

*cost-effective emissions reduction technologies worldwide*

For immediate release

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## **RJM International successfully completes major NOx reduction project at AES Kilroot, Northern Ireland**

RJM International, the innovative, UK-based provider of emissions reduction technologies for fossil fuel and bio-fuel-fired plant has just completed a major clean coal technology assignment on Units I and II at AES Kilroot, Northern Ireland's largest power station.

With a focus on engineering intelligence to keep costs and downtime to a minimum, RJM's own engineers have achieved a significant reduction in NOx emissions, yet done so without compromising saleable flyash or boiler efficiency. In fact, levels of CiA (Carbon in Ash) have been significantly reduced and boiler efficiency levels have improved.

AES Kilroot is located on Belfast Lough, east of Carrickfergus and was commissioned over 20 years ago. Today it supplies the province with up to 440MWe of power when burning coal and 520MWe when firing fuel oil, from its two T-fired units.

Two years ago, as part of its preparation to meet the increasingly stringent NOx emission thresholds laid down by the Large Combustion Plant Directive (LCPD) and scheduled for introduction on 1<sup>st</sup> January 2008, the plant embarked on a major investment programme to improve its emissions performance.

In order to assist with this process, AES Kilroot hired RJM International, a specialist provider of emissions reduction technologies with a strong track record of success in this field.

The challenge faced by RJM International was significant. The primary task was to reduce NOx emissions to the new LCPD threshold of 500mg/m<sup>3</sup>@ 6% O<sub>2</sub> for coal-firing and 400 mg/m<sup>3</sup>@ 3% O<sub>2</sub> for oil-firing. However, it had to do so in such a way that CO emissions were not adversely affected; O<sub>2</sub> in the form of levels of excess air would not increase significantly as this affects boiler efficiency and finally, that CiA (Carbon in Ash) levels would not rise beyond the saleable limit of 7% CiA as a result of the NOx reduction work; in fact the contracted levels were below this level, to provide some operational margin. In addition, the hardware modifications needed to be made during a relatively short outage period, and the units needed to return to service ready to generate reliably.

The tables overleaf clearly demonstrate the results that have been achieved by RJM International following its review, analysis and re-engineering of certain key components relating to the combustion of oil and coal.

.../2

<b>Category</b>	<b>LCPD and contract targets</b>	<b>Original LNCFS Combustion system</b>	<b>RJM Perf. Test data</b>
NOx firing South African coal mg/m <sup>3</sup> @ 6% O <sub>2</sub> dry	500	648	444 31% reduction
NOx firing Colombian coal mg/m <sup>3</sup> @ 6% O <sub>2</sub> dry	500	638	339 47% reduction
CiA % firing South African coal	<6.5%	8%	5.5% 31% reduction
CiA % firing Colombian coal	<6.5%	4.1%	1.25% 69% reduction

<b>Category</b>	<b>LCPD targets</b>	<b>Original LNCFS Combustion system</b>	<b>RJM Perf. Test data</b>
NOx firing oil mg/m <sup>3</sup> @ 3% O <sub>2</sub>	400	491	383 22% reduction

RJM International was able to deliver these impressive results by following its own set procedures.

Firstly, it obtained baseline data by running the plant continuously for several hours and recording performance criteria at 200 critical datum points throughout the combustion process.

After that, the data was audited using specialist, 3<sup>rd</sup> party calibrated instruments and a physical check of the plant was undertaken to ensure actual dimensions matched those on the engineering drawings.

Then the baseline data from the test-firing was entered into RJM International's proprietary CFD modelling programme and the computer model was run and appropriate adjustments made, based on sound combustion technology and RJM experience, until the outputs in terms of data - including the emissions values achieved with the CFD model were consistent with the values measured during the plant test.

Once this bench-marking equivalence was reached, with the computer model actually reflecting plant behaviour under normal operating conditions, then the real work could begin.

RJM International technicians and engineers could make virtual changes to the model, one at a time, to see what impact each change has on all the other parameters.

To give just one example of how RJM International's engineering expertise was applied at AES Kilroot, let us look at the issue of unburned carbon. CFD analysis confirmed that not only was some of the coal leaving the furnace in an unburned state, but also that the majority of this unburned coal was coming from the lowest coal injection point, even though these particles spent the longest time in the furnace. This was achieved by comparing the coal injection points vertically above the lowest one and therefore closer to the flue exit.

.../3

Clearly, a number of options exist to resolve this, including such things as changing the size of the coal particles, changing the velocity at which the coal enters the furnace, balancing the four coal inputs from a single mill at each corner of the furnace (to ensure consistent volumes) and changing the speed and direction of the air which provides the O<sub>2</sub> to enable the combustion process to take place.

All of these options were explored via the CFD model and it was only the optimum solutions which made the transfer from computer-based binary data to actual, physical changes on site. Of the real changes made, one was modifying the SOFA ports to smaller area nozzles with different angles of injection and another was to modify two out of four of the existing Loesche dynamic Mill Classifiers to the latest Loesche technology.

Another advantage of the CFD modelling system is that the plant can be “run” in the virtual dimension on a range of different input fuels. Most UK plants source coal from many parts of the world, including South Africa, Colombia, Indonesia, Russia and Australia. AES Kilroot was no exception to this and because these fuels have such different combustion behaviours, RJM International has been able to provide AES Kilroot with a combustion system which embraces widely-variable fuels, whilst still maintaining the emissions thresholds within fine tolerances. This is important as it gives the plant considerable leverage when it comes to purchasing future coal contracts, as it is not tied to a single supplier or source.

This approach, which is RJM International’s main modus operandi, ensures minimum plant downtime and keeps costs down too, yet still delivers the results required.

Commenting on the project, Mr. Lyle Woodard, Project Manager for AES, said “We have been very pleased with both the RJM design process and the end results. This was a very challenging project technically and in terms of schedule. From the detailed and analytical RJM modelling approach, we received an engineered solution which resulted in a minimum of intrusive modifications and no disruptions to the plant’s operations. Not only were the modifications practical within the planned outages, but they performed right out of the box, requiring minimal adjustment and optimization. The results have exceeded expectations; after several months of operations it appears that we will be able to maintain our entire coal diet, emissions are well below required limits, and we have seen significant improvements in efficiency, CiA, and particulate emissions over the baseline measurements take just before the outages.”

Commenting on the modifications, John Goldring, Managing Director of RJM said, “Emissions reduction is a complex field, combining maths, physics and chemistry, but by carrying out very detailed analysis of plant performance under different operating conditions and input fuels, we were able understand exactly what was going on at each stage in the combustion process.

“Armed with this information, we were then able to develop and implement a series of engineering solutions to change the performance behaviour of the plant on a consistent basis.

“We also wanted not just to meet all the latest LCPD requirements, but come in well below the current thresholds, so that the plant had a good margin which would endure for a number of years.

Secondly, we wanted to meet those thresholds without upsetting any other parameters, most notably CiA levels, and I am pleased to say we have more than achieved this by providing >50% NOx reduction and >50% CIA reduction with a comparable fuel to the performance of the original low NOx system.

“All the work we carried out on site was done according to the strict rules laid down by the CDM Health & Safety Regulations and our key sub-contractors, in particular, the Shaw Group, must take the praise for the success of the installation process.

“Finally, from a practical point of view, what we wanted to end up with for the plant operators was a simple set of operational procedures so that the desired emission levels can be maintained, no matter which input fuel is being fired,” he confirmed.

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