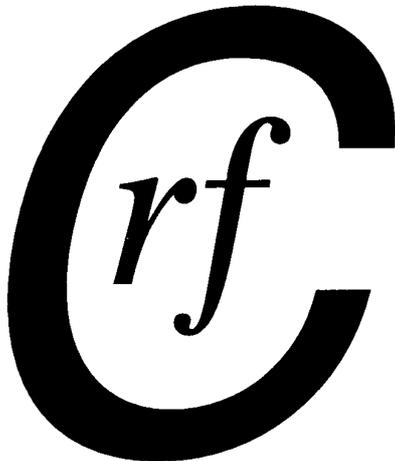


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NEWSLETTER



*of the
Coal Research
Forum*

EDITOR'S COMMENTS:

Well I've held the front page for the hot news of the release today, 23rd May, of the Government's Energy White Paper - a snappy little 343 page number- so is it all clear now?! Well, possibly. The paper contains all which we might have come to expect. However, in some ways, the problem seems to be that although there is a clear recognition of the need for urgent action to fill the generation gap with a range of low carbon options, the nuclear issue seems to have dominated public discussion. There seems to be an inability in certain quarters to recognise that all options need to be considered, including nuclear, and that to exclude any at this time would be folly.

If the life of the current fleet of nuclear and even some of the coal-fired plant were to be extended, which, I feel, is quite possible given the short time scale to 'lights-out', it would reduce the electricity supply gap and change many of the scenarios currently being discussed.

It was also particularly unfortunate timing that BP chose the same day to pull the plug on their carbon capture and storage project- not the message many of us wanted to hear.

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Darling publishes Energy White Paper

23 May 2007

Greater energy efficiency and a secure, low carbon energy mix for the long-term are at the centre of the Energy White Paper published by Trade and Industry Secretary Alistair Darling today. In a statement to the House of Commons, Trade and Industry Secretary Alistair Darling said: "We face two big challenges - climate change and maintaining stable and affordable energy supply in an increasingly unstable world. The Energy White Paper sets out a long term framework for action to address these challenges at home and abroad. "The UK is also becoming increasingly dependent on imported oil and gas at a time when global demand is accelerating. We will ensure that we make the most of our substantial remaining reserves in the North Sea, have a diverse range of sources for our imports and make further progress opening up markets in Europe and more widely.

"With a third of our current electricity generation capacity due to close in the next 20 years there is also a pressing need for investment in new low carbon sources. We will work to ensure there is a market price for carbon into the long term by strengthening the EU Emissions Trading Scheme. We will triple the amount of electricity we get from renewables by 2015. We want to lead in the development of carbon capture and storage. And we will consult on the significant role that new nuclear power stations could play in cutting emissions and diversifying our supply. "With the measures we are proposing across government on energy and the wider environment we can cut emissions by between 23-33 million tonnes of carbon by 2020 - the equivalent of removing all the emissions that we get from every car, van and lorry on Britain's roads today.

"Every action set in train by this White Paper is important, and none will be easy. Nor can we become a low carbon economy in a single step. But if each of us acts we can start to deliver the low-carbon economy vital to our prosperity."

Environment Secretary David Miliband said: "There's a real will among consumers and businesses to become more energy efficient, tackle climate change and move the UK towards a low-carbon economy. Government's role is to make it as easy as possible for them to do this. The Energy White Paper is part of that picture.

"For consumers, it means extra help to improve the energy efficiency of even more homes because we are proposing that energy companies will have to double their efforts in promoting efficiency measures. This will in turn reduce emissions and fuel bills.

"For businesses, we're giving the go-ahead to the world's first mandatory carbon trading scheme aimed at large commercial and public sector organisations, such as banks, supermarkets and central government departments. The new Carbon Reduction Commitment will be a cost-effective scheme that will save over a million tonnes of carbon per year by 2020, while enabling businesses to continue to show real leadership in tackling climate change.

"And for the wider international community, action to tackle climate change in the UK is vital if we are to bring the US, China and India to the table to agree a new climate change deal. That's why this White Paper also sets out our international energy and climate change strategy and I hope it will resonate far beyond the shores of the UK."

Foreign Secretary Margaret Beckett said: "To deliver energy security and accelerate the transition to a low-carbon economy requires urgent and ambitious action at home and abroad. As the Stern report indicated, we will need a massive step change in investment to achieve this necessary transition in the time available. In particular, given that major economies are going to continue to use coal, we need to make sure that the technologies that eliminate carbon emissions from coal use are developed and deployed as rapidly as possible. The UK cannot act alone, but it can take the lead in working towards this goal, and the Energy White Paper will help us do that."

Announcements in the White Paper include:

- * A requirement for new meters to come with a real-time display from 2008 and a short term offer of free displays from energy suppliers for households to 2010. In addition, the Government is encouraging the introduction of smart meters, also with displays, in the household sector and for small firms and expects everyone to have a smart meter within 10 years, whilst requiring smart meters for all but the smallest of businesses in the next five years.

- * A consultation setting out how the energy efficiency of consumer electronics will need to improve is published.

- * A consultation to double energy suppliers' current obligation to deliver energy efficiency measures to customers through a new 'Carbon Emission Reduction Target'.

A cap and trade 'Carbon Reduction Commitment' for large commercial organisations such as banks, supermarkets and large local authorities.

- * A 'Distributed Generation' Report is published including simplification of energy market and licensing arrangements for localised energy by the end of 2008 and clearer export tariffs from all six major energy suppliers for microgenerators to sell excess electricity.

- * Legislation to band the Renewables Obligation to benefit offshore wind, wave, tidal and other emerging technologies. The cap on the amount of co-firing generation qualifying for support will be removed.

- * Publication of a Biomass Strategy as well as a response to 'Creating Value from Renewable Materials' - a 2 year progress report on the Strategy for Non - Food Crops and Uses.

- * Detail on the competition announced in the Budget to build the world's first end-to-end Carbon Capture and Storage plant, which will deliver at least 300MW capacity, 90% CO₂ saving, and be up and running between 2011 and 2014.

- * Legislation to allow the storage of natural gas under the seabed and unloading of Liquefied Natural Gas at sea.

- * A three month deadline within which DTI will make consent decisions on large scale energy projects, pending more radical reforms set out in the Planning White Paper.

- * A new energy market information and analysis service from this autumn.

- * A Low Carbon Transport Innovation Strategy is published backed by funding of £20m for public procurement of low carbon vehicles, an up to £30m R&D

'Innovation Platform' and £5m additional funding for the Energy Technologies Institute.

In addition, published alongside the White Paper, are:

* A new consultation on the Government's preliminary view that it is in the public interest to give private sector energy companies the option of investing in new nuclear power stations. A 20 week public consultation running until 10 October starts today.

* A related consultation setting out the proposed 'Justification' and 'Strategic Siting Assessment' processes for new nuclear power. A 'pre-licensing' process has separately been started by the Health and Safety Executive. Work on all three of these facilitative actions will be on a contingent basis alongside the main nuclear consultation. We will review whether to continue with this work in the light of the main consultation responses.

The Planning White Paper, published on Monday 21 May, has separately set out proposals for a new consent regime for nationally significant energy infrastructure. This will help reduce costs, delays and uncertainties incurred by the private sector while also providing an appropriate opportunity for the public to challenge development.

<http://www.gnn.gov.uk/environment/fullDetail.asp?ReleaseID=286525&NewsAreaID=2&NavigatedFromDepartment=False>

BP spoils Darling's big day as it scraps carbon storage plans

23 May 2007

BP has abandoned plans to build a "green" power plant in a snub to Alistair Darling on the day that the Trade and Industry Secretary unveiled a new energy strategy aimed at reducing carbon emissions. Just hours after Mr Darling announced his Energy White Paper yesterday, the oil giant halted work on a £1bn-plus carbon capture and storage facility in Scotland, blaming delays in state subsidies. BP's decision is an embarrassment for the minister, whose White Paper is designed to underline the Government's commitment to take a global lead in cutting greenhouse gases.

The oil company, in a joint venture with Scottish & Southern Energy, has spent £30m during the past 18 months preparing to build a gas-fired power plant that would generate electricity and store 90% of the emissions created in a depleted North Sea oil field. Similar projects are planned by other power companies. But because the advanced technology makes such plants uneconomic, the Government promised to kick-start two or three facilities with subsidies.

BP said yesterday that it had hoped to get a decision on state aid by the end of 2006, but this was pushed back to the end of 2007. But the White Paper indicated that a decision might not come until well into 2008 or beyond. "That's an extension too far," said a BP spokesman. "It would have been difficult to keep the project alive when there is uncertainty about funding. We have already spent a lot of money on the project."

Scottish & Southern Energy said it was "still trying to understand [BP's] decision" and had not decided whether to continue the project. A source said the company "was surprised and just a little bit angry".

BP said it had not tried to spoil Labour's big day. "We had taken the decision, and did not see any point in not talking when asked about it."

BP was one of the first companies to consider building a carbon capture and storage plant and it is possible it felt a subsidy was inevitable. Subsequently, other companies submitted proposals, including Centrica, E.ON, and RWE.

It is thought the Government has decided against a carbon capture plant run on gas in favour of one that burns coal.

<http://www.telegraph.co.uk/money/main.jhtml?xml=/money/2007/05/24/cnbp24.xml>

7th European Conference on Coal Research & its Applications University of Cardiff - 2008

The preliminary stages of the organisation of the next Coal Research Forum conference are progressing well. The venue has been agreed as the University of Cardiff and the dates have been fixed for Wednesday 3rd to Friday 5th September 2008.

Robert Davidson of IEA Clean Coal Centre will also be holding a Workshop, similar to that held in Canterbury last year, which will precede the conference at the same venue on Tuesday 2nd September 2008 - topic yet to be decided. Watch for further announcements on our new improved website at.....

<http://www.coalresearchforum.org/> created by Fraser Wigley of Imperial College London.

Coal Combustion Division Meeting "Recent Developments in Carbon Capture & Storage (CCS)" 17th April 2007

This was the first meeting of the Coal Combustion Division held by the new divisional chairman, Jon Gibbins, and took place at Imperial College, London. The meeting was well-attended with good representation from both industry and academe which, no doubt, was a reflection of the high level of current interest in the chosen topic.

The first presentation was by Richard Hotchkiss of RWEpower and was entitled "Coal Combustion Plant with Carbon Dioxide Capture and Storage". He began his talk by illustrating the changes which had taken place between 1990 and 2005 in the way in which the UK generated its electricity. The only figure which had not changed was nuclear at 19%, coal had fallen from 67% to 34%, oil from 7% to 1% but gas had risen from 0.5% to 39%. These were big changes and the effect on the generators portfolio of plant was similarly large.

Richard then described the current fleet of coal-fired generators owned by RWEpower: Tilbury, (3 x 350MWe + 1 mothballed plant); Didcot (4 x 500MWe) and Aberthaw (3 x 500MWe). Tilbury and Didcot have opted out of the LCPD which means that they have a life of 20,000 operating hours from January 1st 2008. Aberthaw has opted in and is in the process of being designed for FGD

plant retrofitting. All of RWEpower boilers are co-firing biomass. If RWE chose to do nothing they would find that by 2015 they would have only one coal-fired plant operating which is clearly not what they would wish to happen. The next question is what to do to retain a similar level of coal-fired generation beyond 2015? New-build plant will be necessary, important issues need to be identified such as, location of plant and route of fuel, grid access including financial and technical issues of power plant relative to electricity consumption, ability to obtain permits and the advantages of continuing on the present site.

A discussion into coal combustion and the role and environmental importance of carbon dioxide followed, including how it can be stored. Richard then explained the basics of coal-fired power generation and highlighted the need to ensure clarity when considering terminology, particularly in the case of £/tonne of either carbon or carbon dioxide.

Richard then briefly described the feasibility study which RWEpower had undertaken for Tilbury. It was found to be a good location for both power demand and the receipt of coal via its existing jetty.

Richard reviewed supercritical technology and the options for carbon capture such as amine scrubbing, oxyfuel firing, gasification with the water-shift reaction and more long-term options such as chemical looping.

A plot was shown in which the cost of CO₂ capture, as a percentage of plant output, fell as the efficiency of the plant increased. This confirms the belief that there is little point in fitting CO₂ capture to inefficient, existing plant as the penalty would be too great.

The clean coal strategy for Tilbury is a supercritical coal replant option for 2 x 800 units with direct cooling which would be designed to be CO₂-capture ready. With regard to CO₂ storage there are a number of technical, commercial and legal obstacles to be overcome. These include public acceptability, assignment of liabilities, UK government position, direction and support, and the need for recognition of CCS within the EU and by the Kyoto process.

Other key findings to emerge from the RWEpower feasibility study are that IGCC has higher capex, no efficiency advantage and significantly lower flexibility in non-capture mode compared with supercritical plant. If carbon capture is installed from plant construction the through life costs for IGCC and supercritical pf plant are close. The risks issues are felt to be dependent upon the time of construction and size of the CCS retrofits.

CCS is currently uneconomic and technically unproven on large scale power generation plant. Some very approximate generic costs were that CCS increases the plant capex/kW by 50%, reduces efficiency by 10% and requires CO₂ transport infrastructure. It increases through life generation costs by 50% and will result in a major reduction in NPV for Tilbury.

The economics of CCS are highly uncertain and very sensitive to assumed commodity prices. The CC-ready state of the plant at Tilbury is meant to infer that space will be available for the retrofitting of such plant should RWEpower wish to do so. Most CO₂ vented from well heads is allowed to escape into the atmosphere.

Richard then identified some research activity which is planned for the RWEpower 0.5MW Combustion Test Facility. This includes a £650K amine

scrubbing programme and a similarly funded oxyfuel programme, using coal and biomass. Both activities are funded by the DTI and involve other collaborators.

Richard showed some photomontages of Tilbury as it would look with both new and existing plant in place and how it will look after reconstruction is complete. The activities to be carried out include closure and demolition of the existing units, relocation of the coal stock and construction of the capture plant. Some options are still open in terms of boiler type. Transport options to the southern North Sea were also mentioned. No infrastructure is currently in place for the high pressure 250 mile gas pipe line and the projected costs are ~£250 million. Only four suitable sea-going CO₂ tanker vessels are available in Europe and uncertainties exist over purity of CO₂ and transportation conditions, i.e. pressure and temperature.

The definition of what constitutes capture ready was also presented. In Richard's view it must be a plant which can accept the efficiency penalty which CCS brings; it must have sufficient land available for CO₂ capture; it must have adequate space for connections for amine scrubbing or oxygen for oxyfuel firing and a suitable route out for the CO₂. There should be a consideration of where the CO₂ will be stored and also that the planning and environmental permissions for future capture will be in place. To address these issues a considerable amount of expertise must be acquired and the planned test work described earlier will help to achieve these goals. Other areas in which there is a need for clarification are that there are no market mechanisms to put a positive into CCS. CCS is not recognised in emissions trading; CO₂ permits are a volatile commodity with no certainty of the future post-2012. Undersea disposal legal issues, waste management and legal liabilities are all outstanding but some progress has been made on undersea legal issues.

Richard closed his talk with a brief description of the major activity in this area in RWE in Germany. Their plan is for a 400MWe IGCC with CO₂ capture from the start. It will involve an entrained gasifier for bituminous coal or a fluidised gasifier if lignite is to be the fuel. A water-shift gas reaction will be used and the CCGT will be fired with hydrogen. The CO₂ will be stored underground off or on shore.

The second presentation was from E.ON UK and was given by Ben Goh. It was entitled "1MWth Oxyfuel Combustion Test Facility". Ben described the CTF and highlighted some of the previous studies, such as coal quality issues, NOx emissions, ash deposition, biomass firing, corrosion and additive testing, which this versatile test unit had been able to address. The work described, which included the conversion necessary to simulate oxyfuel firing, was part of an ECSC project entitled ASSOCOGS, (ASSessment of Options for CO₂ capture and Geological Sequestration). The project started in January 2004 and partners included Aristotle University of Thessaloniki, Centre for Research & Technology Hellas, CERECO, IMCG International, University of Nottingham and IVD Stuttgart. E.ON's activity in the project was to review the design changes necessary to allow their CTF to perform oxyfuel firing, to develop revised operational procedures, prepare the new design and construct and commission the modified CTF. The operational procedures would then be refined and a series of parametric tests would be carried out followed by a review of the data obtained and the implications from them.

One of the main modifications was to install an oxygen supply. Oxygen was mixed with cooled and cleaned flue gas to give the desired oxygen content for the combustion air. It was also necessary to prevent uncontrolled air ingress into the fuel system and to achieve this, a stream of dried, flue gas with added oxygen

was passed through the PF feeder. The drying of the flue gas was achieved by installing a chiller in the flue gas line.

The test programme used oxygen contents in the range 15% to 28%, by volume, wet; with excess oxygen at 1% to 4%, dry, with overfire air at 0% to 25%. The ASSOCOGS test coal, Kleinkopje, was from South Africa.

Tests are also in progress for a DTI Oxycoal UK project and for this the coals used are Thoresby and El Cerrejon. This project is also concerned with the study of deposition and corrosion as well as combustion behaviour. Parameters measured on the CTF include NO, O₂, CO, SO₂, LOI, ash size distribution, extracted water composition, heat flux, flue gas temperature, corrosion, deposition, slagging and fouling. Preliminary results show that CO₂, SO₂ and NO increase as oxygen in combustion air increases, whereas CO decreases. Ben concluded his presentation by saying that the DTI project is still on-going and the data is still being gathered.

David Waldron of Alstom Boiler Retrofits Ltd., and based in Derby, gave his talk entitled "Experiences with Direct Injection of Biomass in PF-fired Boilers". Dave began his talk by reviewing the status of biomass today in terms of its characteristics and the technical options for using it in coal-fired boilers. Not only are there differences in the physical forms of biomass but also in their moisture content. This is acknowledged as being a key property in terms of successfully utilising biomass. Four categories of biomass were mentioned; untreated biomass, for example, firewood, forest residues, straw and palm kernels; treated biomass, wood pellets and olive pellets; cultivated energy biomass crops, short rotation coppice (SRC), willow, poplar, cereals and miscanthus; and residues and waste-derived fuels, such as residues from agriculture and industry, demolition wood, sewage sludge and waste-derived fuel, RDF. The major differences between coal and biomass were illustrated by comparing the proximate and ultimate analysis data. The main differences are the high volatile matter and oxygen content of the biomasses and their low calorific values when compared with coals.

Dave explained the options for co-firing in that co-milling is cheap but is limited to about 5% by heat input and that some stringy biomass can cause operational problems. With direct injection more biomass can be used, up to 25% to 30% by heat and the milling / injection system can be customised for a particular series of biomasses.

To illustrate the differences in properties that affect handling, a table was presented which showed that SRC wood chips could contain 4 to 5 times as much moisture as coal, would occupy 7 to 8 times the volume for the same mass as coal and had just under one half of the calorific value of coal. These are probably the widest differences between coal and biomass and in some cases the differences will not be as problematic. Differences in shape of coal and biomass char particles were shown where it was found that the coal char was a more rounded, dense particle whereas that from the biomass char was more skeletal and retained some of the original shape of the unburnt biomass particle.

Dave then went on to describe details of the recent conversion that Alstom had undertaken to convert Fiddlers Ferry to direct injection of biomass. Two units, (Unit 2 and unit 4) were converted to direct injection and commissioned in September 2006. This was the first biomass direct injection conversion in the UK. Alstom supplied the material handling equipment comprising conveyors, screens, magnetic separators, day storage silo, rotary air locks and fans, screw feeders and hammer mill. One elevation of 8 biomass burners and PF pipework were also

installed as was dust, fire and explosion suppression equipment and a new control system.

Dave then showed a very interesting video in which the components and their functions were described during the conversion programme. The performance of the units after conversion exceeded the design target in that 25% biomass by heat could be fired satisfactory which was 5% above the guaranteed limit. A total of 1,500 tonnes power day of biomass has been regularly fired at Fiddlers Ferry on each unit made up of a number of different biomasses such as palm kernel waste, wood pellets and olive cake. The use of biomass gave lower CO₂, SO₂, NO_x and LOI compared with coal. Increasing biomass content up to 40% has an effect on efficiency which is acceptable if the biomass is not too wet. However, the wetter the biomass the more pronounced is its effect on unit efficiency.

Dave concluded his talk by re-stating the benefits of direct injection and that of the dangers of excessively wet biomass from an efficiency and also handling aspect. Fiddlers Ferry successfully burnt 38,000 tonnes of biomass in November 2006.

The final session before lunch was an open discussion lead by Professor John Patrick of the University of Nottingham on combustion research and training needs. It was clearly apparent, if anyone in the audience was not aware of the fact, that there is now, more than ever, a need for bright, young, enthusiastic engineers who want to work in the power generation industry. Unfortunately, this has not been the case for a good number of years in the recent past which has been a contributory factor is turning potential engineers into other disciplines. Now things are different but what can be done? The industry needs to make itself attractive to the young graduates of today and needs to be able to compete effectively against the other seemingly more attractive options that present themselves to the academic high flyers of tomorrow. And on that slightly worrying note and with stomachs rumbling, the meeting broke up for lunch.

After a pleasant lunch and with the usual difficulty in getting people back to their seats after lunch the session started a little later than planned. The afternoon proceedings were opened by Mike Farley of Doosan Babcock (DB) who talked about future UK power generation in a carbon-constrained world. As Mike presented 50 slides I hope it will be understood that the summary of his presentation cannot be as comprehensive as it might otherwise have been!!

Mike opened with an update of the company for whom he works, DB, who recently acquired MBEL. He then outlined the scope of his talk which included clean coal technologies, carbon capture and storage; can the plant be built in time? And what is needed from the government? There had been considerable changes that had happened to coal over the last year. These included the recognition that the world scene will continue to include massive amounts of coal generation and coal-fired power plant must be cleaned up not substituted. There has been a loss of confidence in gas and a recognition that it too needs to be cleaner. The replacement of coal by gas is not sufficient for climate change mitigation and has a negative impact on security of supplies. There is also a recognition that nuclear can make an important contribution to cutting emissions but only on a very limited contribution to filling the generation gap up to 2016. The UK coal fleet, already old, is one year older and the time available to start building new power plants that can fill the generation gap is one year less and now only nine years. Doosan have evidence from their customers that clean coal is accepted and can be either supercritical or via gasification. At present 38% of UK electricity is generated by coal with the largest source of coal being from Russia; this rising to 48% in the winter of 2006/7. By contrast China is building

30 to 40GW of coal-fired power plant every year of which those units greater than 600MW are supercritical. Similarly, in India there are 10GW megaprojects being built involving 800MW supercritical pulverised coal fired boilers.

Supercritical and IGCC plant available now can provide higher efficiency and lower emissions than current coal; lower cost electricity than gas or renewables and are suitable for UK or imported coals and CCS. New-build IGCC whilst having the potential for hydrogen use and CCS still has challenges to overcome in poor availability, high cost and a lack of flexibility. The latest designs are attempting to improve availability with consequences on cost and efficiency (Hatfield, 41%).

Advanced SC for new build seems to be the technology of choice for the vast majority of orders. The reasons are that it has proven availability, load flexibility and a wide fuel range including biomass. It matches any other coal technology for emissions, easily meets LCPD limits for 2016, can be built now 'capture-ready' and can be retrofitted to existing UK stations.

The way forward for coal in the UK, according to Mike, was that CCS will be needed for both coal and gas if CO₂ targets are to be met; projects have to start soon and before the best options for CCS are finalised and regulations in place. It is essential that in order to maintain a diverse portfolio much of the capacity needs to be carbon abated, clean coal power plant. It is likely, therefore, that the projects will be a mixture of CCGT (capture ready), clean coal with CCS and clean coal (capture-ready) plant. The UK Coal Forum Sub-Group is exploring options based on low (5GW), medium (10GW) and high (15GW) amounts of new/replacement coal power plant.

Mike then discussed carbon capture and storage (CCS) options such as post-combustion capture using amines, pre-combustion capture using gasification/shift reactions (IGCC) and oxyfuel firing. Comparisons were presented between Net Cycle Efficiency (at LHV) where amine and oxyfuel were similar (~37%) but IGCC was lower, (~35%). In terms of specific investment costs IGCC was highest, (~€1,800/kW) with oxyfuel next, (just over €1,600/kWh) and amine just under this figure. Cost of electricity was ~6€cents/kWh for IGCC, and around 5€cents/kWh for the other two options. In technical terms, oxyfuel and amine scrubbing have similar footprints.

Mike then described Project 407 ASC Retrofits with CO₂ capture which DB is leading. The project will demonstrate how to retrofit ASC, how to make the design capture-ready, and how to retrofit amine scrubbing or oxyfuel firing. The project appears to demonstrate that ASC retrofits and ASC with carbon capture are economic in terms of the cost of electricity generated. It is felt that a capture-ready ASC retrofit will be a strong candidate for the DTI CAT strategy Demonstration Funding. Other project members are Alstom, Air Products, E.ON and IC London. Phase 1 of the project entitled Underpinning Technologies also involves BP, RWE and the University of Nottingham. Phase 2 entitled Development & Demonstration of Oxyfuel Combustion Systems involves DB, IC London and the University of Nottingham. As part of the project, DB will convert their full-size combustion test facility (40+MW) to oxyfuel firing. Mike has shown that the technologies exist and do not need to be invented. They are available with full commercial guaranteed for capture ready plant now. However, carbon capture technologies need scale-up and full-size demonstration.

The generation gap was then discussed by Mike. Opted out coal accounts for 8GW, opted out oil for 3GW, and closure of the last two Magnox plants (2.3GW) with 1% growth (7GW) will lead to a generation gap of 20GW. This could be 29% if growth is 1.5%. It is too late for nuclear build and renewables cannot fill the

gap. Build capacity is limited so it is vital that we start the new building and retrofitting now. 22GW of plant needs to be in operation in nine years time.

The way forward for UK coal was spelled out by Mike. It was clear that CCS for coal and gas would be needed if CO₂ targets are to be met. Projects have to be started soon and before the best options for CCS are finalised and the regulations are in place. The need to maintain a diverse portfolio will require that a mixture of capture ready CCGT's, clean coal with CCS 'Demonstration Plants' and capture ready clean coal. One of the options to explore is the Medium build scenario (10GW) comprising 50% coal and 50% gas.

Opportunities for UK clean coal power plant are, in the case of the opted out plant, to fit ASC with FGD and SCR between 2010 and 2015 or build new on the same sites. For opted in plant new NO_x control equipment, i.e. SCR needs to be fitted soon. ASC retrofits are possible or new build on the same site. In terms of time scales, retrofits would require 4 years and new build 6 to 7 years. These time intervals are based on the assumption that key specialist resources such as design and engineering in the boiler and turbo-generator OEM's, procurement of materials and performance equipment and construction and commissioning labour are all available. Added to this are the facts that some OEM already have full order books to 2012, global capacity as a whole is limited, material supply bottleneck often decide the construction programme, there is a limited pool of construction labour skills and there has been no UK build plan against which the industry can make its plans. Possible solutions include the development of an industry plan, development of an industry-wide training scheme and the implementation of measures to simplify planning and consents, including standards for BAT.

As far as DB is concerned capture-ready clean coal technology is available now for new build and retrofit. They are continuing to work with their customers to develop their projects to and maintain their activity in the underpinning R&D on clean coal and CCS. DB wishes to build up their engineering resources in the UK, India and China in line with demand for their products. DB also recognises the need to build up their construction resources and will use the Coal Forum as a route towards a better basis form planning.

Mike concluded his epic tour of the clean coal kingdom by spelling out a message to the UK government ahead of the 2007 Energy White Paper. It was that we need recognition that it is already a major challenge to fill the generation gap! Never forget that if plants are not built the lights will go out. Phasing is essentials; "just in time" is not feasible. The EWP must be absolutely clear that new/replacement coal and gas power plants are necessary. UK Government must kick start multiple CCS demonstrations and re-establish confidence in long-term support for R&D. It must look at the implications of low coal, medium coal and high coal scenarios on demand for UK and imported coal. Finally, it must ensure that training agencies, universities and Trade Unions recognise new build coal and gas plant and CCS in their forward planning.

Phil Hare of the Finnish-owned company Poyry, pronounced 'peroo' we were told, gave a presentation entitled "Economics modelling CCS". Phil began by stating that Carbon Capture and Storage (CCS) has the potential to make a significant contribution to the UK's longer term climate change goals. However, the precise timing, cost and volume of potential deployment depends on a wide variety of factors, including the policy framework, the evolution of costs and carbon markets, the availability of other abatement options and future fuel prices. The work he described was a study commissioned by the DTI to develop a detailed understanding of the potential costs of CCS in the UK, and to construct supply

curves of CCS for the future, taking account of the most up-to-date information. In it there is a description of the modelling framework and key results.

Poyry Energy Consulting has developed a model to examine how the economics of the entire process of CCS in the UK will change as the volume of deployment increases- i.e. develops a cost supply curve. The model was designed to be relatively comprehensive in that it includes major sources of CO₂ emissions from all industrial sectors; pipelines to transport the CO₂ and potential offshore storage sites. It will also allow investigation of sensitivities, so that the many parameters and assumptions involved could be varied to consider a range of cost scenarios. The elements modelled within each stage of the process were as follows:-
Capture:- technologies, performance, capital costs, operating costs, ROC, fuel costs, carbon markets, learning curves, asset lifetimes. Transport:- onshore, existing terminals, offshore, hub and spoke vs. direct connect, pipes, compressors. Storage:- field type, EOR revenue, sea depth, reservoir size depth, platform costs, drilling costs.

The analysis includes and considers taking the lowest cost technologies from an array of technical alternatives; calculating the cost of abatement against alternative counterfactuals, the impact of various underlying economic factors, such as fuel prices, optimising the transport networks and storage sinks and considering how the situation changes into the future as, for example, new power stations are needed, and oil and gas fields cease production.

Phil pointed out that more carbon is captured than abated and then went on to explain the difference between capture and abatement. To illustrate the point, imagine a 500MWe unit without CCS burning ~1.4Mt coal and producing 3.0Mt CO₂. When fitted with CCS the same unit still burns ~1.4Mt coal and now emits only 0.4Mt CO₂ but only generates 400MWe. The capture is therefore 2.6Mt. However, the non-CCS unit would need only ~1.2Mt coal to generate 400MWe and would only produce ~2.5Mt CO₂ so the abated CO₂ would be only 2.1Mt. [Only a small point, I know, but important, I think - Ed!!]

Phil then presented abatement curves using the model. In the case of capture costs, the model selects the optimal type of capture technology. It was found that the cost of retrofitting coal-fired plant was just above £20/tonne CO₂ while for gas it is above £30/tonne of CO₂. A key reason for this was said to be the difference in the volume of CO₂ emitted from a coal fired plant which is far greater than from a gas fired plant. As a result the volume of gas abated would be far higher - reducing the unit cost of abatement. In the case of transport costs it was found that Direct Connect and Hub & Spoke showed little differences in cost. The cost was directly related to the amount of steel needed for the pipelines and the number of booster stations. In the case of storage costs it was found that when enhanced oil recovery (EOR) was possible the revenue earned offsets the other costs of CCS, the costs of storing CO₂ in aquifers was ~£1/tonne and in oil and gas fields it was between £1 and £20/tonne of CO₂ stored. Total costs were also presented which indicated that the potential exists for abatement of round 100mtpa CO₂ at prices below £30/tonne. However, the data obtained is highly sensitive to the underlying assumptions and examples of the effects of changes in fuel prices, the inclusion of carbon allowances and counterfactuals.

Phil concluded his talk by saying that their evaluation of the economics of the entire process of carbon capture, transportation and storage had shown that there is significant potential for CCS at prices below £25/tonne CO₂ but that it is very sensitive to input assumptions especially fuel and choice of counterfactual. Furthermore, while costs of capture are the dominant component the transport

network can make a considerable contribution to accessing the very cheap sinks in the UK.

Jon Gibbins filled in the next slot as the hoped for speaker was not available. Never short of a word (or two) to say, Jon proved to be an admirable substitute!! Jon gave us a talk on "UK CCS policy Areas: The CCS Competition Links - A Personal View".

Background information was provided by comparing the reserves and resources of carbon in fossil fuels with emissions from 1860 to 1998 followed by a number of stabilisation scenarios with CO₂ concentrations between 350 and 1,000ppm. He then went on the quote parts of the Stern Review on different temperature rises and their effects resulting from increases in CO₂. A temperature increase of 3°C relative to pre-industrial temperatures would result in the onset of irreversible melting of the Greenland ice sheet. Increases of 5°C would lead to the risk of weakening of natural carbon absorption and possible increasing natural methane releases and weakening the Atlantic THC. [Ed's note – The THC, or thermohaline circulation, is a global ocean current system. In the North Atlantic, warm surface waters (commonly called the Gulf Stream and part of the Atlantic THC) transport vast amounts of heat from the equator towards the Arctic]. In addition, a 5°C rise is also thought to increase the risk of abrupt, large-scale shifts in the climate system, (e.g. collapse of the Atlantic THC and the West Antarctic ice sheet).

Stern felt that there is still time to avoid the worst impacts of climate change if we take strong action now. CCS is essential to maintain the role of coal in providing secure and reliable energy for many economies. CCS is a technology expected to deliver a significant portion of the emission reductions. The forecast growth in emissions from coal, especially in China and India, means CCS technology has particular importance. There is also strong case for greater international co-ordination of programmes to demonstrate carbon capture and storage technologies, and for international agreement on deployment. Building on these announcements the enhanced co-ordination of national efforts could allow governments to allocate support to the demonstration of a range of different projects.... One element that enhanced co-ordination could focus on is understanding the best way to make new plants capture-ready.

In hierarchical form Jon listed policies affecting CCS on coal. In top spot was a 'post-Kyoto agreement 2021 onwards', followed by a nearer term 'post-Kyoto agreement – 2013 to 2020'. Below this was 'EU energy & climate policy', 'UK energy & climate policy' and 'utility portfolio aspirations'. The penultimate position was 'customers aspirations' and last of all as 'other stakeholders aspirations'. Other factors involved in policy debate affecting CCS on coal included all those mentioned above plus gas and oil supply concerns, nuclear proliferation, adaptation, development and US/China G8 plus and Events.

Jon then listed the UK CCS proposals, (Teesside, Peterhead/Miller, Hatfield, Immingham, Killingholme and Tilbury) and those in other parts of the world, (Statoil-Mongstad, BP-Carson, Statoil-Tjeldbergsgodden, SaskPower, Stanwell, Futregen, Xcel Colorado and RWE).

The London Protocol has recently been extended to allow CO₂ storage and OSPAR are now debating storage.

In January the EU issued a communication on An Energy Policy for Europe in which it pledged to provide global leadership and a clear vision for the introduction of CCS. This would be achieved by regulatory framework (including

EU ETS), more and effective research and international action. By 2020 all new coal-fired plants should be fitted with CCS and existing plants should then be progressively follow the same approach.

In the recent UKL budget statement it was announced that the Government will launch in may a competition to develop the first full-scale demonstration of CCS the results of which will be announced next year. It was also announced that a review top examine the vehicle and fuel technologies which over the next 25 years could help decarbonise road transport.

Jon also provided more details of SaskPower as he feels this could be one of the first plant to be up and running. It will be 450MWgross, 300MW net and will capture 90% CO₂. There will arise 3million tonnes of CO₂ for sequestration to EOR sale. It will, represent a 1.6million tonnes per annum reduction and is fast tracked to enter service in 2011.

Jon discussed a number of CCS related statements that had appeared recently in the press, for example "Blair and Merkel lean on Bush to join battle against climate change" [Some hope! Ed] - [Oops!! eat your words, Ed!!]. "Beckett chairs UN climate debate" but was not expected to be able to achieve universal agreement.

The phased introduction of CCS globally was presented in which the first tranche in 2010 required speed not numbers in its implementation, the second tranche in ~2015 was semi-commercial but support was still needed and rollout in ~2020 was where CCS becomes the standard new build and retrofit. Just to compound the already difficult scenario Mr M.R. Smith, vice president of Bechtel commented in December 2006 that costs for new plant, materials and labour are rising very steeply, of the order of 20% to 30% during 2006.

Jon drew his presentation to a close by summarising what advances are needed. In his view we must start on the first tranche of CCS plant now which will immediately trigger relevant R&D; we must get the new technologies working, mainly engineering solutions for IGCC and basic research and engineering development in parallel for oxyfuel firing. We must get the best out of existing PF technology using post-combustion capture options and capture ready and retrofit strategies. In the case of storage issues, ETS, capacity optimisation and safety monitoring and long-term liabilities are key but not for the first tranche.

For transport and storage systems there are pipeline routing issues to be resolved. In political terms there are regulatory, fiscal back-up and post-Kyoto issues and for build capacity, people, expertise and manufacturing capacity are all vital.

Finally Jon offered the question "Incremental development versus innovation?" and closed with the statement that CCS systems will operate in new ways in new markets.

The final presentation of the day was given by Mike Gibbons of Powerfuel and was entitled 'The Hatfield IGCC Project'.

By way of scene-setting Mike highlighted the well-publicised generating gap that is likely to kick in with a vengeance in 2011 to 2012 and the several benefits that coal-firing can give to the power generator. He then summarised the Stern Review for HM treasury. In short, climate change risks to the economic and social activity are similar to those associated with the great wars and it is difficult or impossible to reverse them. Climate change threatens access to water, food

production, health, use of land etc. and the poorest countries and people will suffer earliest and most. The costs of stabilisation at 500ppm to 550ppm CO₂ will be about 1% of GDP by 2050. The power sector should be 60% to 75% carbonised by 2050. CCS allows the continued use of fossil fuels without damage and it is an essential policy measure that a carbon price is established. Finally and crucially, policies are required to support low carbon technologies urgently.

The opportunities for gasification were then reviewed and included the capability to handle a great diversity of fuels and fuel sources, the creation of a renewed interest in coals to liquids conversion, the formation of a high concentration and pressure stream of CO₂, the option to co-produce hydrogen, the formation of a replacement for natural gas and the use of proven technology throughout.

Mike then described the Hatfield Project, which is owned by Powerfuel plc and has recently secured investment in coal supply from an existing colliery. 51% of Powerfuel plc is owned by Kuzbassrazrezugol (KRU) who is one of the top ten coal exporters in the world and for whom this project represents the first investment outside of Russia. Hatfield colliery has access to 100 million tonnes of good quality coal. The project has planning permission and partial Government consent to build an IGCC on this site. The location is only 25 miles from the coast which is beneficial from a CCS aspect and is also close to a number of existing coal-fired power stations.

The scheme is for a 900MW (gross) coal-fired IGCC plant with a target generation date of 2012. It will be fitted with carbon capture from the outset and the project is financed to £1billion. Other features of the project include the possibility to produce hydrogen for transport use, the availability of syngas for use in CCGT's and the opportunity for bio-ethanol investment on site.

Key issues include engineering work and contract strategy, the development of the CO₂ infrastructure and North Sea regulatory issues, long term allocations in ETS, the protocol of release of ETS units for CCS and the UK Government support framework.

In the case of the EU ETS Mike compared the situation between an existing, old, coal-fired station which emits ~6.8million tonnes CO₂ per annum, would get a free ETS allocation of 4.1million units per annum and which, if priced at €25/tonne, would have a value of €102million per annum. The CO₂ saved would be zero. However, the new Hatfield plant would emit only 0.6million tonnes CO₂ per annum for the same output but would only receive 2.1millions free ETS per annum. These would have a value of €53million per annum but the CO₂ savings in this case would be 5.4million tonnes per annum. In Germany there is a different emission trading plan which gives longer term certainty. Mike quoted an example of a new German plant which, while emitting 5.6million tonnes of CO₂ and having an allowance of 5.6million ETS units per annum would at €25/tonne, has a value of €140 million even though the CO₂ saved would be zero.

Mike then discussed the CO₂ transport infrastructure issue and showed that around Humberside there were five coal-fired stations which collectively emit over 54 million tonnes of CO₂ per annum. Fortunately, there is an ample supply of CO₂ sinks offshore of Humberside and which are made up of depleted oil and gas fields, gas / condensate fields, saline water bearing reservoir rocks and coal seams.

Reverting to the Hatfield project Mike confirmed that there had been strong progress on the gasifier license agreement which had now been signed and will involve Shell technology. There is now in place a connection agreement with the

National Grid and the preliminary design package was completed in April 2007. Discussions regarding the CO₂ line continue and FEED work is being initiated.

Mike then presented a series of plots against time for UK Baseload (£/MW) Annual TWA Nominal, UK NBP price (p/therm) which showed no clear trends and also the collapse of the price of the EU allowance for CO₂.

The current big risks were felt to be a lack of government support framework and a lack of CO₂ disposal infrastructure.

The Hatfield Project has been modelled using advanced techniques using costs based on preliminary engineering. The coal contract in place represents a key advantage and the market data is subject to change. The view, based on 2006 data, is that it is a robust project but ETS pricing is not bankable.

Mike closed his presentation by stating the Hatfield vision which is to be the first commercial coal-fired power station in the world to generate with carbon capture.

The event was closed by Jon Gibbins who hoped that everyone had found the useful, which I am sure they had, and wished them a safe journey home.

Darling outlines race to lock up carbon emissions

21 March 2007

The UK can be the birthplace of the world's first full scale Carbon Capture and Storage (CCS) demonstration plant, Alistair Darling said today. Following the announcement in the Budget of a competition to build a full scale CCS demonstration plant in the UK, the Trade and Industry Secretary said: "Carbon capture and storage has massive potential to allow us to meet our energy needs at the same time as cutting carbon emissions. It opens up huge possibility, not just for Britain but for the world. "This is new technology for power plants, never done before on a commercial scale, but the UK is well placed. Depleted oil and gas fields in the North Sea are suitable for storage and we have world class expertise in geo-engineering. "Gas and coal are important to the energy mix globally and in the UK. The Stern report was clear that, even with strong action on renewables and other low-carbon technologies, fossil fuels may still make up to half of the world's energy supply by 2050. "CCS has the potential to reduce CO₂ emissions from fossil fuel power stations by up to 90% and contribute 20% of global CO₂ mitigation by 2050."Rapid deployment of CCS technology in growth economies such as China and India will be vital. This competition gives innovative UK industries the opportunity to become the leading exporters of CCS technology for the low carbon age." More detail about the competition will be announced in the Energy White Paper in May and the result will follow next year. Carbon Capture and Storage is a process by which the carbon in fossil fuels is captured either pre-combustion or post-combustion and committed to long-term storage in geological formations such as depleted North Sea oil and gas fields.

The UK Government is already at the centre of efforts at home and internationally to build understanding of the potential of CCS and to remove barriers to its development:

- * A cross-Government taskforce is working to develop a regulatory regime to enable CO₂ to be safely and legally stored on and off shore and to encourage capture-ready generation. A consultation on this will be launched later this year.

- * The UK was instrumental in changing the London Protocol in November last year to allow CO₂ to be legally stored in the marine environment. Working

towards a similar agreement in June this year to amend the OSPAR Convention, which similarly governs North East Atlantic waters.

* First recipients to be announced later this year of DTI's £35m Carbon Abatement Technology demonstration fund, including CCS. £20m Technology Strategy programme funding is also going into clean energy technologies such as CCS.

* The UK and Norway are collaborating on a future regulatory regime for storage under the North Sea and looking at the possibility of joint infrastructure on the sea bed.

* The UK is actively pressing for CCS to be recognised in the EU Emissions Trading Scheme and supports its inclusion in the Clean Development Mechanism of the wider UN Framework Convention on Climate Change.

* The UK is leading the EU Near Zero Emissions Coal initiative helping to develop CCS demonstration in China. The Government has provided a £3.5m contribution to this project and is actively pursuing similar in India.

* The Stern Review estimates that CCS has the potential to contribute up to 20% of global CO₂ mitigation by 2050. Furthermore, the Stern report estimates that to achieve stabilisation at 550ppm without CCS will increase costs by more than 60%.

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SES and YIMA Sign Preliminary Agreement for Syngas to Methanol to DME Plant in China's Henan Province

7 May 2007

Synthesis Energy Systems, Inc., a coal gasification company involved in the efficient conversion of low cost fuels into clean energy and chemical products, and Yima Coal Industry Group Co. Ltd., a large Chinese integrated coal company, have signed a preliminary agreement to establish a joint venture company for a new integrated coal gasification to methanol and dimethyl ether plant in Henan Province, China to help supply the region's growing petrochemical and transportation fuel needs.

At the signing ceremony, Lorenzo Lamadrid, Chairman of SES, said, "This key relationship-our third project in China-positions SES with one of China's largest coal producers and one of the country's top companies focused on the development of the coal-to-chemicals industry as an environmentally responsible and viable alternative to supplying China's rising energy demands. We are honoured and eager to work with YIMA, as we continue to expand our operations in China and worldwide."

The JVC will construct, own and operate the Plant, which will utilize the Company's licensed U-GAS® technology to convert low-quality, high-ash coals into a clean gaseous mixture called synthesis gas. The syngas produced will then be used as a feedstock for the production of methanol, a basic building block used in manufacturing for a wide variety of chemical products including plastics, paints,

construction materials, as a hydrogen carrier for fuel cell applications, or as an alternative fuel. In this application, the coal-derived methanol will also be used to produce DME, an alternative to liquefied petroleum gas, liquid natural gas, diesel and gasoline. The parties are also considering opportunities for power generation applications. Formation of the JVC is subject to the negotiation and execution of a definitive agreement and approvals from both companies.

When completed, the Plant is expected to have a daily capacity of 10 million standard cubic meters of syngas and an annual capacity of 1 million tons of methanol. The Plant's capacity will help support the rapidly growing demand of Henan's industrial companies. With nearly 100 million people, Henan is the most populous province in China and one of the region's leading coal and aluminium production centres.

YIMA's Chairman Wu Yulu stated, "We are pleased to partner with SES and believe the advantage of SES' U-GAS® gasification technology to convert a wide array of low-quality coal, including high-ash fuels, into high-value energy and chemicals in an efficient and environmentally acceptable manner will provide our joint venture with a strong growth platform."

"This JVC is a step forward for China, as the country seeks solutions to address its reliance on imports and offset the effects of rising oil prices by accelerating its efforts to develop oil substitution programs that utilise its vast deposits of coal. Using coal-derived methanol to produce DME, and other clean fuels, can help meet China's and the world's need for non-petroleum-based fuels and petrochemical feedstocks," concluded YIMA's Chairman Wu Yulu.

Worldwide, SES is working to rapidly develop and commercialise alternative energy and chemical projects, technologies and systems based on the clean gasification of low-cost fuel sources and establishing U-GAS® as a reliable and efficient alternative source of energy and chemical products to manufacturers.

The Company currently is leveraging its engineering, procurement, and project development expertise in China through two additional U-GAS® coal gasification projects. The first facility, located in Shandong Province, is about 75 percent complete with start-up anticipated by mid-summer of 2007 and commercial operations expected to begin by the third quarter of this year. SES' second project, located in Inner Mongolia, is similar in structure to the Plant in Henan — an integrated coal gasification to methanol and DME project. This second project is expected to break ground by the end of this summer and be in operation by late 2008.

Among the dignitaries witnessing the signing ceremony were Madam Wu Yi, Deputy Prime Minister of China, China's Minister of Commerce, and Sanmenxia City Mayor Li Wenhui.

About Synthesis Energy Systems

Synthesis Energy Systems, Inc. is an energy and technology company that deploys proprietary systems and technology to gasify low value fuels to replace high cost energy and chemical products sold to major global markets. The U-GAS® technology, which the Company licenses from the Gas Technology Institute, is designed to turn waste coal products into high value synthesis gas for use in power and chemical applications. The technology performs this gasification without many of the harmful emissions normally associated with coal fired energy production. SES currently has offices in Houston, Texas and Shanghai and Beijing, China.

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Clean-coal technology is the future

22 May 2007

Tomorrow the House of Commons will witness the publication of the Government's second Energy White Paper in just four years. This reflects the confusion and panic which has gripped Whitehall in recent times as energy has quickly risen to the top of the Government's agenda. Essentially, both documents have been driven in a large part by the need to try to guarantee energy security for the UK. To set this in context, the UK faces two major long-term energy challenges; the need to cut carbon emissions and the need to deliver secure supplies of clean energy at affordable prices. North Sea reserves are in decline and the UK is increasingly dependent upon imported oil and gas.

In addition, current nuclear power stations, the UK's largest source of non-carbon electricity, are approaching the end of their lives. Coupled with the closing of older coal stations, the UK could face a huge generation gap by 2016, if new stations are not commissioned soon. Energy policy is inextricably linked to the availability of resources. Estimates and definitions of domestic oil and gas reserves vary but on the narrowest definition they would meet current levels of production for 41 and 65 years respectively. Overdependence on imported gas, ongoing instability in the Middle East and energy rich countries such as Russia using energy supply and price as a political weapon have rightly forced a re-examination of energy priorities. There is suddenly a welcome new focus on finding new energy options, preferably local ones. And in all that talk, an old energy option, but in a new guise is resurfacing as a legitimate contender. Yes, coal is back and it's getting a new look. The new coal solutions don't involve burning it in the traditional polluting ways.

Instead coal can be gasified in order to cut its carbon emissions when generating electricity and even more significantly, it can be converted to liquid fuel, to lessen our dependence on the Middle Eastern oil states. However, because of their carbon emissions, current coal-fired power stations are considered to be environmentally unfriendly. Coal has been the backbone fuel for Britain. Today, it still plays a very important part in our electricity generation, producing more than 35% of the UK's baseload electricity during an average year. In recent, unseasonably warm winters this has risen to 50%. The fuel has many advantages. It is plentiful, indigenous, relatively cheap, flexible and responsive to peaks and troughs in demand, can be stored, is not prone to outages or unavailability and is not vulnerable to geo-political risk. Only nuclear power can match these advantages. However, Britain now imports more coal than is produced at ongoing deep and opencast mines, which adds considerably to the UK's balance of trade deficit.

The fuel's environmental impact is being addressed and coal is on the verge of a radical rebirth. New power stations are now being planned which gasify the coal and have the ability to capture over 90% of the carbon emissions for sequestration. Importantly, they are backed by Friends of the Earth. The Integrated Gas Combined Cycle (IGCC) is a near zero emissions clean-coal solution for the UK. Such stations can dispose of the captured carbon in, for

example, the emptying oil fields of the North Sea which consequently can extend the lives of oil fields through pressure being applied on old and difficult to extract reserves, thereby prolonging oil production. Known as enhanced oil recovery, this process would also lead to substantial financial benefits for the Treasury. This new dawn for coal is reflected in the new mines planned for Wales. Unity Power is planning five new pits as coal prices reach record highs. Tower Colliery, which has rightly earned its place in Wales' rich mining history, looks set to close as the reserves become harder to work; a natural consequence in this extractive industry, but the maintenance of the mining skills base at Tower has been crucial to today's new thrust. Tower's survival demonstrated that the markets for domestic coal existed and remained strong, contrary to what many of coal's detractors repeatedly claimed. Importantly, older coal-fired power stations like Aberthaw are also becoming much more green and efficient. New FGD filters to remove substantial amounts of sulphur dioxide are being installed. This will allow Aberthaw to continue for the foreseeable future. New Welsh pits can meet the station's demand.

Renewables, such as wind, have been receiving Government subsidies for years through the Renewables Obligation, and yet they are unreliable and intermittent. The RO currently amounts to a staggering £1bn a year and by the end of this scheme will have totalled some £32bn. New clean-coal power stations, alongside new nuclear build can plug the energy gap and provide the security of energy supply the Government craves. New mining developments in Wales are part of the answer, not the problem.

by Tony Lodge who is author of Clean Coal – A Clean, Secure and Affordable Alternative, published today by the Centre for Policy Studies, the right-of- centre think tank.

US Greenhouse Gas Emissions Rise

9 May 2007

U.S. and Russian greenhouse gas emissions rose in 2005, more than cancelling out a dip in the European Union's emissions despite growing calls to limit global warming, official data shows. Combined emissions by the United States, Russia and the EU, accounting for about half the world total, rose by 0.4% to 14.55 billion tonnes in 2005 from 2004, according to data compiled by Reuters from the U.N. Climate Change Secretariat. "Emissions trends are continuing upwards, which contradicts political rhetoric globally," Bill Hare, a Greenpeace adviser who also works at German Potsdam Institute for Climate Impact Research, said during 166-nation U.N. climate talks in Bonn. And experts say that emissions by developing nations led by China and India, which do not have to report 2005 data to the Bonn-based Secretariat, are rising far faster as they use more coal and oil to power their fast-growing economies. A report by U.N. climate panel last week said the world was running out of time to make the deep cuts needed to combat global warming, which could bring widening droughts, heatwaves, and floods, spread disease and push up world sea levels. It said world emissions would have to peak by 2015 and fall by 50% to 85% by 2050 to reach a goal of limiting temperature rises to 2 to 2.4°C above pre-industrial levels. "Deep emissions cuts by industrialized countries are needed," Yvo de Boer, head of the U.N. Climate Change Secretariat, told 1,000 delegates at the opening of the May 7-18 talks in Bonn on ways to slow warming. And Germany wants to use a meeting of leading industrialized and developing nations it will host next month to push for new commitments to cap greenhouse gases.

U.S. data submitted to the Secretariat show emissions rose by 0.7% in 2005 to a record 7.24 billion tonnes and were 16.3% above 1990 levels. Russia's report shows that emissions, which plunged with the collapse of Soviet-era smokestack industries in the 1990s, rose by 2.2% in 2005 to 2.13 billion tonnes. But they were still 28.7% below 1990 levels. Emissions by 27 EU members dipped by 0.8 percent to 5.18 billion tonnes and were 8.0% below 1990 levels, with big 2005 cuts by Germany, Finland and the Netherlands. "The figures could still be adjusted slightly," said Andreas Barkman of the European Environment Agency. The United States, the EU and Russia are the main emitters among industrialized societies. Nations including Japan and Canada have not sent in data for 2005. The European Union and Russia are signatories of the U.N.'s Kyoto Protocol, which seeks to cut emissions of greenhouse gases by 35 industrialized nations by 5% below 1990 levels by 2008-12 in a first small step to slow warming. President George W. Bush opposes Kyoto-style caps on emissions, saying they would cost jobs, but is trying to cut the amount of carbon dioxide emitted per dollar of economic output by 18 percent in the decade to 2012. Washington says it is on track to reach that goal. Some U.S. states, such as California, and cities are embracing Kyoto-style caps. A 1992 U.N. climate convention, backed by Washington, set a non-binding goal of limiting emissions to 1990 levels by 2000. http://news.yahoo.com/s/nm/20070509/pl_nm/climate_emissions_dc

Chinese Coal-Fired Capacity Nears 699,700 MW

23 May 2007

The total capacity of Chinese fossil-fired power plants in operation or under construction as displayed in the new McIlvaine Chinese Utility Plans database is 699,700 MW. The database displays data on 1,255 plants (or multiple units) comprising more than 2500 individual boilers. Coal accounts for 646,000 MW, gas 8,100 MW, and oil 2,145 MW. The fuel is unknown or undecided for 43,000 MW of capacity. Because of the short 24-36 month development schedule, most of the planned units will be operating in the next three years.

Presently, 470,000 MW are in operation. The McIlvaine database shows more coal plants likely to be in operation in 2010 than the official Chinese estimate of 622,000 MW of coal capacity. By 2011 China will have more coal-fired capacity than the US and Europe combined, and more than the next six countries combined.

Coal Generation Capacity: World, 2011 (MW)

Country	Coal Capacity (MW)	% of World
China	650,000	38
US	350,000	21
Russia	78,000	5
Germany	60,000	4
Japan	40,000	2
South Korea	35,000	2
Other Countries	487,000	28
Total World	1,700,000	100

Many of the older Chinese units are 150 MW in size or smaller. Most of the units under design are 600 MW. Many of the planned units are of the super critical design. The database does not include industrial coal-fired boilers. There are many thousands of these small boilers. Many are being retired as the power is being supplied by the new utility units.

The database also tracks environmental projects both at existing and new plants. More than 300 additional scrubbers are planned for the 2006-10 period. Shortly, China will have more scrubbed capacity than the United States and already has more than all of Europe. The database includes names of system suppliers, licensors, and component suppliers.

All the new plants will have efficient electrostatic precipitators or fabric filters for particulate control. Some older plants with inefficient precipitators are being replaced with fabric filters. These projects are also identified.

Chinese Utility Plans identifies a number of NOx removal projects incorporating selective catalytic reduction (SCR). It also identifies component suppliers. Presently the catalyst suppliers are offshore companies. Suppliers of power plant components such as boilers, pulverisers, air heaters, and fans are also identified. Many of the suppliers of these components are offshore companies. Confusion over the English spelling of Chinese plant names has made it difficult for these suppliers to properly analyse Chinese activity. Since this database has been carefully compiled to eliminate errors and since it is continually updated, it will eliminate this confusion.

<http://www.engineerlive.com/oil-and-gas-news/17341/chinese-coalfired-capacity-nears-699700-mw.shtml>

Meeting on “Understanding the Low Carbon Economy”

As many of you will know by now, the above meeting, originally scheduled for 25th and 26th April at Rugby and sponsored by the IChemE Environmental Subject group, was unfortunately cancelled at short notice. However, it has been possible to accommodate many of the speakers in two upcoming Coal Research Forum events. These are the Advanced Power Generation Divisional meeting at Rugeley power station to be held on Wednesday 20th June 2007 and which is being organised by Peter Sage and the CRF Autumn Meeting to be held on either Wednesday 24th October or 14th November 2007 at the University of Birmingham Conference Centre, where the latter event is still to be finalised, (please see the Calendar of Coal Research Events for details of both of these events at the end of this Newsletter).

Ipswich Town First UK Football Club to Become Carbon-neutral

4 May 2007

The club announced it had reached its target for saving 3,200 tonnes of carbon dioxide through nearly 14,000 pledges from supporters. The bid to reach carbon neutral status was launched with the support of main sponsor E.ON, the Defra Climate Challenge Fund and the Community Carbon Reduction Project (CRed). Now the target has been reached, the club will now receive a substantial five-figure donation from E.ON for Jim Magilton's player budget. The campaign has run throughout the season, asking fans to make an energy efficiency pledge for their homes on the Save Your Energy For The Blues website, in return for a range of Ipswich Town prizes. It was a pledge from season ticket holder Mel St Pier, who told of his plans to buy a hybrid car, that took the project past the target. Derek Bowden, Ipswich Town chief executive, said: "Over the last six months, the club has also worked hard to decrease its own energy consumption with the current figures showing a decrease of 20% compared to the same period last year.

"This has been done through a number of measures, including switching the club to a green energy tariff, fitting the floodlights with low energy light bulbs, plus ensuring that catering kiosks fridges are emptied and turned off between fixtures." He added: "I would also like to say a massive thank you to all the fans, schools, local businesses and project partners who have helped us reach this target." Ipswich captain Jason De Vos, who acted as project ambassador, said: "It has been really inspirational to see the way the fans have embraced this scheme." Ipswich Town has become the first British football club to become carbon-neutral. On meeting its emission target, its sponsor, E.ON UK, donated funding to the purchase of players.

<http://www.eadt.co.uk/content/eadt/news/story.aspx?brand=EADOnline&category=News&tBrand=EADOnline&tCategory=News&itemid=IPED03%20May%202007%2018%3A41%3A59%3A270>

Student Bursaries for 2007

Up to 6 travel and subsistence bursaries for up to £300 are on offer to bona-fide full-time students wishing to attend appropriate coal-related conferences, such as the 2007 ICCS&T to be held at the University of Nottingham, (please see the Calendar of Coal Research Events for details of both of these events at the end of this Newsletter). To apply, please send the abstract submitted to the conference with a brief supporting letter from your supervisor to:

Prof. J.W. Patrick
SChEME
The University of Nottingham
Nottingham
NG7 2RD

The bursaries come with no obligations to the recipient other than to supply a short essay about his or her impressions of the conference to the Newsletter for inclusion in the next edition.

Update on new Research Fund for Coal & Steel (RFCS) Projects

The annual feature on new RFCS projects is absent from this newsletter as previous sources of information are no longer available to the editor. If any reader is able to provide a source of the information the newsletter editor would be pleased to hear of it.

CALENDAR OF COAL RESEARCH MEETINGS AND EVENTS

Date	Title	Location	Contact
5 June 2007	Seminar on carbon capture: technology options and making plant carbon capture ready	London, UK,	Shelley Quinn, Institution of Mechanical Engineers, 1 Birdcage Walk, London SW1H 9JJ, UK Tel: +44 20 7973 1260 Fax: +44 20 7222 9881 Email: s_quinn@imeche.org Internet: www.imeche.org/events/carbon
Wednesday 20 June 2007	Annual Meetings of the Coal Research Forum and the Coal Utilisation Subject Group (ICHEM) and Advanced Power Generation Divisional Meeting, "Zero Emissions Power Plant"	Rugeley Power Station, International Power plc	Dr David J A McCaffrey Tel : 01242-236973 E-mail : mail@coalresearchforum.org Mr Peter Sage Tel: 0870 190 6243 E-mail: peter.sage@aeat.co.uk
28-31 August 2007	The International Conference on Coal Science and Technology, (ICCS&T), 2007	The East Midlands Conference Centre, The University of Nottingham, Nottingham	Dr A J Wickham Conference Management P.O. Box 50 Builth Wells Powys, LD2 3XA E-mail: confer@globalnet.co.uk or info@2007iccst.org
10-14 September 2007	24th Annual International Pittsburgh Coal Conference	Johannesburg, South Africa	Johan van Dyk, PO Box 1, Sasolburg, South Africa, 1947 Tel: +27 16 960 4505 Fax: +27 11 219 2398 Email: pitt2007@sasol.com Internet: www.sacoalprep.co.za/events.htm
13-14 September 2007	2nd Conference on Clean Coal: Securing the Future	London, UK,	Stephanie Mercier, Coaltrans Conferences Ltd, Nestor House, Playhouse Yard, London EC4V 5EX, UK Tel: +44 20 7779 8189 Fax: +44 20 7779 8946 Email: smercier@euromoneyplc.com

			Internet: www.coaltrans.com
4-5 October 2007	2nd International Symposium on Capture and Geological Storage of CO ₂	Paris, France,	François Kalaydjian, IFP - Communication Division, 1 & 4, avenue de Bois-Préau, 92852 Rueil-Malmaison Cedex, France Tel: +33 1 4752 6440 Fax: +33 1 4752 7049 Email: francois.kalaydjian@ifp.fr Internet: www.co2symposium.com
Wednesday 24th October or 14th November 2007	The Coal Research Forum Autumn Meeting, to be held jointly with the ESG, CUSG and ECTSG of the IChemE, "Understanding the Low Carbon Economy"	The University of Birmingham Conference Centre.	Event Organiser : Dr David J A McCaffrey Tel : 01242-236973 E-mail : mail@coalresearchforum.org Programme Organiser : Mr Clive Hadfield Tel : 01455-552999 E-mail : chadfield@tiscali.co.uk
Wednesday 21 November 2007	Coal Preparation Divisional Meeting Joint with the Minerals Engineering Society Southern Group	The University of Nottingham, Nottingham	Mr Andrew Howells E-mail: hon.sec.mes@lineone.net
Wednesday 28 November 2007	British Flame Research Committee, "The Development of Industrial Burner Technologies to handle New and Difficult Fuels"	National Metal Forming Centre, West Bromwich, West Midlands	Mr. Geoff Rhine, Tel : 0121-441-3865 E-mail : jmrbf@aol.com
Tuesday 2 September 2008	IEA Coal Science Workshop (topic to be advised)	University of Cardiff	Robert Davidson. IEA Clean Coal Centre Gemini House, 10-18, Putney Hill, London, SW15 6AA. Tel : 0208-7890-2111. robert@iea-coal.org.uk
Wednesday 3- Friday 5 September 2008	7th European Conference on Coal Research and its Applications	University of Cardiff	Dr A W Thompson Tel : 0115-936-2351 or 01332 514768 E-mail : awt_crf@btinternet.com