd had witness the test of XPlate™ with the coal-fired combustion test rig. It was observed that the temperatures of hot gas at the distance 0.4 meter, 1.15 meters, and 1.8 meters away from the burner increased 30°C, 16°C, and 15°C, respectively, within 20 minutes after the complete XPlate™ installation. As the temperatures were continuously increasing, the furnace pressure also increased to almost the positive pressure. The operator has adjusted the control by adding atmospheric cool air into the end of furnace in order to cool down the gas temperature in the reactor and brought the pressure back to normal. The condition was maintained for an hour before the removal of XPlate™ sheets from the pipes. The gas temperature was then expected to drop; however, the operator reduced the inlet air in order and maintained the temperature.

The content of this observation report provides background information regarding the technology behind the XPlate™, outlines the process involved with installing and evaluating the XPlate™ during this trial and highlights the benefits that could be gained. QE International Ltd is committed to working in partnership with Eskom to deliver substantial reductions in emissions and fuel costs. We look forward to a long and mutually beneficial relationship.

Dr. Wudh Chayabutra

Director,

QE (Quantum Equilibrium) International Ltd

2 Product Information

2.1 What is the XPlate™?

The XPlate™ (Xenogenic Plate) is the result of over 10 years of intense research into the patented molecular Xenogenic-fuel technology. It is a device which is easily installed at locations such as power plants, steel plants, cement plants or any site which uses coal or gas to fuel industrial boilers, kilns, or furnaces. Improved combustion efficiency and reduced emissions are achieved through installing the XPlate™ due to its ability to store a natural charge which is then released as fuel or air passes through the treated pipe. This technology has been proven to be effective by many government and private organisations both in the UK and abroad.

Figure 2a: This coal-fired cement plant is just one of the locations where the XPlate™ can be of benefit.

2.2 How it Works

When air flows in the pipes, oxygen and nitrogen molecules naturally move, interact, or hit each other and the side wall of the pipe. The interactions that occur between the atoms of a molecule with the other atoms of the other molecules cause forces of attraction to occur; these forces are known as intermolecular forces. These intermolecular forces cause the molecules to adhere together and form molecular clusters.

Before

After

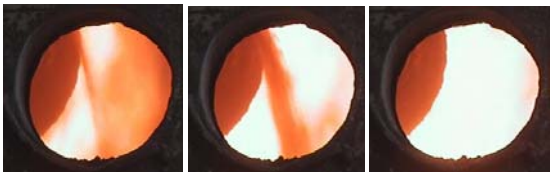


Figure 2b: Photographs from actual test site

When these clusters enter the combustion chamber, combustion is generally not completed, leading to emissions being produced.

The XPlate™ reduces the forces which cause clusters to occur. This is achieved by the ability of the XPlate™ to store naturally occurring charges, and then transfer these positive and negative ions to passing fuel or air clusters. The effect seen by installing the XPlate™ is to break down clusters of fuel or air molecules; therefore all single fuel and oxygen molecules can then be burnt with each other in the combustion chamber. In the application of industrial boilers or kilns where a flame can be seen, the effect of increasing combustion efficiency by the XPlate™ can be observed by the naked eye through the change in flame colour and brightness (see figure 2b).

3 Installation of XPlate™

3.1 Eskom Test Facility

The pictures of the test facility at Eskom Combustion 1 MW Thermal Test Facility site in Johannesburg, South Africa are shown in figures 3a – 3e. The rig has one burner equipped with several thermocouples and measurement. Sub-bituminous coal was used in this trial.

Figure 3a: Eskom Research & Innovation Centre

Figure 3b: Combustion test facility building

Figure 3c: Top floor shows the secondary air pipe and the combustion reactor

Figure 3d: Top floor shows the coal pipe to the burner

Figure 3e: Combustion chamber

3.2 XPlate™ Installation

During the plant survey of the Eskom Combustion 1 MW Thermal Test Facility site, 5 installation sites were identified for the purpose of a meaningful evaluation and are depicted in the figures 3f – 3i. They were at the primary air pipe and the secondary air pipe. The XPlate™ was installed without any downtime and could even be installed whilst the rig was running; consequently there was no negative effect to operational proceedings during the installation process.

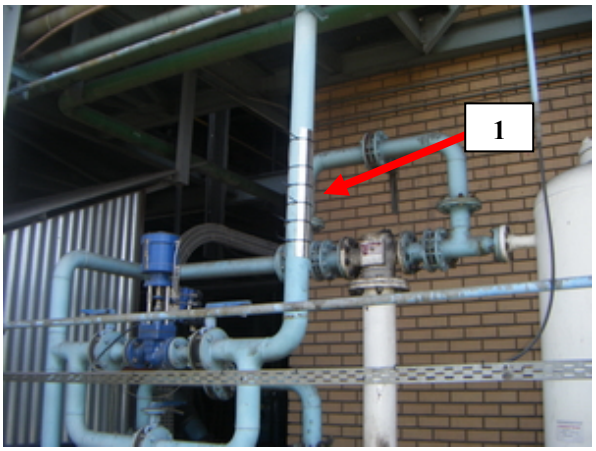


Figure 3f: XPlate™ installation site at the primary air pipe after the air compressor

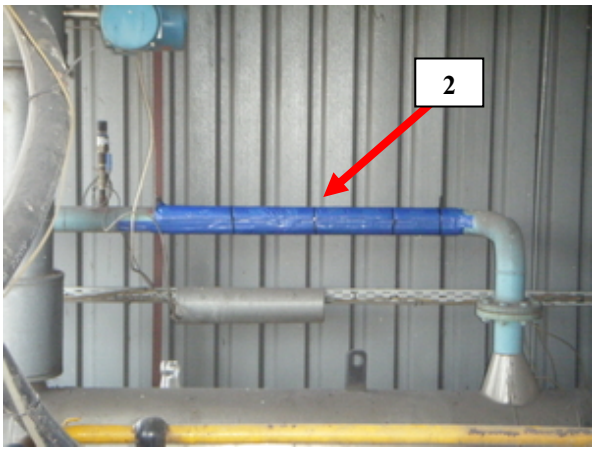


Figure 3g: XPlate™ installation site at the primary air pipe before the heater

Figure 3h: XPlate™ installation site at the secondary air pipe after the blower

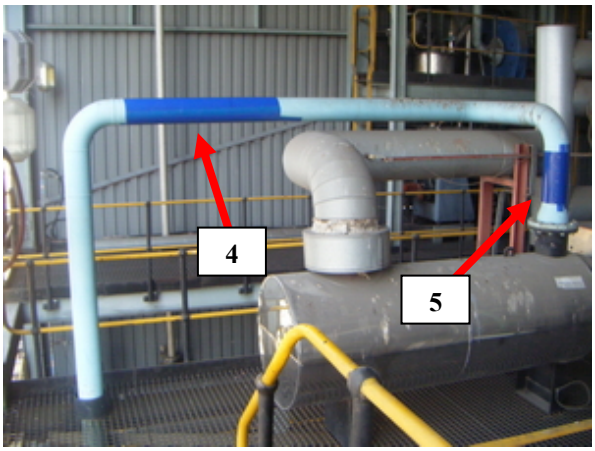


Figure 3i: XPlate™ installation site at the secondary air pipe before the heater

4 Test Evaluation

4.1 Objective

The objective of the trial is to see any possible effect of XPlate™ that might be contributed to the combustion of coal. By giving a limited time to test XPlate™, Eskom was also conducting their own tests during the trial of XPlate™.

4.2 Witness Observation

4.2.1 Trial Setup

The trial was carried on September 3rd, 2009. At time 9:15 a.m. – 10:15 a.m. the trial was set as the 'before' condition. Several parameters including the gas temperatures at the distance of 0.4 meter, 1.15 meters, and 1.8 meters away from the burner were recorded (shown in figure 4a). At 10:15 a.m., XPlate™ was started to install until 10:45 a.m. The coal feed was set constant at 170 kg/hr and the lambda (λ) fuel : air ratio was set constant. The percentage excess O_2 was around 5.5%. One fixed type of Eskom's sub-bituminous coal was used through the trial.

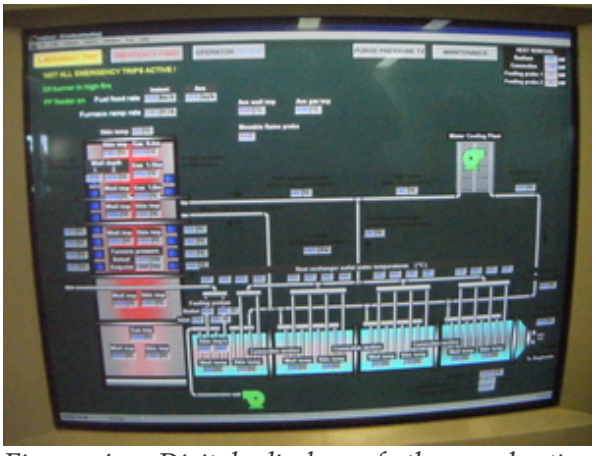


Figure 4a: Digital display of the combustion chamber

4.2.2 Observation

As shown in figure 4b, it was observed that the temperatures of hot gas at the distance 0.4 meter, 1.15 meters, and 1.8 meters away from the burner increased 30°C, 16°C, and 15°C, respectively, within 20 minutes after the complete XPlate™ installation. Once the reaction temperature increased, the concentrations of SOx and NOx were also observed to increas. The furnace pressure was set at -150 Pa, but the actual pressure was around -80 Pa and -60 Pa. As the temperatures were continuously increasing, indicating the furnace was too hot, the furnace pressure also increased to almost the positive pressure, of -2 Pa. The operator has adjusted the control by adding atmospheric cool air into the end of furnace in order to cool down the gas temperature in the reactor and brought the pressure back to normal negative. It was important to note that the adjustment was made before the temperature increased to its maximum.

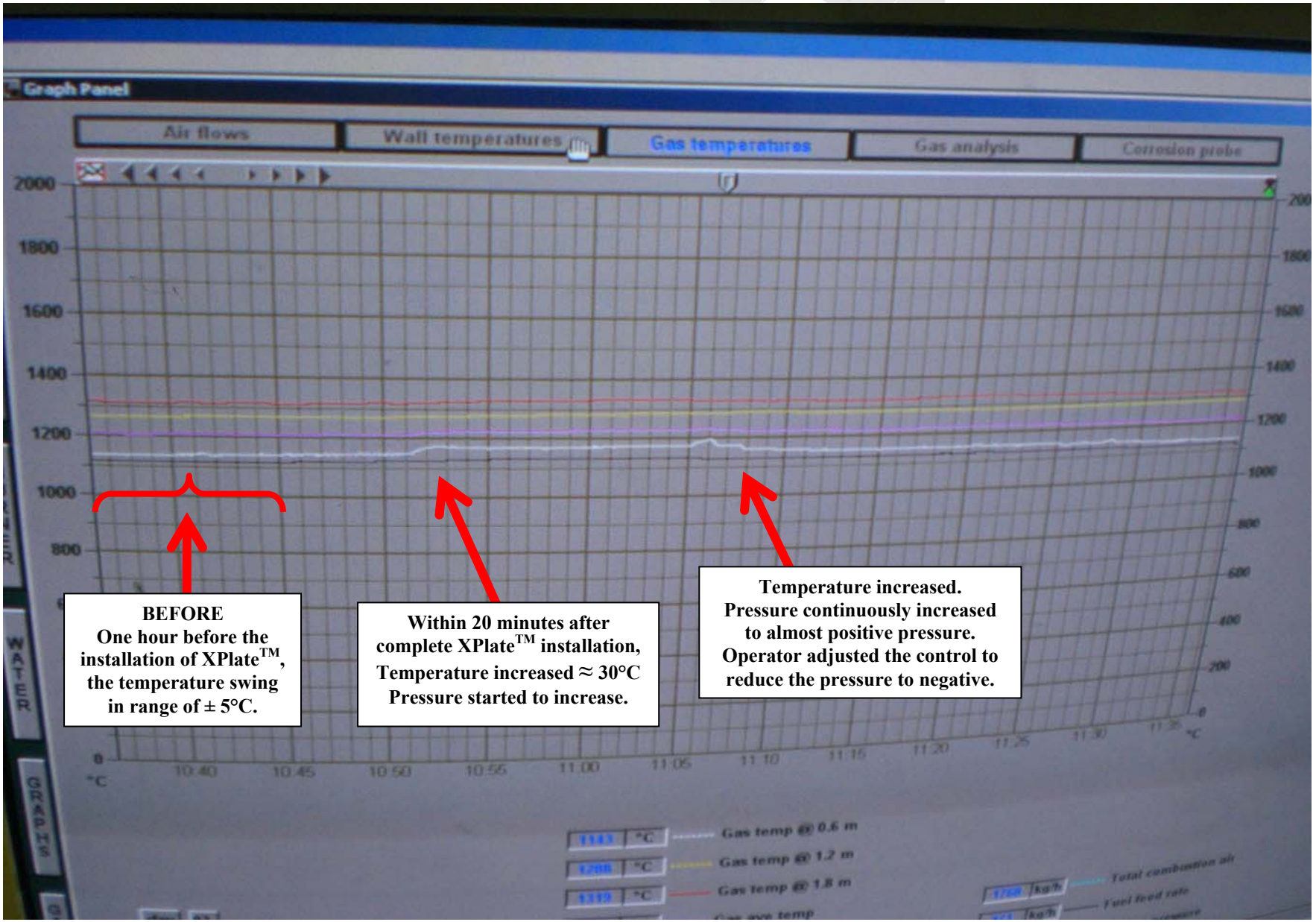
The trial was running under this condition for an hour before the removal of XPlate™ sheets from the pipes. The gas temperature was then expected to drop; however, the operators reduced the inlet air in order and maintained the temperature. The % excess O_2 was reduced from 5.5% to 3.5%.

4.2.3 Recommendations

It has been observed the changes in temperatures and pressure inside the furnace after having XPlate™ installation. Our recommendations are:

1. The increase of temperature and pressure inside the furnace indicates more enthalpy has been produced during the trial period.

Figure 4b : Gas temperature profiles



2. The concentration of SOx and NOx were observed increase due to the increase of combustion temperature. In order to prevent the increase of SOx and NOx, the combustion temperature should be controlled at a constant value by lowering the coal feed rate. Lowering the coal feed rate directly represents to the energy saving of coal. The emission quantity of SOx and NOx are also expected to reduce.

3. The research agreement on the proper test protocols should be conducted in order to gain the maximum benefits of XPlate™ technology. Several parameters such as coal feed, air intake, combustion temperature and pressure, λ ratio, CO, CO_2, NOx, SOx, ID fan speed, radiant heat flux, ash analysis, and controls shall be well integrated.

4.2.4 Expected Benefits

Improvements in combustion efficiency are anticipated during the first moment of installation. These benefits will be ascertained through collection and comparison of data from KPI variables which have been identified during project design meetings as those that would be able to detect improvements that have occurred (e.g. coal consumption, emissions, combustion characteristics etc).

The benefits that are expected to be gained from installing the XPlate™ are the ability to reduce the excess oxygen to optimum levels, improve the firing rate, and reduce coal. Other benefits may be identified throughout the trial period as teams from QE and Eskom work together to maximise the effects of electrostatic reduction in the fuel and air that has been generated by the XPlate™.

5 Why QE International?

5.1 How We Can Help

Continued research into fuel efficiency technologies

At QE (Quantum Equilibrium) International Ltd and QE (Thailand) Co. Ltd. we are determined to benefit our clients through continued worldwide research into methods of reducing emissions and reducing costs with alternative fuel solutions.

Our overarching mission is to facilitate the alleviation of the increasing global fuel and environment crisis through a variety of methods in improving fuel efficiency and reducing costs.

Long-term partnerships

We believe in the value of long-term relationships. We want to work with you as partners, working together towards a common, shared goal of benefiting your organisation in the highest and best way possible.

We believe the highest value in a business relationship can best be achieved by focusing strategically over the long-term rather than merely a tactical, short-term approach.

Risk-free approach

It is our policy and belief at QE (Quantum Equilibrium) International Ltd that you as a client should never bear risk from doing business with us. We stand by our solutions and guarantee that they will benefit you as they are specifically designed to do so.

Personal assistance to inform and support

Our aim is to serve you at the highest level and in order to achieve that end it's imperative that we support and inform you every step of the way.

We recognise that you need to be able to make good business decisions based on having high quality, accurate information. You need expert advice and expertise to benefit the most from our solutions – that's exactly what we provide.