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The complete alternative solution

Fairport Engineering describes its activities in providing handling and conveying solutions for alternative fuels for the cement and power industries. Key projects it has been involved with are Castle Cement's Ketton works, Cemex's Rugby cement plant, as well as Fiddlers Ferry and Didcot power stations.

Above: Castle Cement's Ketton works.

These days alternative fuels are becoming increasingly important to industrial energy consumers. In particular, over the last few years, fossil fuel replacement has been a subject of keen focus in the power generation and cement industries in the UK. Driven by economics, supply issues and environmental incentives, coal-fired power generators have increasingly adopted co-firing regimes with naturally occurring biomass materials. Simultaneously, cement manufacturers have encouraged the use of a wider range of alternative fuels derived from a variety of other waste sources. The advent of these initiatives has prompted the need for process plant enhancements to many power stations and cement works in the UK. Power stations, in the main, have added alternative materials handling schemes for the biomass fuels and cement works, as well as new materials handling schemes, while upgrading their environmental systems to allow the waste fuels to be burnt in keeping with environmentally sensitive emissions legislation.

Fairport Engineering Ltd has been active in developing and delivering these alternative fuel schemes with clients in the power and cement industries for some time now. As a case in point, in 2003, Fairport was instrumental in providing materials handling systems for tyre chip and processed sewage pellets at Lafarge's Cauldon cement works. Scrap tyres have the same energy value as coal and by using scrap tyres Lafarge can:

- Improve the overall environmental performance of the works;
- Help solve the UK's scrap tyre disposal problem;
- Preserve non-renewable fossil fuels for future generations;
- Reduce energy costs.

Processed sewage pellets (PSPs) are made from sludge that remains after sewage treatment and has a similar energy value to coal. PSPs are also considered to be a 'carbon neutral' fuel. The UK generates almost a 1Mt of sludge from sewage treatment each year. Dried processed sewage pellets are a relatively new product for which the main uses are fertiliser and fuel. Having carried out successful trials in 2003, Lafarge is now successfully using this fuel permanently at Cauldon.

Cauldon, near Stoke-on-Trent, has the capacity to make up to 1Mt of cement each year and has successfully used chipped scrap tyres as an alternative fuel for many years. In 2004, it started to use processed sewage PSPs. The materials handling systems that Fairport engineered at Cauldon were based on an intelligent crane system for the tyre chips and a conventional conveying system for the PSPs.

Alternative fuels for power generation

In the coal-fired power station sector Fairport has designed and built two reception, storage and addition systems for naturally occurring biomass fuels. The first, in 2004, was at Scottish & Southern's Fiddlers Ferry station and the second, more recent installation in 2006, was at RWE NPower's Didcot station. Designed to handle and store biomass fuels such as olive kernels, wood pellets, citrus pulp, sunflower pellets, maize pellets and shae nuts, these systems incorporate push floor feeders at the heart of their design.

Scottish & Southern encourages the use of biomass as a fuel in power generation because it is carbon-neutral and therefore gives rise to less greenhouse gases. Boilers, adapted with direct injection burners at Fiddlers Ferry, can fire up to 30% biomass in the fuel mixture, providing a significant reduction in CO₂ emissions. In power generation terms this co-firing assists compliance with the Large Combustion Plant Directive, which aims to reduce emissions of sulphur dioxide, nitrogen oxides and dust from plants with a thermal output greater than 50MW.

The new biomass facility at Didcot will allow RWE NPower to increase the proportion of biomass used in its current fuel mix from around 1.0% to 10%. This new investment could replace more than 300,000t/y of coal with biomass and avoid up to 700,000t of carbon emissions being released into the atmosphere every year.

The new plant is a biomass storage and reclaim facility which will contain different types of biomass materials like sawdust, wood chips and palm kernels. A moving floor inside the plant feeds biomass fuel onto a conveyor system, which connects into the coal con-

veyor system. After converging with the coal supply, the blended fuel is fed into silos. From the silos the blend is milled into a fine dust and blown into the boilers, creating the heat required to power the steam turbines and generate electricity. The creation of this system is a very positive step towards ensuring that renewable energy makes up 10% of UK electricity consumption by 2010 as part of the 'Renewables Obligation.'

Alternative fuels trials at UK cement plants

From an environmental perspective, UK cement producers have to address different issues in harnessing the benefits of alternative fuels – a case in point being part of the sustainability performance initiative that Cemex has implemented at its flagship plant at Rugby. Having performed tyre chip burning trials in 2005 Cemex has recently undertaken a significant consultation exercise to gain the necessary operational permits from the Environmental Agency.

The Rugby works is one of the most modern cement making plants in the world and has the largest kiln operating in the UK with a production capacity of 1.8Mt/y. This capacity will allow a further significant portion of the 40M scrap tyres in the UK to be recycled in a safe and beneficial manner. This, in conjunction with the recently commissioned UK£6.5m new dust filter installation, whose overall management and installation supervision was undertaken by Fairport, signifies an increasing need to be a good environmental neighbour whilst taking advantage of what alternative fuels can offer.

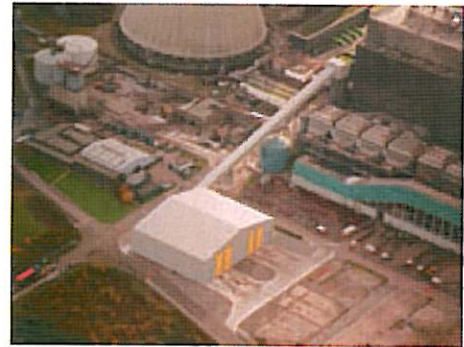
The new dust filter works by extracting dust from gases produced in the kiln and is installed on the plant's exhaust duct to provide a physical barrier to the dust as it passes from the kiln to the chimney. Whilst the old electrostatic filter – which the new bag filter replaced – operated well within the statutory emission limits, Cemex wished to improve its environmental performance even further. Results to date indicate that dust emissions have been cut by 80% since the new filter became operational in April 2008. This level of performance will undoubtedly lead to other alternative fuels being considered for use at Rugby – bearing in mind that at Rugby tyre chips represent an energy replacement of up to 12% and Climafuel, a refuse derived fuel, could constitute an energy replacement of up to 30%.

In a similar vein, Fairport and its Austrian technology partner A Tec Advanced Process Technologies completed the installation of the Kiln 8 by-pass at Castle Cement's Ketton works in February 2006. The circulation of volatile materials such as alkalis, sulphur and chlorine within the kiln system can lead to pre-heater blockages and/or restricted kiln output. The control of volatiles in the kiln system is therefore a limiting factor on kiln output and performance. The objective of the project was to engineer and install a by-pass system that would allow a high proportion of the volatiles to be removed from the kiln gas stream.

Some 7% of the of the kiln gases are diverted into the by-pass system and cooled in an initial quench chamber with atmospheric air. The cooled dust-laden gases are




then ducted to a cyclone that separates the coarse dust particles and returns them to the kiln. The volatiles adhere to the fine particles in the remaining gas stream, which is passed to a second quench vessel before being treated in a downstream dust filter. Dust is collected in the filter and the resultant cleaned gas is returned to the main kiln stack for release to atmosphere.



Top: NPower's biomass power production facility at Didcot.

The future of alternative fuels in the UK

It is evident from the examples noted in this article that alternative fuels will be part of the UK's industrial future. In recognition of this Fairport has formed a partnership with A Tec Advanced Process Technologies to co-operate exclusively on these types of projects in the UK. A Tec is a world leader in cement pyrotechnology and operates an advanced pilot plant for preheater and cyclone optimisation at its process centre in Austria. Patented environmental technology such as Reduchlor, Reduchrome and Redunox is also available.

Both Fairport and A Tec are able to offer a range of alternative fuel handling and processing systems to suit biomass and waste derived alternative fuels. It is believed that the unique combination of A Tec's process technology and design capability coupled with Fairport's all-round engineering and construction expertise can offer UK industry the complete alternative solution when it comes to alternative fuels. For more information please contact Fairport Engineering's communications manager, Linda White. 

Above: Fiddlers Ferry power station uses alternative biomass fuels in its fuel mix.

Below: Cemex's Rugby cement works.

Right: Black bin waste is turned into alternative fuels by S4R.

