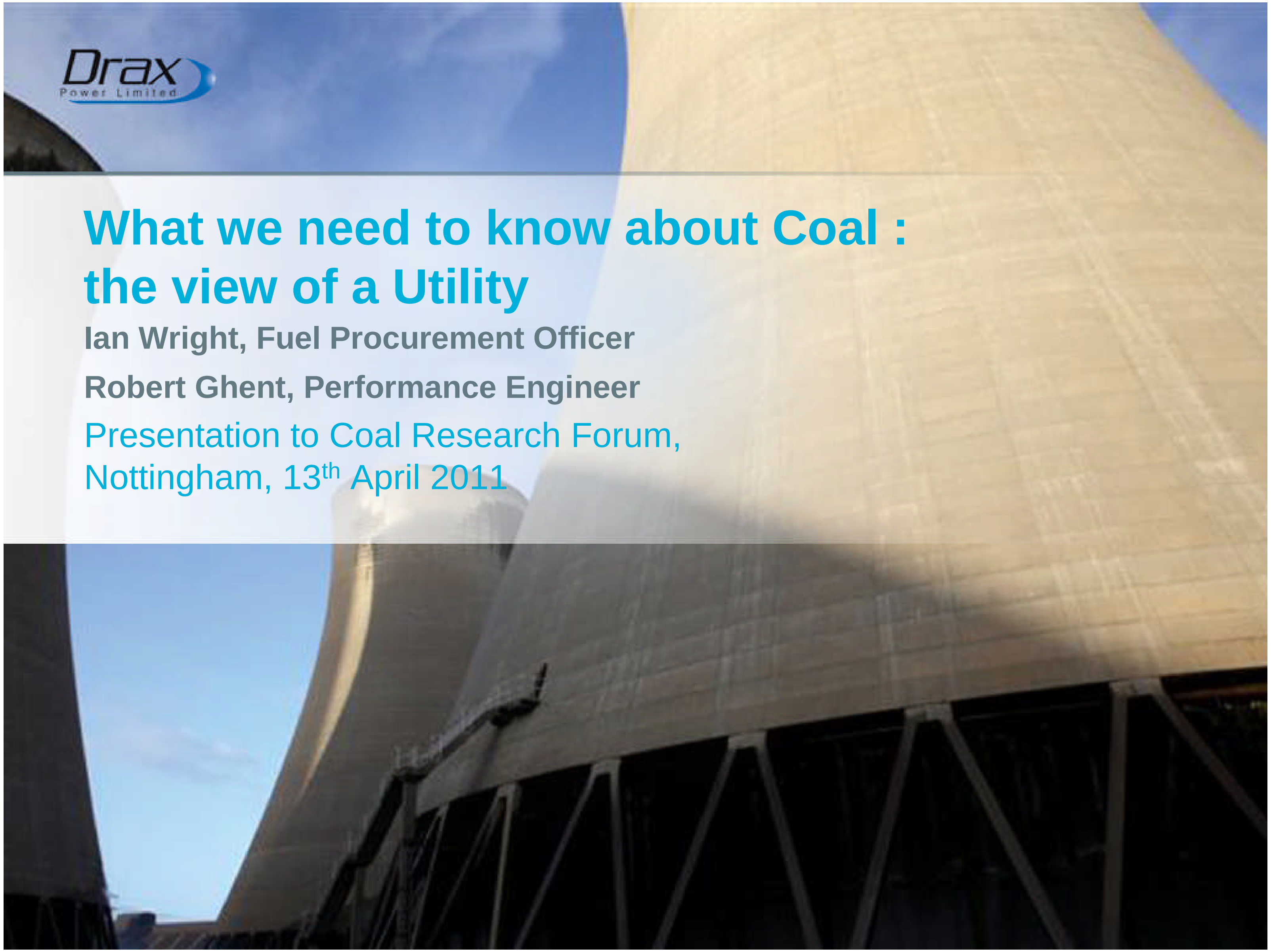


What we need to know about Coal : the view of a Utility

Ian Wright, Fuel Procurement Officer

Robert Ghent, Performance Engineer

Presentation to Coal Research Forum,
Nottingham, 13th April 2011

Drax Today – Key Facts

Listed on London Stock Exchange in Dec 2005

Generates c. 23-27TWh pa - approx 7% of UK's electricity needs

Coal and alternative fuel burn of c. 8.5 – 11Mt pa

Commissioned in two phases – 1,980 MW installed by 1976 1,980 MW installed by 1986

One of the cleanest and most efficient coal-fired power stations in the UK

Six flexible units – 660MW each

760 skilled and experienced employees

Fully environmentally compliant – FGD & BOFA systems fitted

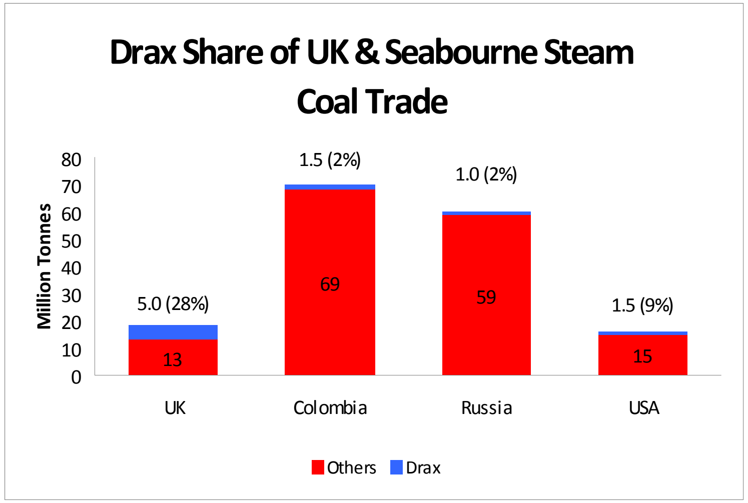
Development of Fuel Procurement Strategy

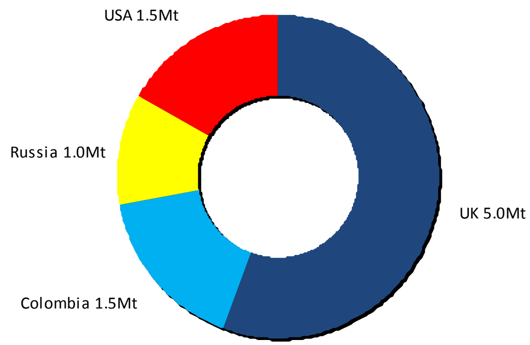
- Up to Winter 2004 Drax was 100% indigenous supplied. Not sustainable due to:
  - UK mine closure programme; and
  - Future environmental constraints.
- Through comprehensive single fuel trial programme:
  - Widened Drax coal specification range; and
  - Added generic (Russian Kuzbass, high sulphur US) and specific named coals (RSA, Colombian, Indonesian bituminous and sub-bituminous) to approved coal list
- Moved to 50-50 indigenous imports ratio
- Moved away from NOx unfriendly coals

Drax Coal Portfolio

Steam Coal	Volume (Million Tonnes)
World consumption	6,000
Internationally traded	700
UK generators consumption	42
UK coal production	18
Drax consumption	9

- Circa 9 Mt coal p.a.
- Typically 50% indigenous. Around 30% of UK production.
- Imports largely from Colombia, Russia and USA.





Biomass Operations

Highest renewable output from single UK facility in 2010

World's biggest co-firing facility

- 500MW renewable electricity capacity
- At full capacity saves > 2.5Mt CO_2 pa

Highest UK renewable output (7% [1] total UK) – despite operating at less than full capacity

- 2010 biomass burn of 0.9Mt (2009: 0.4Mt)
- Do not expect full utilisation at current ROC support

70kt port storage and rail loading facility commissioned

New biomass rail wagons in operation

Complementary 100kt per annum straw pellet plant

All biomass procured against robust sustainability policy

(1) Drax estimate based on Ofgem Renewables and CHP Register data, adjusted for banding

Future Developments
Industrial Emissions Directive (IED)

More stringent emissions standards (NOx and SOx) from 2016

- EU agreed flexibility measures – better idea of compliance window

Timing of closures / plant retrofit a major determinant of future UK reserve margin

Continuing R&D work on technical solutions

- Range of technologies under review – including SCR
- Solution dependent on fuel mix – biomass burn level

Clarity required over biomass support levels

Drax Challenges - Widening the Dark Green Spread

- Gas price low in Europe (pre Japan) alongside strong coal market results in lower dark green spreads
- If DGS margins are low, find value in the fuel diet
- Advantaged fuels
- Lower Heat, Higher Sulphur fuels
- Trials at the boundaries of usual quality acceptance

Widening Dark Green Spread – Fuel Blending

- Blending fuels to stay within emissions bubbles
- Blend ‘out of spec’ high value fuels to create boiler ready fuels
- Designer fuel blending

Drax Boiler

Six Babcock and Wilcox 660 MW boilers

Superheat 568 deg C

Reheat 568 deg C

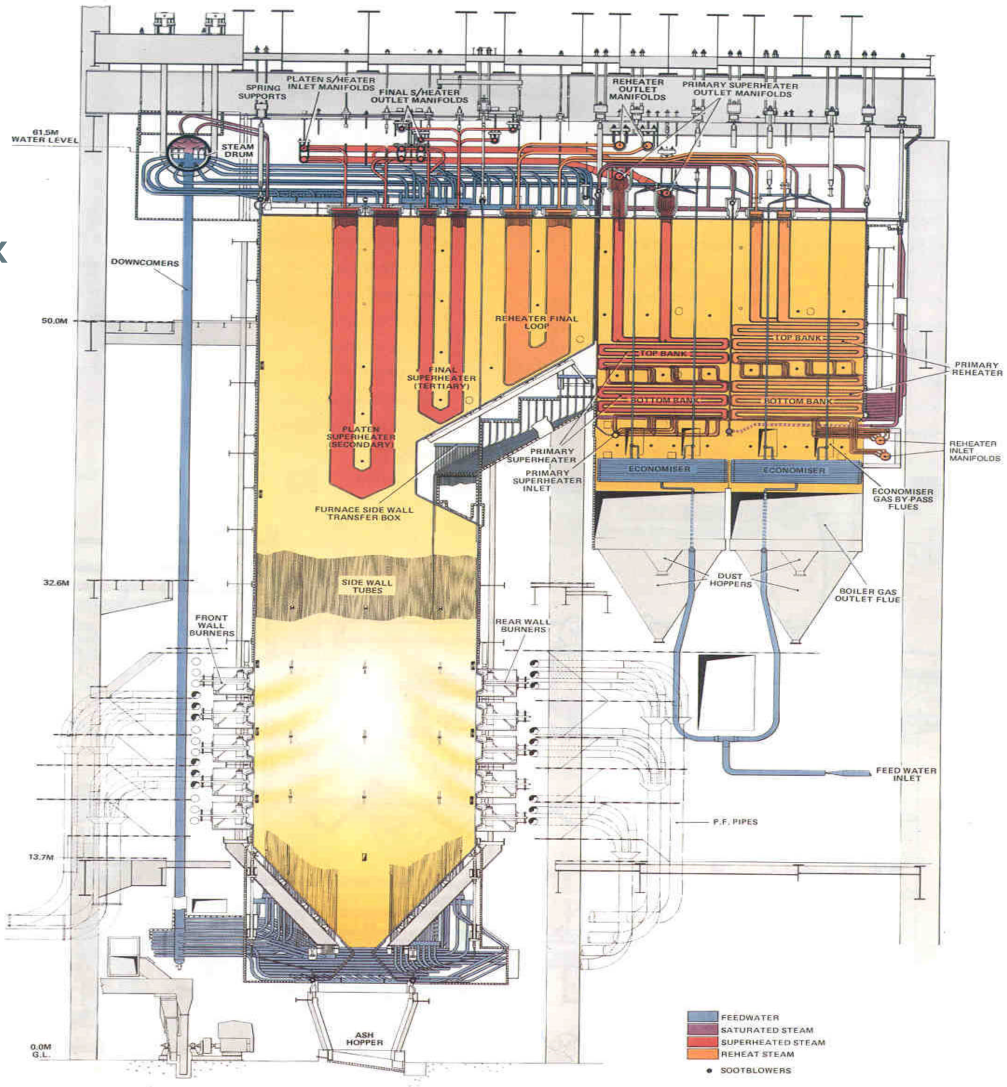
Sub-critical Rankine cycle with single reheat

Opposed wall fired

Low NOx burners

BOFA system

Wet FGD



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Drax basic design coal and coal purchasing

Drax was designed for Yorkshire coals with the following properties (as received basis):

Total Moisture 8%, Ash 20%, Volatile Matter 28%, Fixed Carbon 44%, Hydrogen 3.7%, Sulphur 2%, Phosphorus 0.01%, Chlorine 0.4%, Net Calorific Value 23,400 kJ/kg, Ash Fusion Temperatures: Initial Deformation 1200 deg C and Fusion 1250 deg C. HGI 50. Size maximum 50 mm.

Coals are purchased within to a buying specification which is based on technical design and operating experience.

A broader range of fuels are purchased; where these are 'out of spec' they are assessed and a risk assessment is carried out.

The EPRI Vista Coal Quality impact Model is used for economic and performance assessments of proposed fuels and blends. Trials are then carried out to assess the fuels and blends.

Slagging and Fouling

Base Acid ratio =

(Fe_2O_3 + CaO + MgO + Na_2O + K_2O) /

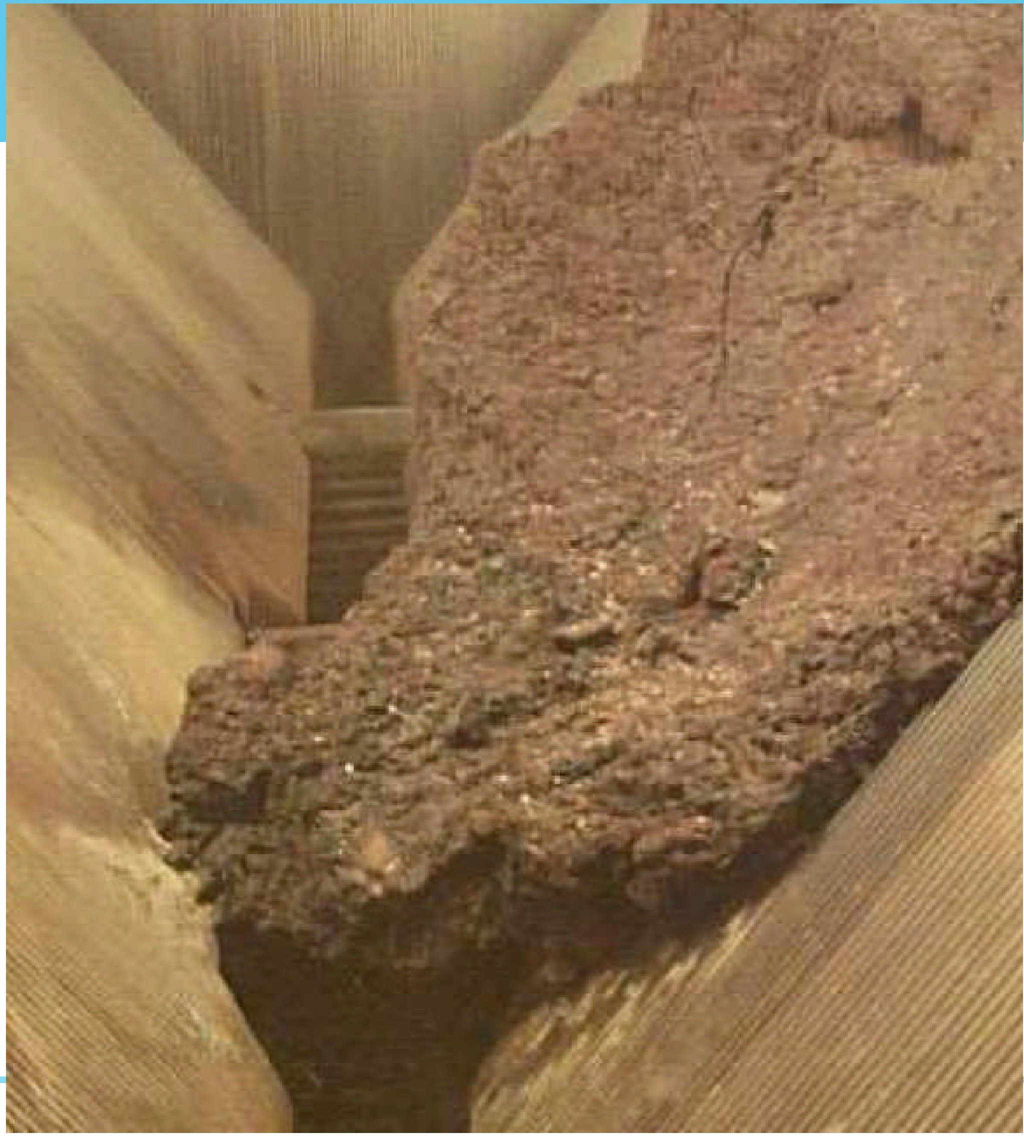
(SiO_2 + Al_2O_3 + TiO_2)

Slagging Index =

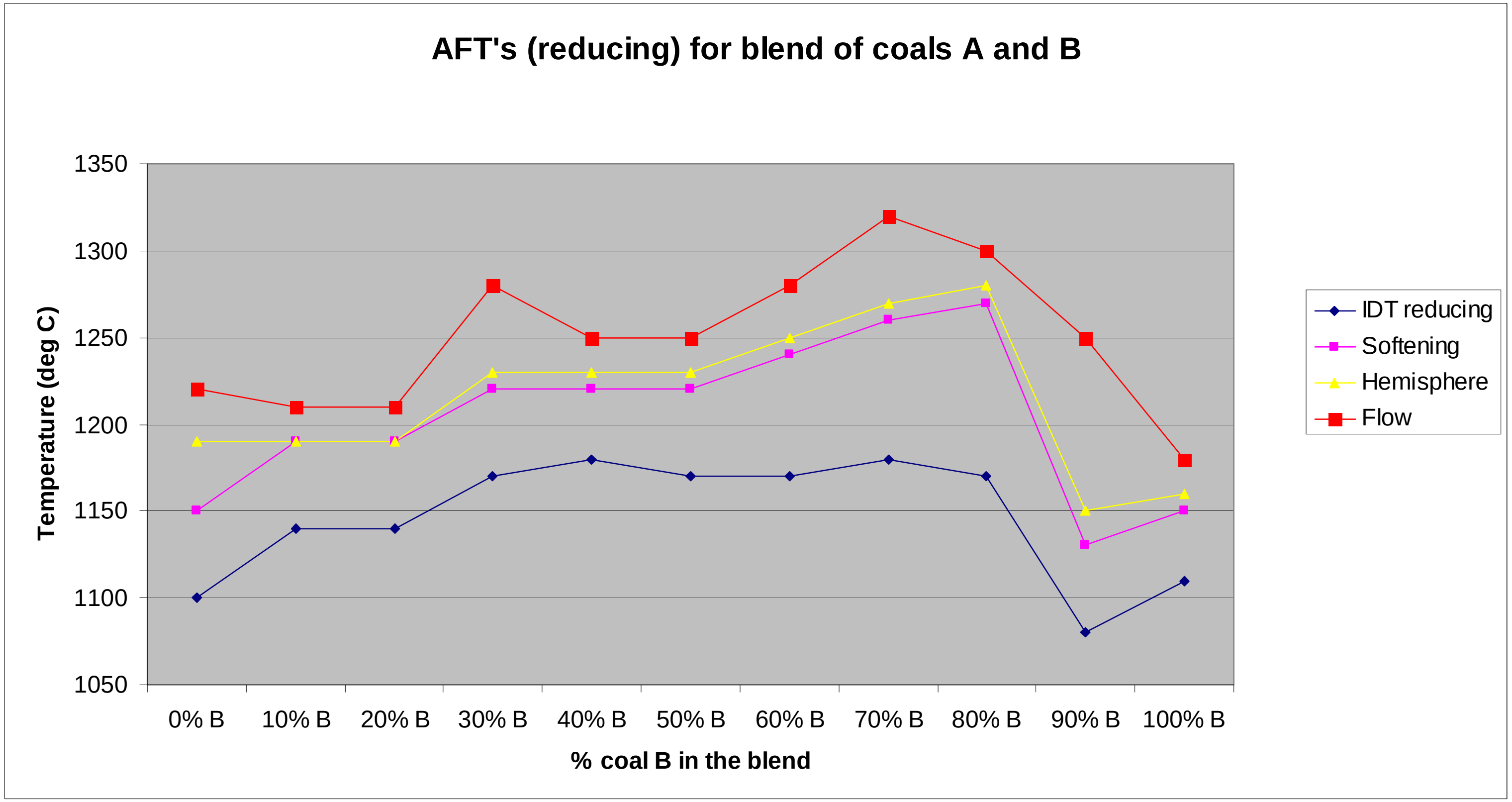
B/A ratio x sulphur dry

Fouling Index =

B/A ratio x %Na_2O in ash



Ash Fusion Temperatures - Eutectics

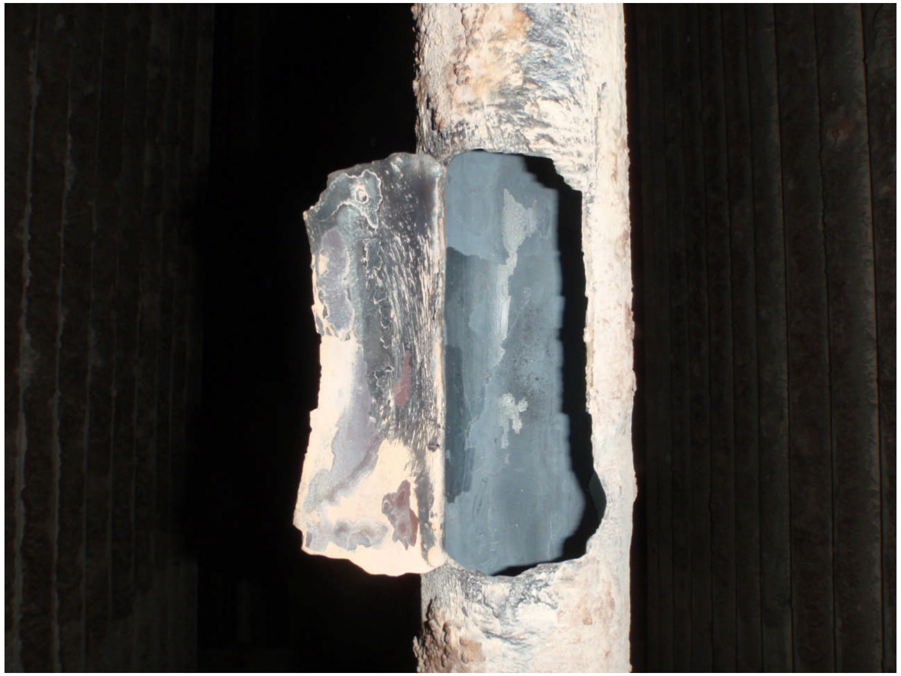


Fireside corrosion

The main components of the fuel that influence corrosion are the sulphur and chlorine content.

Reducing atmospheres affect furnace corrosion.

Metal temperatures are also a factor, as corrosion rates are greatly increased if tube overheating occurs.



Biomass co-firing further development

- 500 MW biomass co-firing capability - further development
  - Prediction and minimisation of slagging, fouling, and corrosion from coal biomass blends
- Continued growth of fuel flexibility
  - Materials handling
  - Coal blending
- Boiler performance
  - Improved fuel air distribution, measurement, and control
  - Flame eyes performance
- Characterisation of co-firing coal biomass blends on emissions and by-products
  - NOx optimisation
  - Ash and gypsum by-products

Summary

- Since 2004 considerable progress has been made with coal flexibility including advantaged fuels such as fine coal
- Since 2003 biomass co-firing capability has been developed to 500 MW
- Now continuing to develop fuel flexibility and biomass co-firing further, and optimise boiler performance

Any Questions?

Appendix

Rising to the Carbon Challenge - Biomass Development

2003

Start of co-firing, blending biomass with coal through existing coal milling equipment

2004

R&D for direct injection of biomass independent of coal milling equipment

Launch of energy crop programme

2005

Installation and operation of pilot direct injection facility

2006

Installation and operation of second direct injection facility (100MW capacity)

2007

Investment in wood yard for processing local energy crops

Investment in 400MW direct injection co-firing facility

2008

Launched development of dedicated biomass business with Siemens Project Ventures / Drax Joint Development Agreement

Initiated comprehensive biomass sustainability policy

Investment in 100,000t pa straw pellet plant

2009

Secured grid rights and sites for first dedicated projects

Re-design and re-launch of energy crop programme

Investment in purpose built biomass train wagons and port facilities

2010

Completion of direct injection co-firing facility (500MW capacity)

Rail wagons and port facilities operational

Largest UK renewable facility

Continue to progress technical and commercial development of dedicated biomass business