

Burning 'difficult' coals

This project developed an advanced burner that will allow cleaner combustion of difficult coals at lower cost.

The need

Difficult coals generally cost less than other coals but are harder to burn and thus more expensive to utilise in standard power station furnaces. In addition, the current burners available for use with these coals are less effective in achieving low emissions of harmful air pollutants such as nitrogen oxides (NO_x). Higher combustion efficiency and use of a low NO_x burner would lead to lower costs (and thus cheaper electricity for the consumer) and lower environmental impact (fewer NO_x emissions and less carbon released for the same amount of energy generated).

The results

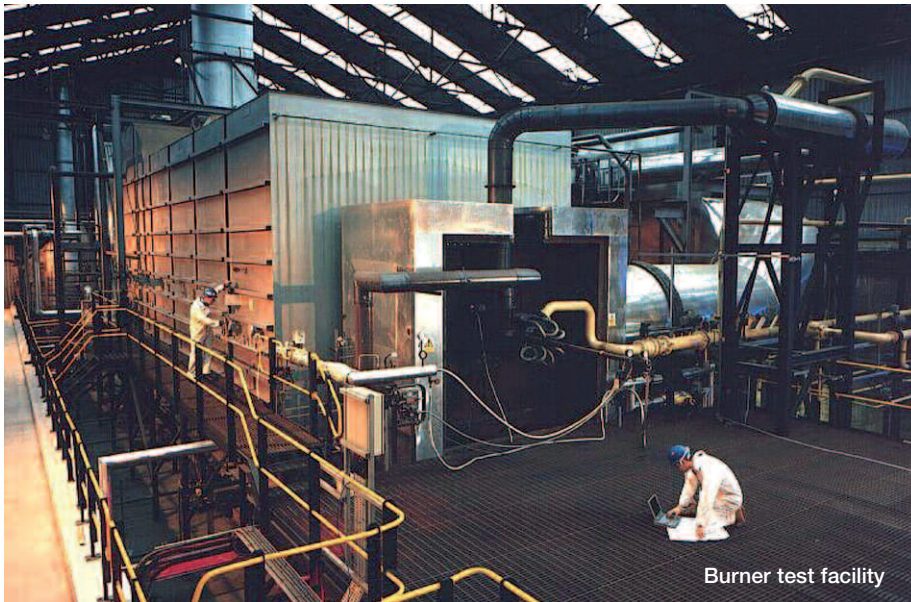
The composition of the difficult coals used in this project affect the ability of standard burners to achieve a stable flame with low NO_x emissions and good combustion efficiency. In this Doosan Babcock led project, researchers tested four difficult coals and a UK bituminous coal (the 'reference' coal) with an advanced, low NO_x emission burner. The coals (two from China, one from the US and one from the UK) had a range of different characteristics that made them difficult.

The Doosan Babcock burner achieved stable combustion with good efficiency and NO_x emission levels at below EU limits. Good combustion efficiency offers the potential for lower capital costs and less need for support fuels (generally oil) for plants burning difficult coals (so fewer carbon emissions). It also gives ash of a composition that makes it suitable for use

in products such as building materials, producing significant cost and environmental benefits compared with sending it to landfill. Burning difficult coals using the new burner will result in much lower NO_x emissions (at least half) compared with the previous technology used to burn them, with associated savings in air pollution control costs.

Prior to full-scale testing at Doosan Babcock, computer modelling and an extensive programme of laboratory-scale testing were used to characterise the test coals using new techniques developed by Imperial College London.

Without the new burner, utility companies would have to use cheaper, difficult coal in a more expensive plant or a more expensive coal – either of which mean higher electricity prices for the consumer.



Burner test facility

'Difficult' coals

Any coal has some components that are easy to ignite and some that will not burn. A 'difficult' coal has a lower proportion of 'easy to burn' material and a higher proportion of material that does not burn or is hard to burn. Difficult coals make up a significant proportion of world coal stocks (less than 10% in some regions but over 80% in others).

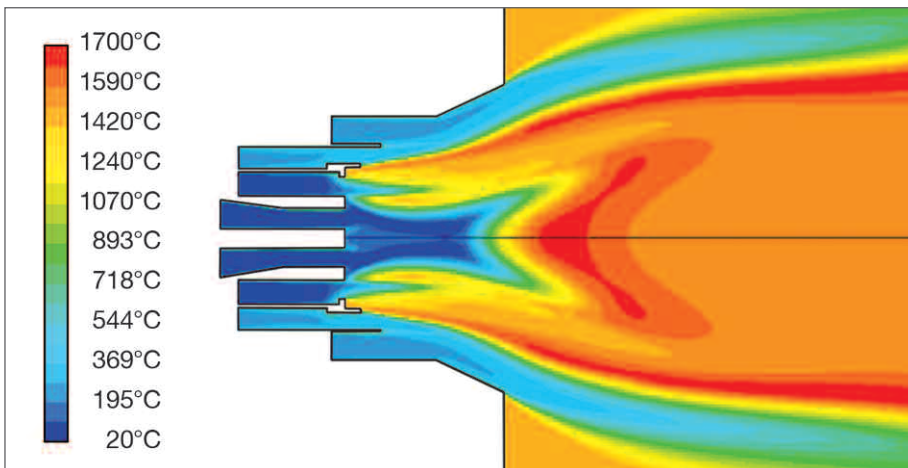
Market potential

The development of the new burner gives a business advantage to difficult coals as they can now be used in standard plant. The overall potential market size for difficult coals for power stations is difficult to estimate as it will be influenced by the uptake of carbon capture and storage technology and the attitude of individual markets to the use of alternatives to coal. The biggest markets are likely to be China, the US and possibly India.

An advantage of the new burner is that it enables different boiler designs to be used to burn difficult coals. This has the potential to positively influence profit margins. The project team is aware of up to 10 companies in the market globally. Doosan Babcock expects the market for its advanced low NO_x burner to be between 500 and 1,000 units, mainly in areas such as Eastern Europe, China and the US. Further development of the burner tested in the project has already led to its successful installation on a large, new-build, utility boiler utilising a difficult coal.

HOW THE TECHNOLOGY STRATEGY BOARD MADE A DIFFERENCE:

'The new burner enables difficult coals to be fired in standard, lower cost boiler furnaces'



Temperature profile of a modelled flame from a difficult coal

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Collaborative research and development projects are one of the tools that the Technology Strategy Board uses to drive innovation in the UK. The Technology Strategy Board is a business-led executive non-departmental public

body, established by the Government. Its role is to promote and support research into, and development and exploitation of, technology and innovation for the benefit of UK business, in order to increase economic growth and improve the quality of life. It is sponsored by the Department for Business, Innovation and Skills (BIS).

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Project partners

Doosan Babcock Energy Limited and Imperial College London

Technology Strategy Board investment

£171,800

Total project investment

£554,150

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