No. 57 **January 2010**

NEWSLETTER

of the Coal Research Forum

EDITOR'S COMMENTS:

As we move into a new decade I would like, on behalf of the CRF, to wish all of our readers a happy new year and hope that it will bring to us all a more optimistic outlook for the future.

Looking back on the Noughties I don't personally think it was a great decade - at least that's the perception I have. The most vivid memories for me are those of 9/11 and 7/7 with the now familiar concerns over safety whether you are on a tube train or in the sky.

And then there was the recession? For many people the question was 'How could that be allowed to happen?' Here was the man in the street - doing OK, living within his means as he always has, when out of the blue comes this sea of toxic debt followed shortly after by the painful sounding 'quantitative easing'. So now we, collectively, every one of us, you and me, the nation, are massively, unbelievably, interminably (it seems) in debt - thanks, guys, that was just what we needed.

And then there is climate change. Two names spring to mind in the climate change circus at this time, the hitherto relatively obscure University of East Anglia and Copenhagen. The hacked e-mails of some of the former academics were seized upon by the climate change deniers to show conclusively that scientists fiddle their results (and grants!) and that climate change is a sham. And as for Copenhagen - do we really believe that we can positively address the effects of global warming when we cannot even agree on what should be done? Thinking about this conference a well-known Churchillian phrase popped into my thoughts which I thought I would share with you. "Never in the field of climate change was so much flannel emitted by so many to such little effect".

Here endeth the Editor's Winter Whinge! I feel better now! Enjoy 2010, it will not be as bad as I see it!

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Joint Meeting of the Coal Research Forum, Environmental Division and the Royal Society of Chemistry Energy Sector "Seminar on Co-firing and Fuel Characterisation"

15th September 2009, University of Nottingham

This event attracted nearly 50 attendees with good representation from industry as well as academe. Professors Mercedes Maroto-Valer, from the University of Nottingham and Alan Williams from the University of Leeds welcomed the attendees.

Late stand-in, but ever reliable, Dr David McCaffrey chaired Session 1 due to the absence of Dr Michael Whitehouse whose delay in arrival was apparently due to a combination of traffic problems both inside and outside the university campus.

The first talk was given by Dr Ed Lester of the University of Nottingham and was entitled "PF Combustion Efficiency and Ash Properties during Coal/Biomass Co-combustion". Ed began by explaining the driver for this work with the UK Governments stated targets of the replacement of a 10% of fossil fuel by renewables by 2010 and 20% by 2020. The challenge with biomass combustion is making use of the high reactivity of biomass materials whilst overcoming their poor grindability.

Ed began by describing thermal analysis studies of biomass coal blends, a technique which is particularly suited to this type of study. The work involved examining the effects of using different heating rates, different particle sizes and different proportions of coal and biomass. The findings lead to the conclusion that this technique would be very useful in solving a problem facing power generators who were firing such blends. This problem was being able to measure the actual biomass content of the blends that were being fired. Physical separation of the coal from the biomass after co-milling was found to be impossible and a method to determine the blend composition was needed. The results showed that the volatile matter from the biomass and the coal were evolved over different temperature ranges thereby leading to a means of quantifying the composition of the blends. Different biomasses proved to have sufficiently different volatile evolution profiles to enable them to be identified and quantified from multi-component samples. Ed developed the analysis of these blends using three different techniques known as Cross Point, Peak Region and Profile Mapping each method being more accurate than its predecessor. The methodology has been successfully applied to coal/biomass blend samples supplied by a power generator.

Ed then moved on to describe his work on the understanding and being able to predict the combustion of coal and coal/biomass blends. The extensive use of image analysis of coals and their chars enabled Ed's team to be able to predict the burnout behaviour of many different types of coal. This knowledge was then applied to biomass as part of the need to characterise their chars and thereby their combustion behaviour. In many cases the biomass particles remain similar to the original unburnt biomass particle and retain a vestigial skeleton of char.

Ed also described their studies into the modelling of both the combustion and gasification of coal and coal/biomass blends using models developed within the University of Nottingham.

The very interesting and extensive summary of the work being done on coal / biomass blends was concluded by an investigation into biomass ashes and their sintering and melting behaviour. Some interesting video clips of the behaviour of biomass ash during heating were a memorable feature of this presentation.

Overall, the conclusions from this work were that although biomass solves some problems it creates others, its characterisation is very different from that of coal and that biomass ash will continue to need vigilance.

The second paper was presented by Dr Leilani Darvell of the University of Leeds and was entitled "Biomass Residues as Power Station Fuels". Dr Darvell explained that the three most widely used biomasses in the UK in recent years were olive residues, wood and palm residues and that these were the materials which she had been studying. The main aspects of her work with the biomass samples, which had been supplied by RWEnpower, were their characterisation and combustion performance.

The biomasses showed quite a variation in nitrogen content from ~1.4% for the olive wastes, 2.8% for the palm residue and ~3.5% for the shea residue, all on a dry, ash-free basis. Of importance was the NOx-forming potential of the biomasses. To investigate this tendency chars were prepared using a CDS 1000 Pyroprobe (inert atmosphere, heating rate of 10^{O}C/ms, to a final temperature of 1000^{O}C). Partitioning of nitrogen between the char and volatile matter was calculated by a material balance from the N content of the fuel and that of the resultant char prepared under the conditions listed above. As has been found by other workers using high volatile matter biomasses, the nitrogen was almost completely evolved as volatile matter. The highest nitrogen evolution of nearly 91% of the nitrogen content was from the palm residue and the lowest was from shea residue at just under 80%. This is beneficial from a flue gas NOx standpoint if used on utility boilers.

Char combustion tests were conducted in a thermogravimetric analysis (TGA). Decomposition of the chars was also studied and the evolved species were found to be mainly N_2, NO and NO_2 with traces of hydrogen cyanide and cyanogen from some of the biomasses.

Ash compositional data on the biomasses predicted potentially serious fouling and slagging tendencies with very low ash softening temperatures being measured.

Dr Roy Garwood of the University of Glamorgan gave the third presentation which was called "Fluidised Bed Combustion of Mixture of Coal and High Moisture Content Biomass". This work, which was sponsored by BCURA, involved a study the fluidised bed combustion of biomass from the sugar beet processing industry with coal. The beet pulp is a very high moisture material (up to 70% moisture) and it was planned to test the combustion characteristics and combustion efficiency of a number of coal beet blends. This was done using a small-scale fluidised bed combustor based at the University of Glamorgan. The combustor has a rating of 20kW thermal and uses gas as a start-up fuel. It uses a sand bed of 160mm diameter which operates at 850 to 950^{O}C. The coal beet blend is fed through a screw conveyor when the bed temperature reaches 450^{O}C. The coal used for the tests was Thoresby singles (~6 to 8mm) and the coal beet blends tested so far are 50/50, 60/40 and 70 30 coal to beet. The biomass known as pressed sugar beet pulp contains ~2% ash, 71% water and has a CV of 5.32MJ/kg. The beet carbon content was 14.04%, hydrogen 1.76%, oxygen 10.94% and nitrogen 0.14%. The blends were burnt successfully and the bed temperature was found, not surprisingly given the moisture content of the beet, to fall as the beet content increased. NOx and SOx levels were reduced as the proportion of beet increased. Based on the data obtained an operating strategy using neural networks is being carried out. Dr Garwood indicated that beet pulp

continues to be a valuable by-product from sugar production and is still sold as cattle feed but the producers can afford to burn some of it provided the associated costs are not too high.

Session 1 was brought to a close by a talk given by Mr Mark Flower of Imperial College London. The title of his presentation "Combustion of Single Particles of European Ash" caused slight consternation in the mind of the newsletter editor until it was explained that the ash was in fact a tree and not a combustion residue! That is how a life working with coal makes you think!!

Mark began his presentation by showing a CFD plot of oxygen concentration in the near burner zone of a furnace firing oak, lignite and bituminous coal particles. There was a difference between the profile for oak and the other two which he suggested was due to the slower devolatilisation of the large oak particles. This led into the main theme of his talk, which was about how biomass properties might be usefully and economically altered in order to make their combustion more efficient. Size reduction would be beneficial but is known to be costly. Moisture content also had an effect on grinding but was less clear cut.

Mark then described a three microscope system which has been developed which is capable of measuring the surface area and volume of biomass particles. This allows him to measure the shape aspect ratio of particles (surface area of sphere with same volume as particle/surface area). It also, when combined with the dry mass, allows measurement of the density of the particle.

Mark also used a wire-mesh apparatus to investigate burn out of cubes of wood of 2mm to 5mm in size. A video clip of a combustion run was shown and from this it was possible to extract data points as follows: Oak particle, 23.4% Moisture, 20.38mg, Shape of 0.76, 35mm^3. Measured drying time ~2.4s, devolatilisation ending time is 8.9s, burn out time is 17.9s. Most of the size reduction in char burning appears to take place in the final few seconds, suggesting burning takes place at constant volume but variable density.

Mark concluded his talk by stating that the combustion behaviour of Balsa, European Ash and Oak had been studied in a single particle wire mesh apparatus. Drying times were found to depend upon moisture content, although there is some unexplained variation in the results. Devolatilisation ending times were found to primarily depend upon dry mass, but also shape and to a lesser extent moisture content and burn out times were found to depend heavily upon dry particle mass (i.e. and not much else).

A buffet lunch, up to the usual high standard come to be expected from the University of Nottingham, was well received by the attendees. For those who were not taking part in the RSC Energy Sector AGM Ed Lester had kindly volunteered to show those interested the latest toys he has to play with! This offer proved to be very attractive with most of those not otherwise engaged following Ed over to the laboratories. Although the writer did not visit the lab, (having worked in some of them until quite recently), feed back was that it was a very interesting and enjoyable visit.

The afternoon session was chaired by Dr Will Quick of E.ON Engineering Ltd and began at 2.30pm (Session 2 being the AGM) and first up was Ms Karen Finney from the University of Sheffield who described in her paper the "Reuse of Spent Mushroom Compost (SMC) and Coal tailings for Energy Recovery". Karen explained that the main objective of the work was to divert spent mushroom compost from landfill and aid the cleaning of land contaminated by coal tailings by generating a source of renewable sustainable fuel. This was to be achieved by

evaluating ways in which SMC and coal could be used to produce energy and to investigate and characterise the emissions produced from the thermal treatment of such wastes. It was noted that any use of such wastes would have to show compliance with the Waste Incineration Directive (WID). This is legislation concerning the incineration of hazardous and non-hazardous wastes and it imposes limits to solid emissions, such as fly ash and gaseous emissions such as NOx, SOx and HCl.

Karen showed data on the characteristics of the two wastes and pointed out that both were high in moisture and ash which lead inevitably to a very low as fired calorific value regardless of the blend composition. In addition, the sulphur and nitrogen contents were rather high.

A series of pelletisation tests were carried out using a blend of equal parts by weight of SMC and coal tailings. An optimum process was achieved in which a 1% starch binder addition was made, a pressure of 2,500 to 6,000psi was used and steam conditioning for 5 minutes at a temperature of 45^{O}C to 75^{O}C.

A series of combustion tests were also described using a laboratory-scale fluidised bed and a packed bed combustor using both pelletised SMC/coal tailings and raw dried SMC. The pellets were found to burn better than the raw SMC and the fluidised bed combustor was superior to the fixed bed version in both cases.

Karen then presented data on gaseous emissions from the combustion tests. Although NOx was compliant to WID regulations, the SOx and HCl emissions were not.

In summary, Karen reported that pelletisation followed by fluidised bed combustion was the best way to dispose of the SMC and coal tailings waste. Combustion efficiencies up to 98% were possible in some cases. This could be improved in a number of ways such as using turbulent secondary air to improve mixing and using an industrial-scale reactor with a deeper bed. However, there appear to be other problems needing further study. For example, in addition to the non-compliant gaseous emissions fly ash removal also needed to be improved in order for the WID regulations to be compliant. The composition of the ash was also likely to be problematic due to ash agglomeration and a low ash fusion temperature.

Dr Bill Nimmo of the University of Leeds presented a wealth of data from a comprehensive study into the "Combustion of Coal and Waste". It is not easy to summarise the 52 slides presented, but they can be seen on the Coal Research Forum website in the section on past meeting.

Areas studied by Bill and his team included tyre/plastic co-firing, biomass co-firing and oxygen enrichment co-firing. Test facilities used in these studies included a 20kW down-firing combustor and a 100kW+ combustion test facility.

The work on tyre rubber co-combustion included tyre characterisation using TGA and pyrolysis testing. Combustion tests on the rubber, coal and in combination took place up to 25% rubber. NOx reburn studies, char burnout and ash compositional analyses were also performed.

After showing detailed analytical results some conclusions were presented. Although technically feasible to use tyres in the ways previously mentioned, the high cost of preparing the rubber and plastic in a sufficiently fine form made the adoption of this technique prohibitively expensive.

There were clear benefits to using biomass in terms of NOx reduction and better carbon burnout and the use of oxygen enrichment may have a role to play with more difficult coals.

The third paper was by Mr Patrick Cooke of E.ON Engineering Ltd. and was entitled "E.ON's Experiences of Methods for Measuring Biomass Purity of Mixed Fuels". Patrick began his talk by describing the E.ON Engineering and its activities. The role of the Renewables Obligation (RO) was explained where an increasing amount of electricity has to be generated from renewable sources and for which there is a Governmental financial incentive. This can be done by "fresh" or "recovered" biomass and the definitions of each and their pros and cons were described. The use of recovered biomass presents a potential problem to the electricity generator since to qualify as an RO-allowable fuel it must be shown to contain >90% of its energy content from plant or animal matter.

The heterogeneous nature of biomass means that to demonstrate its RO compliance to OFGEM a rigorous sampling and analysis regime must be in place. An example of a technique using nitrogen as a marker which is used at E.ON's biomass fired plant at Steven's Croft was described. The fuels are forestry residues, short rotation coppice and waste wood. The waste wood may contain urea formaldehyde resin which has a very high nitrogen content (~39% as received). By analysing the clean and waste wood the amount of inerts or contaminants can be measured and compliance demonstrated.

Other methods mentioned by Patrick included radio carbon dating. It is based on all fossil carbon being ^{12}C but atmospheric carbon, i.e. from biomass is partly ^{12}C and partly ^{14}C. This method can be used on flue gas samples but is complex and expensive to acquire and operate. One other technique described was selective dissolution in which the sample is treated with sulphuric acid and hydrogen peroxide. The aim is that the biomass is selectively removed by dissolution and a method has been circulated by CEN as TS/15440. Analysis of the untreated fuel and treated residue allows the energy content of the biomass to be calculated. E.ON's examination of the method was inconclusive.

The importance of analysis of biomass, in particular the recovered variety was clearly shown by Patrick during his talk. Although there has been progress in producing suitable methods it appears that some more work needs to be done to obtain methods suitable for all forms of biomass-related fuels.

The final paper of the day was a joint effort by Mr Cliff Mullins and Mr Paul Skinner of Minton, Treharne and Davies Ltd. and was entitled "Fuel, Biomass and Waste Analysis and Characterisation for Co-combustion". The group provide scientific consultancy, surveying and testing services to a worldwide client base from offices in the UK, USA and Asia.

Cliff began by showing a series of slides reviewing the history of the company and describing some of the areas of expertise that had been built up over the years. This was followed by a talk from Paul Skinner in which he described coal test methods they use and some of their consultancy activities in more detail. Sea transportation of coal had provided an opportunity to demonstrate that coal can and often does self-heat and even if not igniting can suffer oxidation which causes a lowering in calorific value.

The high reactivity of Indonesian coals has resulted in the need for the bulk carriers which transport these coals to have very well sealed hold to minimise ingress of oxygen en route. The atmosphere above such coals in the sealed holds has been found to contain carbon monoxide which prevents further oxidation of

the coal by limiting availability of oxygen. Coal storage was also described where it was shown that proper compaction of stockpiles could minimise coal oxidation to acceptable levels even upon prolonged storage.

The event then concluded and Professor Maroto-Valer thanked both the presenters and the audience.

Impressions of the International Conference on Coal Science and Technology (ICCS&T)

26-29th October 2009
by Katie le Manquais
University of Nottingham

With funding partly provided by the CRF, I was fortunate enough to attend the recent ICCS&T 2009. On this occasion, the biennial conference was held in Cape Town, South Africa – an exotic location that made a very welcome change from 2007, when the conference took place in my native Nottingham. And, having been a part of the support staff for that event, I was looking forward to a much more relaxed affair and letting someone else do all the running around.

To this end, the local organising committee did not disappoint, providing a well structured and very interesting three days. The location of the conference was particularly good, with the hotel offering uninterrupted views of Table Mountain. In addition, the social highlights included traditional South African entertainment in the form of the Cape Minstrel Troupe and a massive indoor BBQ on the Spier Wine Estate near Stellenbosch.

In total, the conference attracted well over one hundred and fifty delegates, about half of whom were from South Africa. As such, I was impressed that the international flavour of the conference had not been dampened by the current economic climate, although numbers did appear to be slightly down on two years ago. However, the standard of the oral presentations ultimately seemed to have improved and I listened to a number of excellent talks. Particular personal favourites included "In-situ Diagnostics of Oxyfuel Combustion of Victorian Brown Coal" by Professor Chun-Zhu Li (Curtin University, Australia) and "Implications of Global Climate Change for the Coal Industry" by Dave Collins (Promethium, South Africa).

There were also some very attractive poster presentations, a couple of which were directly allied to my ongoing research - combustion additives. The content of these led to some very interesting conversations, specifically with Professor Byungho Song (Kunsan National University, Korea) and Lucinda Klopper (a Masters student from North-West University, South Africa). Overall, interest in this area seemed to be much greater than two years ago, a trend that definitely bodes well for my future work.

Furthermore, as a final year student currently in the 'writing-up' stage of my PhD, attending the ICCS&T was an invaluable opportunity for me to present some of my work to other students, researchers and, rather more intimidatingly, to some of the world's most eminent coal scientists. Nevertheless, my oral presentation, "Combustion Enhancing Additives for Coal Firing - The Importance of Catalyst/Mineral Interactions" was generally well received, although some lively debate did cause me to overrun my allotted time slot. Even so, I found defending my work a rewarding, if challenging, experience and good practice for my upcoming viva.

Once again, the conference was an indispensable vehicle for both widening my fundamental knowledge and for broadening my outlook on the field. Consequently, I came back full of new ideas for progressing my own work and with a much better idea of where coal research in general is headed. I believe this should stand me in good stead, as I am about to leave academia and head out in to industry, albeit while still working in the same general field. I just hope that I'll be able to attend the ICCS&T 2011, which is being organised by INCAR (an institute of the Spanish Council for Scientific Research) and will take place in Oviedo, Spain.

Accordingly, I would like to express my sincere thanks to the CRF for providing me with the chance to attend this conference and to visit an amazing country like South Africa. Moreover, I would definitely encourage all other interested students to apply for a travel bursary, attending a national or international conference is not an opportunity to be missed.

Carbon emissions will not peak for 20 to 30 years - claims China minister

6 December 2009
China's carbon emissions will peak between 2030 and 2040, the country's science and technology minister told the Guardian as the global climate change summit began in Copenhagen. In an exclusive interview, Wan Gang said he hoped the maximum output of Chinese greenhouse gases would come as soon as possible within that range, and spelled out the steps that needed to be taken to achieve this. His comment, while not official policy, is the closest the world's biggest emitter has come to setting a target for when its output of greenhouse gases will start to fall.

Setting a peak date for developing countries, whose emissions are rising rapidly, will be a key issue for negotiators in Copenhagen trying to map out a global strategy to avoid a rise of more than 2C in the planet's temperature. Scientists agree a greater rise would have dangerous consequences.

Think tanks, research groups and academics in China have variously estimated that the emissions peak could come between 2020 or 2050, but the government has yet to announce a target. Wan narrowed the range considerably by predicting that the peak would definitely come between 2030 and 2040.

"There are some uncertainties here, so it is difficult to say whether it will be in the beginning, the end or the middle, but I can say for sure it will be within that range," he said. "As the minister of science and technology I would say the sooner the better."

The precise timing, he said, would depend on uncertain factors such as the pace of China's economic growth, rate of urbanisation and level of scientific development. But he added that the earlier date in the range would be possible if China continued to invest in renewable energy, improved energy efficiency, commercialised carbon capture technology and changed consumer behaviour.

Wan, a non-Communist member of the state council, said China has proved its ability to meet and often exceed its targets in the current five-year plan to improve energy efficiency by about 20%. His ministry has already exceeded by 30% its goal during this period of investing 10bn Yuan to reduce emissions and deal with the consequences of climate change.

Jim Watson, of the Tyndall Centre at the University of Sussex, said: "I think this range makes it difficult for China to make a full contribution to keeping the rise in global temperatures below two degrees. That would be more compatible with a peak within 2020 to 2030. But it is very significant that the minister is willing to talk of a peak, even a range, at this stage."

Environmental groups gave a cautious welcome to the figure, but said China could be more ambitious if rich nations provide technology and finance. "This is a good thing. This is the first time that a ministerial-level official has confirmed the peak range," said Yang Ailun of Greenpeace. "If China really makes climate change a priority, they could peak by 2030. And if they get support from developed countries, they could do it even faster."

An agreement to transfer technology and money from rich to poor nations is one of China's main goals at the Copenhagen conference. China is keen to get international help to reduce the price of silicon processing for solar panels and to develop ultra-efficient coal gasification plants. It is already collaborating with the UK on a project to capture carbon dioxide. In future, Wan said the country will explore the potential for storage or conversion to algae biofuels.

"Seventy per cent of our electricity comes from coal," the minister said. "If we can capture all the CO_2 from this, imagine how much emissions we could save. But it is not something we can do in the short term." But most of China's future emissions savings will come from improved efficiency of power plants, buildings and transport and from nuclear, solar and other forms of renewable energy.

Last week, the government in Beijing announced its first carbon intensity target, which would slow the increase of emissions relative to economic growth by 40%-45% between 2005 and 2020. Even with this measure, the country's output of carbon dioxide is expected to increase by about 90% if the economy grows by 8%.

Although the carbon intensity target is lower than China achieved over the previous 15 years, Wan said it posed an "arduous task" because the government has already picked most of the low-hanging fruit when it came to upgrading inefficient power stations.

Wan said the priority at Copenhagen would be to establish a framework for transferring funds and money, rather than getting hung up on figures.

"If we can achieve this goal, that is good enough," he said. "Copenhagen is very important to all governments and politicians. It's an important turning point, but it is also just the start of human efforts to tackle climate change. It is not the end."

http://www.guardian.co.uk/environment/2009/dec/06/china-carbon-emissions-copenhagen-climate

End of climate change talks - now what?

22 December 2009.
And what of Copenhagen in the end? Environmental groups are dubbing the summit “Brokenhagen”. But were the talks a complete disaster or is there some light at the end of the tunnel?

On the positive side, delegates did sign an agreement of sorts on Friday, the Copenhagen Accord. The document sets out a target of limiting global temperature rise to 2°C and recognises that all nations need to work to that goal. Delegates also agreed to provide around $30 billion in short-term funding to help developing countries reduce emissions and deal with the effects of climate change. In the long term, developed nations have agreed to set up a $100 billion a year fund by 2020.

And on the less positive? The Copenhagen Accord, drafted during the mid-week deadlock by UK Prime Minister Gordon Brown and 26 other leaders and put forward to much fanfare by US President Barack Obama on Friday, has failed to garner consensus from delegates.

In what appears to be a response to pressure from China, key parts of the Accord, including a statement pledging to cut carbon emissions by 50% by 2050 were removed.

Critics argue that the Copenhagen Accord is nowhere near far-reaching or radical enough to deal with climate change and delays a new Kyoto-type treaty with binding emissions targets for another year.

Developing nations are now even accusing the world's wealthiest nations of strong-arm tactics to force them into signing the proposed Copenhagen Accord in return for receiving their share of the pledged $100 billion climate change fund. "This summit has been a complete failure – the climate accord should be sent to the recycling bin," says Andy Atkins, executive director of Friends of the Earth. "The developed world… must face up to its global responsibilities with a strong and fair agreement within months," he adds.

The light at the end of the tunnel is that the Copenhagen Accord does pave the way for further agreements and, as the text states, provides for nations to "commit to implement individually or jointly the quantified economy-wide emissions targets for 2020… before 1 February 2010".

Brown has said that he will lead an international campaign to turn what agreements have been reached at Copenhagen into a legally binding treaty. "This is the first step we are taking towards a green and low carbon future for the world. First steps are difficult, but they are also necessary," he said on Saturday. "I hope that we can move quickly to the next step which is to get a legally binding treaty."

http://www.energyefficiencynews.com/i/2675/?

Lessons to be learned from Copenhagen

December 22, 2009
The world's best spin-doctors couldn't put much of a glow on the Copenhagen summit. Representatives of 120 countries gathered in the Danish capital with solemn pledges to draft an international treaty to fight man-made climate change, but all that emerged was a vague text with a few good intentions and no firm commitments. It's not much comfort to think that no treaty might be better than a hastily composed bad one.

What failed in Copenhagen was not so much the willpower as the approach. In the style of the UN, everyone had a seat at the table, every voice counted, and every ephemeral coalition of countries needed only shout to make itself heard.

More modest processes could address the summit's original goal: limiting the human contribution to any increase in average world temperatures to no more than two degrees, compared with pre-industrial levels.

Much had been accomplished before Copenhagen. But much remains to be done to keep this diplomatic fiasco from turning into an economic and ecological crisis. U.S. President Barack Obama already takes climate change seriously and the Chinese government has come to realize that it must do something, for domestic as much as for diplomatic reasons.

The EU, which offered serious pledges of further emission cuts, could mend fences with the poorest nations, which will need foreign investment to cope with the new demands.

The next steps could include stronger regional agreements, even bilateral ones. Little by little, a pragmatic approach -- as opposed to the maximalist UN way -- could put pressure on refuseniks into joining.

In the longer term, all governments have the same interest. They want to encourage the massive private investment -- hundreds of billion dollars annually -- needed to make much of a dent in man-made emissions of greenhouse gases. For the money to be channelled into the new technologies or processes, businesses need carbon price predictability, and a level playing field. Copenhagen didn't provide either. But the fight is far from over.

http://www.financialpost.com/todays-paper/story.html?id=2368850

IEA warns of huge investment needed for low-carbon energy sources

11 November 2009

The world's energy systems will need an extra $10.5 trillion (£6.3trillion) in investment between now and 2030 to reduce dependence on fossil fuels and avoid "irreparable damage to the planet", the International Energy Agency (IEA) warned yesterday.

In the run-up to next month's climate summit in Copenhagen, the IEA's annual global outlook outlined parallel forecasts – one based on the current trajectory of global energy consumption, the other a lower-carbon model requiring major international policy co-ordination.

"The outlook provides both a caution and grounds for optimism," said Nobuo Tanaka, executive director of the IEA. "Caution, because a continuation of current trends in energy use puts the world on track for a rise in temperature of up to 6^{o}C and poses serious threats to global energy security. Optimism, because there are cost-effective solutions."

Recession has severely dampened demand for energy, but while energy use will fall in this year for the first time since 1981, demand is still set to rise by 1.5% every year until 2030.

Without intervention, fossil fuels will remain the primary energy source and emissions will also rise by 1.5% per year, pushing up global temperatures and leading "almost certainly to massive climatic change and irreparable damage to the planet", the IEA fears. The price of oil will be back up to $100 a barrel by 2020 and $115 by 2030.

Recession has also sent investment in energy plunging. The IEA estimates that upstream oil and gas investment budgets fell by 19%, or more than $90bn, this year. End users are also spending less upgrading to energy-efficient appliances and vehicles.

The danger is that once economies recover and energy demand rebounds, insufficient supplies will be available. "The financial crisis has cast a shadow over whether all energy investment needed to meet growing energy needs can be mobilised," the IEA says.

Some $26 trillion in investment will be required to meet projected energy demand through to 2030, more than half of it in developing economies.

All is not lost, however. According to the IEA's second scenario, "radical and co-ordinated policy action across all regions" can keep emissions of harmful carbon dioxide into the atmosphere below a safe threshold.

The biggest tranche of savings will come from energy efficiency, particularly in buildings, industry and transport. But demand will still rise by 20 per cent and the extra $10.5 trillion cost of re-setting the balance towards renewable sources will take the total investment needed to $36.5 trillion.

The IEA estimates that $197 billion per year will be needed by fast-growing, developing countries by 2020 to avoid older, dirty technology – nearly twice the €100 billion (£89.7 billion) figure put forward by EU leaders last month. The Clean Development Mechanism, under which carbon credits can be earned by investing in poorer countries, will also need to be massively expanded and upgraded to cope with a much more central role, the IEA says.

http://www.independent.co.uk/news/business/news/lowcarbon-energy-sources-need-105trn-investment-warns-iea-1818246.html

Scientists give their take on University of East Anglia e-mail hacking

4 December 2009
As climate change sceptics seize upon "hacked" emails which they claim show global warming data has been manipulated, Channel 4 News online asks 10 scientists what they think of the furore.

Dr Stephan Harrison, School of Geography, University of Exeter: "The emails have been seized upon by climate change sceptics as evidence that scientists are involved in a global warming conspiracy. We shouldn't get too carried away, however. Irrespective of what may or may not have been said in some private emails, this doesn't change the physical properties of carbon dioxide, and doesn't change the fact that human activity is warming the planet."

Professor John Burrows, Director of the Biogeochemistry Programme, Centre for Ecology & Hydrology: "The peer review scientific process was created to try to avoid conspiracies from any side on an issue. Despite the adverse reaction in some quarters the current discussion is a good example that whilst it doesn't always look perfect, an open debate, backed up by peer review, is what science is all about."

Professor Piers Forster, School of Earth and Environment, University of Leeds: "Scientists at the Climate Research Unit do an amazingly hard job.

Nothing I have read makes me doubt the veracity of the peer review process or the general warming trend in the global temperature record."

Bob Ward from the Grantham Research Institute on Climate Change and the Environment, London School of Economics and Political Science: "Once appropriate action has been taken over the hacking, there has to be some process to assess the substance of the email messages as well. The only way of clearing the air now would be through a rigorous investigation."

Dr Andy Challinor, lecturer in Climate Change Modelling, University of Leeds: "The idea that the many scientists across the globe working on climate change could collude in misrepresenting the fundamentals of the science is ludicrous, since it would be both counter-cultural to science and logistically impossible."

Dr Shaun Fitzgerald, Industrial Fellow, University of Cambridge BP Institute: "I fail to understand why people want to debate the evidence base for climate change rather than debate what we should be doing anyway to reduce our impact on the planet."

Professor Bob Spicer, Professor of Earth Sciences at the Open University: "Any investigation should not only tackle issues associated with allegations of inappropriate data manipulation, but also who actually hacked the servers and stole emails that are, after all, private property. There is a vast array of freely available scientific data, including evidence from the geological past, that climate change has happened, sometimes happens quickly, and is happening now."

Prof Jim Skea, Research Director at the UK Energy Research Centre: "The lesson for the future is that action needs to be taken quickly and decisively when scientific integrity is called into question. This is a messy and complicated affair and that's why a careful inquiry is needed to sort out the facts from the rumour."

Dr Philippe Marbaix from Université Catholique de Louvain (UCL) in Belgium: "There is, unfortunately, too much evidence: the earth is warming, and this is going to cause damage of potentially large magnitude. We are in a finite world, and if we ignore this basic fact, we will face increasingly serious problems - including but not only due to climate change."

Professor Rowan Sutton, Walker Institute, University of Reading: "Throughout the Earth's history there have been natural changes in climate caused by many factors, including variations in the Earth's orbit around the Sun, volcanic eruptions, and changes in greenhouse gas concentrations. The scientific evidence now shows that people are changing the global climate."

http://www.channel4.com/news/articles/science_technology/ten+scientists+on+climate+change+aposemailgateapos/3450137

Scientists claim worst-case scenario for global warming on the way

18 November 2009
The world is now firmly on course for the worst-case scenario in terms of climate change, with average global temperatures rising by up to 6°C by the end of the century, leading scientists said yesterday. Such a rise – which would be much higher nearer the poles – would have cataclysmic and irreversible consequences for the Earth, making large parts of the planet uninhabitable and threatening the basis of human civilisation.

We are headed for it, the scientists said, because the carbon dioxide emissions from industry, transport and deforestation which are responsible for warming the atmosphere have increased dramatically since 2002, in a way which no one anticipated, and are now running at treble the annual rate of the 1990s.

This means that the most extreme scenario envisaged in the last report from the UN Intergovernmental Panel on Climate Change, published in 2007, is now the one for which society is set, according to the 31 researchers from seven countries involved in the Global Carbon Project.

Although the 6°C rise and its potential disastrous effects have been speculated upon before, this is the first time that scientists have said that society is now on a path to meet it.

Their chilling and remarkable prediction throws into sharp relief the importance of next month's UN climate conference in Copenhagen, where the world community will come together to try to construct a new agreement to bring the warming under control.

For the past month there has been a lowering of expectations about the conference, not least because the US may not be ready to commit itself to cuts in its emissions. But yesterday President Barack Obama and President Hu Jintao of China issued a joint communiqué after a meeting in Beijing, which reignited hopes that a serious deal might be possible after all.

It cannot come too soon, to judge by the results of the Global Carbon Project study, led by Professor Corinne Le Quéré, of the University of East Anglia and the British Antarctic Survey, which found that there has been a 29% increase in global CO_2 emissions from fossil fuel between 2000 and 2008, the last year for which figures are available.

On average, the researchers found, there was an annual increase in emissions of just over 3% during the period, compared with an annual increase of 1% between 1990 and 2000. Almost all of the increase this decade occurred after 2000 and resulted from the boom in the Chinese economy. The researchers predict a small decrease this year due to the recession, but further increases from 2010.

In total, CO_2 emissions from the burning of fossil fuels have increased by 41% between 1990 and 2008, yet global emissions in 1990 are the reference level set by the Kyoto Protocol, which countries are trying to fall below in terms of their own emissions.

The 6°C rise now being anticipated is in stark contrast to the 2°C rise at which all international climate policy, including that of Britain and the EU, hopes to stabilise the warming – two degrees being seen as the threshold of climate change which is dangerous for society and the natural world.

The study by Professor Le Quéré and her team, published in the journal Nature Geoscience, envisages a far higher figure. "We're at the top end of the IPCC scenario," she said.

Professor Le Quéré said that Copenhagen was the last chance of coming to a global agreement that would curb carbon-dioxide emissions on a time-course that would hopefully stabilise temperature rises to within the danger threshold. "The Copenhagen conference next month is in my opinion the last chance to stabilise climate at C above pre-industrial levels in a smooth and organised way," she said.

"If the agreement is too weak, or the commitments not respected, it is not 2.5°C or 3°C we will get: it's 5°C or 6°C – that is the path we're on. The timescales here are extremely tight for what is needed to stabilise the climate," she said.

Meanwhile, the scientists have for the first time detected a failure of the Earth's natural ability to absorb man-made carbon dioxide released into the air.

They found significant evidence that more man-made CO_2 is staying in the atmosphere to exacerbate the greenhouse effect because the natural "carbon sinks" that have absorbed it over previous decades on land and sea are beginning to fail, possibly as a result of rising global temperatures.

The amount of CO_2 that has remained in the atmosphere as a result has increased from about 40% in 1990 to 45% in 2008. This suggests that the sinks are beginning to fail, they said.

Professor Le Quéré emphasised that there are still many uncertainties over carbon sinks, such as the ability of the oceans to absorb dissolved CO_2, but all the evidence suggests that there is now a cycle of "positive feedbacks", whereby rising carbon dioxide emissions are leading to rising temperatures and a corresponding rise in carbon dioxide in the atmosphere.

"Our understanding at the moment in the computer models we have used – and they are state of the art – suggests that carbon-cycle climate feedback has already kicked in," she said.

"These models, if you project them on into the century, show quite large feedbacks, with climate amplifying global warming by between 5% and 30%. There are still large uncertainties, but this is carbon-cycle climate feedback that has already started," she said.

The study also found that, for the first time since the 1960s, the burning of coal has overtaken the burning of oil as the major source of carbon-dioxide emissions produced by fossil fuels.

Much of this coal was burned by China in producing goods sold to the West – the scientists estimate that 45% of Chinese emissions resulted from making products traded overseas.

It is clear that China, having overtaken the US as the world's biggest carbon emitter, must be central to any new climate deal, and so the communiqué from the Chinese and US leaders issued yesterday was widely seized on as a sign that progress may be possible in the Danish capital next month. Presidents Hu and Obama specifically said an accord should include emission-reduction targets for rich nations, and a declaration of action plans to ease greenhouse-gas emissions in developing countries – key elements in any deal.

6C rise: The consequences

If two degrees is generally accepted as the threshold of dangerous climate change, it is clear that a rise of six degrees in global average temperatures must be very dangerous indeed, writes Michael McCarthy. Just how dangerous was signalled in 2007 by the science writer Mark Lynas, who combed all the available scientific research to construct a picture of a world with temperatures three times higher than the danger limit.

His verdict was that a rise in temperatures of this magnitude "would catapult the planet into an extreme greenhouse state not seen for nearly 100 million years, when dinosaurs grazed on polar rainforests and deserts reached into the heart of Europe".

He said: "It would cause a mass extinction of almost all life and probably reduce humanity to a few struggling groups of embattled survivors clinging to life near the poles."

Very few species could adapt in time to the abruptness of the transition, he suggested. "With the tropics too hot to grow crops, and the sub-tropics too dry, billions of people would find themselves in areas of the planet which are essentially uninhabitable. This would probably even include southern Europe, as the Sahara desert crosses the Mediterranean.

"As the ice-caps melt, hundreds of millions will also be forced to move inland due to rapidly-rising seas. As world food supplies crash, the higher mid-latitude and sub-polar regions would become fiercely-contested refuges.

"The British Isles, indeed, might become one of the most desirable pieces of real estate on the planet. But, with a couple of billion people knocking on our door, things might quickly turn rather ugly."

http://www.independent.co.uk/environment/climate-change/world-on-course-for-catastrophic-6deg-rise-reveal-scientists-1822396.html

Use CO_2 to help gasification efficiency

November 30, 2009
The world has taken a step closer to "clean coal," thanks to new technology that actually uses CO_2 to make power generation more efficient. The research by scientists at Columbia University means that millions of tons of CO_2 could be prevented from entering the atmosphere and instead used to turn coal, biomass and municipal waste into cleaner fuel.

This remarkable double hit is based on a well-established process called "gasification" that is already used to clean "dirty" fuels by heating them with steam and turning them into a mixture of hydrogen and carbon monoxide, known as syngas. In turn, that is then burned in power stations or used to create transport fuels. But until now this process has demanded very large amounts of energy and water, and produced substantial CO_2 emissions.

However, the Columbia researchers have shown that by actually adding CO_2 into the mix and replacing some of the steam, the reaction becomes dramatically more efficient and much cleaner. "We can make efficiency savings of 25% to 30%," assistant professor Marco Castaldi, who led the research, told CNN.

"The process is operated in a very similar way to a conventional gasifier, in that we take the biomass and mix it with some steam... But that's where the similarities end, because instead of just using steam, we also used CO_2, which serves two major purposes. "Firstly it reacts with the biomass a little better than steam. Secondly, because it does a good job, it reduces the amount of steam needed, which saves energy and water. It's a two-fold hit."

After the hydrogen is removed from the syngas, the remaining carbon monoxide can be safely burned underground. In an article published in Journal of

Environmental Science & Technology in November, Castaldi and his team show that if their gasification techniques was applied to a biomass such as beech grass, and this was being used to fuel a fifth of the world's transport, 437 million tons of CO_2 would be used, the equivalent of taking 308 million vehicles off the road.

Castaldi has led experiments on over 50 different kinds of biomass and achieved broadly similar results and the new gasification process is applicable to almost any high carbon solid fuel -- from bark and pine needles to grass and coal. "All of these fuels are a high carbon base, and the CO_2 is taking that carbon and working on it," he said.

Castaldi is convinced his technique can offer cleaner and more efficient power generation, even when applied in "real world" scenarios. "The study that was published was based on lab work," he said. "But we've tested it on a much larger scale, and as we scale it up, we see the same results in terms of better efficiencies and processing... "One big question for us was, OK, we can prove you get an efficiency gain in the gasifier of about 25 percent. But the gasifier is only one part of the overall process in, say, a power plant... But we found that when you put [our techniques] into a much larger system, you still see an improvement of 3% or 4%. "That might seem small, but a power plant is hundreds and hundreds of megawatts, so although it's a small percentage, it's still a huge amount.

"One thing that is often overlooked -- a lot of energy systems use a lot of water, and for every percentage of CO_2 I use that's one less percentage of water."I can see that within five years we could have a fully functional gasifier deployed ... I think initially this type of technology could be retrofit to existing systems -- we could use flue gas to provide CO_2... I can easily see this thing being operational on a plant somewhere."

Castaldi believes that one of the major obstacles to the adoption of his techniques is human, rather than scientific. "When you look at power generation then there is a lot of entrenched knowledge and entrenched technology," he said. "There are many factors that influence how fast these things get taken up."But if you just look at the economics and the scale, and you say you can get a three, four or five percent efficiency, then yes, [power companies] should be very interested."

Castaldi's research group has already had angel investment to create a process development unit, as well as support from the US Electro Power Research Group, and says there are others he is in discussions with. "To have this piece of knowledge noticed is wonderful," he said. "Not just for me or my research group... everyone is taking about CO_2 capture and sequestration at the moment, but this is actually a way of using it."

"Hopefully these findings will stimulate people to think about utilizing CO_2 and other waste streams to make chemicals and products that society wants," Castaldi told Columbia University's Global Impact. "This is what engineering does best, developing processes that can extract value from unwanted materials -- to help make the world a better place."

http://edition.cnn.com/2009/TECH/science/11/29/clean.coal.technology/

E.ON enters Kingsnorth for UK carbon capture competition

10 November 2009

Kingsnorth power station has entered the next stage of the UK Government's carbon capture and storage (CCS) competition after developers E.ON submitted an Outline Solution Bid on November 9.

The news came as one of the other entrants in the competition aiming to deliver the UK's first full-scale CCS demonstration project, the Tilbury station backed by a consortium of Peel Energy, DONG Energy and RWEnpower, pulled out of the competition due to issues over its timetabling.

Also, as part of the National Policy Statements on Energy also released on November 9, Ed Miliband announced that a new CCS Incentive is to fund the programme, which the government hopes will see up to four commercial-scale CCS demonstration projects, including both pre-combustion and post-combustion capture technologies.

E.ON revealed that it had submitted its proposed 1,600MW Kingsnorth supercritical coal-fired power station in the competition, just weeks after losing out to Powerful Power's station in Yorkshire for €180 million (£156 million) of European Commission funding for CCS.

Dr Paul Golby, chief executive of E.ON UK, said he believed that E.ON had the best scheme to meet the UK competition's objectives, where the winning project is set to receive government funding for its construction and operation costs.

"As far as the E.ON Group is concerned, Kingsnorth is part of a wider initiative to help lead the way in carbon capture and storage, which has the potential to be part of the global solution to the global issue of climate change," he said.

Kingsnorth will now compete against the only other remaining entrant, Longannet Power Station in Fife, in the competition, which energy secretary Ed Miliband yesterday said could be decided next year.

http://newenergyfocus.com/do/ecco/view_item?listid=1&listcatid=32&listitemid=3196&section=Carbon

Carbon may not be so bad after all

10 November 2009
Carbon could go from villain to hero, according to researchers who have developed a better way to use "adsorption technology" to drive more efficient heaters and air conditioners.

The process involves using carbon to adsorb a refrigerant — essentially causing it to cling to the carbon's surface, rather than absorbing it — depending on the surrounding temperature. When heated, the carbon would release the refrigerant and cool the surrounding area, storing the extracted heat in a radiator or hot water tank.

Because they operate as closed systems, such adsorption technologies are more efficient than conventional condensing boilers or electric heat pumps. Up until now, though, the problem has been the technology's size: it would have to take up roughly 300 litres for a car air conditioner and even more space for a home heat pump.

Researchers at the University of Warwick, however, have made a breakthrough that could dramatically shrink such devices, making them small and light enough

to use in both cars and homes. Their new design uses very thin sheets of metal distributed through the carbon; each sheet contains 100-plus tiny water channels that help make the heat transfer more efficient. This has enabled the research team to shrink the required size of adsorption technologies by up to 20 times.

Eventually, the researchers hope, such improved adsorption technologies could create domestic heat pumps that could reduce both fuel bills and carbon dioxide emissions by more than 30%. Used in car air conditioning systems, the technology could lead to fuel consumption and emissions reductions of nearly 5%.

The innovation has already attracted interest from commercial developers, prompting the research team to spin out a new company, Sorption Energy Ltd.

"The technology is now ready for commercialisation and we are very excited by the opportunities which are developing," said lead researcher Bob Critoph. "It is particularly pleasing that the technology will significantly help reduce CO_2 emissions."

"This is exciting stuff," added David Auty, CEO of Sorption Energy. "The technology has been proven in the University's laboratories at the sizes needed for vehicles and domestic systems, and there are several other large markets. The ability to provide products which make significant reductions in both energy consumption and CO_2 emissions at a similar price to existing products will make Sorption Energy very attractive to customers, and is very satisfying for the team."

http://www.greenbang.com/carbon-could-prove-the-good-guy-for-better-heating-cooling_12529.html

Deep Geothermal Challenge Fund launched by UK government

22 October 2009
The hunt is on for the next source of clean and reliable energy: heat from deep below the Earth's surface.

In the UK, officials launched that hunt today with the announcement of a new £6 million Deep Geothermal Challenge Fund. Part of the Department of Energy and Climate Change's low-carbon investment fund, the geothermal fund is aimed at helping companies conduct exploratory work to find viable sites for this technology.

"Deep geothermal energy is an exciting and innovative technology that could provide clean, low-carbon and renewable power and heat for the UK," said Energy and Climate Change Minister Lord Hunt. "We want to make sure that this energy resource can play a part in the future low-carbon energy mix. Deep geothermal power from the South West of England alone could meet 2 per cent of the UK's annual electricity demand, potentially creating thousands of jobs in the building and running of new power plants."

Many countries worldwide — including the US and Australia — are switching on to the potential for deep geothermal power to provide low-carbon, non-intermittent energy. British officials say power from deep geothermal would strengthen and diversify the UK's energy mix and would lessen dependence on imported fossil fuels.

There is currently just one geothermal energy station in the UK: the Southampton District Energy Scheme. The station uses hot water pumped from 1,800 metres

below ground as part of the city's district heating network and has operated successfully for over 20 years, saving an estimated 11,000 tonnes of CO_2 per year.

In addition to providing heat, geothermal energy can also power steam-driven turbines to generate electricity.

Projects in England, Scotland and Wales are eligible to bid to the fund. There will be £4 million available this year and £2 million next financial year. Project bids will be assessed and managed by panel established by the Department of Energy and Climate Change. The closing date for bids for the first round of the fund will be 20 November 2009 with the successful projects to be announced shortly after that.

http://www.greenbang.com/geothermal-challenge-fund-seeks-to-tap-earths-heat-energy_12294.html

Artificial leaf has potential for powering vehicles

8 November 2009
Scientists are taking the cue from the photosynthesis process by developing a sort of artificial leaf which then can provide energy to power vehicles.

This amazing finding has been revealed by the scientists at the 1st Annual Chemical Sciences and Society Symposium in Japan.

Photosynthesis involves conversion of water and carbon dioxide into sugars, oxygen and hydrogen. Then these by-products can be utilized as fuel to power the vehicles.

However, the scientists have said that it will take time to develop the mechanism to produce the fuels commercially.

The scientists also discussed the strategy to achieve that goal. Apart from that the future of other alternative sources like solar energy was discussed to face the energy crisis.

According to Kazunari Domen, University of Tokyo, the scientists must devise the mechanism to produce the liquid fuel like wood alcohol or methanol to run a vehicle. This would be same as an artificial leaf which can produce usable liquid fuel as the plants.

http://www.india-server.com/news/energy-from-artificial-leaf-can-power-15449.html

Slow water currents have tidal power potential

2 November 2009
Minesto, a Swedish and UK based company, is developing a new technology for electricity generation from slow water currents that could raise the tidal power potential in the UK from 22 TWh to 40 TWh.

Minesto says it has unveiled a way of using an underwater kite that can harness tidal power. The principle of the technology can be explained as a two stage process.

The first stage increases the relative flow speed entering a tidal turbine. When the tide hits the wing it creates a lift force, since the kite is mounted to the ocean bed with a tether and is controlled by a rudder, the kite can be taken in the desired trajectory. The method increases the flow velocity into the turbine with 10 times the current speed.

The second stage uses a conventional plant to convert kinetic energy into electrical power. The net result is increased tidal power from a smaller package. The tidal power plant weighs 13-14 tons/MW and electricity generation costs using Deep Green are in the range of €0.06-0.14/kWh.

Minesto's tidal concept has been verified on a scale of 1:10 and Minesto is now working on the next prototype in a 1:4 scale. It will be tested outside the coast of Northern Ireland.

The tidal power technology will contribute to "a substantial increase of power from the tides with its ability to produce energy from areas where other technologies are less efficient," Minesto says. The main reason for this is the extended site areas available when looking at sites with a current velocity of 1.2-2.2m/s and depths between 60-120 m. In the UK, Deep Green alone could add 18 TWh of electricity potential utilised from tides. The existing owners of Minesto, Saab Group, Midroc New Technology, Verdane Capital and Encubator have recently invested additional capital to accelerate the development of the slow current tidal power technology.

In total they have invested just under €2 million into the company while additional funding has been received from both Swedish and UK governments.

http://www.renewableenergyfocus.com/view/4937/tidal-power-from-slow-currents-with-kite-usage

Severn Barrage tidal project at risk

October 30, 2009
Plans to build a ten-mile tidal barrage across the River Severn that could generate up to 5% of Britain's electricity are likely to be shelved under a government cost-cutting drive, The Times has learnt.

The Severn Barrage project, which would cost up to £23 billion to build, is set to be indefinitely postponed early next year when ministers announce whether to commit fresh public funding, according to Westminster insiders.

"They are moving towards a political fudge," said one. "They will say they are delaying it, but in reality the lifeline on offer will not be worth very much." The vast cost and tight constraints on future public spending have led ministers to question the project's affordability.

Government figures show that the cost of generating electricity from a barrage across the Severn or from a tidal lagoon could be as high as £317 per megawatt hour, compared with £38 for nuclear power and no more than £85 for offshore wind.

The news will be a blow for advocates of the scheme, including the Sustainable Development Commission. They argue that it would help Britain to meet its ambitious EU targets of generating 30 per cent of UK electricity from renewable sources by 2020.

However, under EU rules, to contribute to those targets, the barrage would need to be generating electricity by 2022. Because it would take up to a decade to build, that would mean construction would have to start as early as 2012 — requiring large infusions of public money within the next two or three years.

Matthew Bell, of Frontier Economics, the author of a report on the costs of the Severn project, said: "Given that the Government has only a limited amount of money and some very ambitious renewable energy targets, it wants to make sure it gets the best value it can — and the Severn Barrage is simply more expensive than any other form of renewable generation."

The Department of Energy and Climate Change, which spent £3 million on the project last year, said that a feasibility study was continuing into the project. External consultants are working on the study, which includes an analysis of five options for how it could be built.

The group is led by Parsons Brinkerhoff, the company that built the New York subway. PricewaterhouseCoopers and DTZ are also involved. The Conservative Party is understood to view the project as an obvious target for potential cost savings.

Two main technologies have been proposed: a conventional barrage, running between the English and Welsh coasts, and a tidal lagoon. Both would harness the enormous tidal range of the Severn, which, at 14 metres, is the second-highest in the world, to drive electricity-generating turbines.

A conventional barrage would have a capacity of 8,640 megawatts and an estimated output of 17 terawatt hours a year — providing about 5 per cent of present UK electricity demand. But such a link would involve moving 18 million tonnes of seabed to create a level surface and require 13 million tonnes of concrete and aggregates.

In July, the chairman of the Environment Agency, Lord Smith of Finsbury, delivered a blow to the plans, hinting strongly that the agency would oppose proposals for the barrage if environmental concerns are not addressed.

http://business.timesonline.co.uk/tol/business/industry_sectors/engineering/article6896064.ece

'Stealth' blades tackle wind turbine challenges

28 October 2009

Nothing is ever simple when building large renewable energy projects. For wind energy – which it is hoped could supply a fifth of the UK's electricity by 2050 – there are logistical challenges and local aesthetic objections, but also a big technical issue. Any time a developer proposes a wind farm near a flight path, the Civil Aviation Authority (CAA) or the Ministry of Defence (MoD) gets jumpy, because windmills do strange things to radar. The British Wind Energy Association reckons that aviation objections are holding back 6GW of wind energy capacity, or enough to power 3.4m homes. About half of all proposed wind projects in the UK have some sort of aviation issue.

But this problem may soon be consigned to history: inspired by stealth warplanes, the windmill manufacturer Vestas has come up with a way to make its turbines and blades almost invisible to radar.

Modern windmills are massive structures that are far better at reflecting radar signals than many of the other objects that a radar system might encounter and wish to ignore. In addition, the blade tips of a large wind turbine can reach speeds of up to 200mph, comparable to the speed of a light aircraft. "They appear on a radar display as a radar track and this, from an air traffic controller's perspective, they think it could be an aircraft and, from an air defence perspective, it means there is unwanted clutter," says the BWEA's head of aviation, Nicola Vaughan, who describes radar interference as "the biggest technical barrier for wind farms, without a doubt". Marine radar operators have problems, too – waves bouncing between windmills and ships can create "ghost images".

Couldn't planes and boats simply be informed where wind farms are, and give them a wide berth? "It might just work for civil aircraft," says Mark Roberts of the defence research company Qinetiq. "But I imagine the CAA wouldn't be too happy because it would cut across their airspace. And from a defence perspective, the bad guys aren't going to play ball." So the best solution is to make the windmills partly invisible to the radar, by reducing the degree to which they reflect radio waves. Then radar software could filter them out. "Radars have filters in them that can be set to mask out returns from things like electricity pylons and buildings," says Steve Appleton of Vestas. "The problem is, if you raise that filter level so you couldn't see turbines, you wouldn't see anything else."

Last week, Vestas announced that it had been working on a way to fix this, using radar-absorbing materials developed by Qinetiq that can be inserted into the blades during manufacture.

He adds: "Vestas gave us a number of criteria when we embarked on this project," says Qinetiq's Roberts. "Minimal cost increase, it had to be incorporated as part of their existing manufacturing process, and it had to be of minimal weight impact."

The radar-absorbing material is similar to the composites used in stealth aircraft and, since it is inserted inside the blade, does not change the aerodynamic profile or efficiency of the windmill. In its trial, Vestas replaced one blade of a standard windmill with Qinetiq's "stealth" blade and found its radar cross-section was significantly reduced.

Vestas plans to carry out a full-scale demonstration next year – with all three blades replaced, and the rest of the structure painted in radar-absorbing material. Appleton insists that the extra costs to a developer should be marginal enough not to put them off buying a "stealth" turbine. Neither Vestas nor Qinetiq would reveal just how much effect the technology currently has, but Appleton said that, as it gets better, he hopes that a wind farm's radar footprint could be reduced by an order of magnitude.

Bringing the stealth turbine to market will still require much development work and, mindful of that, the rest of the industry is not sitting in wait. At last week's BWEA annual meeting, the Department for Energy and Climate Change announced that, along with the wind industry and the Crown Estate, it had awarded £5m to the defence company Raytheon for a project that will examine how to improve radar software. "We'd like to make the radar more intelligent so it can differentiate between a radar return from a turbine and one from an aircraft," says Vaughan.

Step by step, tackling the radar problem from both ends, that 20% target for wind by 2050 doesn't look so hard after all.

http://www.guardian.co.uk/environment/2009/oct/28/stealth-wind-turbines-radar

Desertec Project could provide up to 15% of Europe's energy needs

03 November 2009
Around 15% of Europe's energy needs in 2050 could be provided by a huge solar project in the Sahara desert, after a consortium of European companies signed up to the $400 billion (£240 billion) venture yesterday (November 2).

The Desertec Industrial Initiative (DII) includes major renewables companies such as E.ON, Siemens, RWE and ABB as well as other solar companies in a 12 company consortium, which has committed to building massive solar energy fields across North Africa's Sahara desert. DII said it hopes to be generating electricity by 2015.

The project will utilise concentrated solar power technology (CPS), which uses parabolic mirrors to focus the Sun's rays on containers of water, vaporising it into steam to turn turbines. The electricity will then be transferred to Europe by way of a network of high-voltage cables.

Part of the sun's heat will also be collected in heat storage tanks during the day and then run through steam circuits at night or specifically during peak hours, depending on the demand, meaning the plant can operated almost 24 hours a day.

Power generated is set to be used by the local populations in the region, and DII said that a number of North African countries have approached it about joining the project.

Pivotal

The DESERTEC concept was first announced in 2007, and small pilot schemes were built, but now the structure is in place for what Paul van Son, chief executive of DII, called a "pivotal" project.

He said: "We recognize and strongly support the DESERTEC vision as a pivotal part of the transition to a sustainable energy supply in the Middle East and North Africa and Europe. Now the time has come to turn this vision into reality. That implies intensive cooperation with many parties and cultures to create a sound basis for feasible investments into renewable energy technologies and interconnected grids."

Torsten Jeworrek, member of the board of the DII founding members said the project would go a long way to reducing greenhouse gas emissions and that signing the deal before the Climate Change summit in Copenhagen sent out a positive message to the private sector.

"The question is not whether we should do something, but how we can reduce greenhouse gas emissions to the atmosphere and how this goal can be achieved in an intelligent manner, which results in a win-win situation for both the environment and the economy. With regard to the important UN climate summit in Copenhagen, this private sector initiative demonstrates how business potentials can be aligned with sustainability goals," he said.

http://www.newenergyfocus.com/do/ecco/view_item?listid=1&listcatid=32&listitemid=3171&section=Solar

Low-carbon research centre launched in Yorkshire

5 October 2009
Several UK universities have come together to launch a £50 million research centre aimed at both addressing climate change and developing technologies for a sustainable and low-carbon economy.

The Centre for Low Carbon Futures (CLCF) is a joint initiative between the Yorkshire Universities and the regional development agency, Yorkshire Forward. The centre will be led by the universities of Hull, Leeds, Sheffield and York and draw on the research strengths of all the region's higher education institutions. By adopting a multidisciplinary and cross-university approach across the sciences, social sciences and engineering, the centre aims to improve our understanding of the impact and costs of climate change and identify ways in which organisations and communities can adapt to meet these challenges.

The centre will also develop innovative technologies and methodologies for carbon reduction in partnership with regional business and industry, which will help the region to meet its own emissions reduction targets and to exploit the opportunities available as world economies change to a low carbon model.

The centre has already identified its first four pilot research projects, covering the regional economics of climate change, low-carbon supply chains, biorenewables and carbon capture technology.

"The centre will provide the knowledge base to generate workable solutions for businesses and communities, promoting the uptake of innovations and creating change in the real world," said interim director Tony Hardy. "Its work will protect those most vulnerable to the changes that climate change will bring to us all."

"The Centre for Low Carbon Futures will involve researchers of the highest calibre from many academic disciplines and from across the many universities and research institutes in Yorkshire working together in an atmosphere of intellectual rigour and mutual support," added Brian Cantor, vice-chancellor of the University of York and chair of the centre's interim board. "The centre will create a visionary research and training environment of international quality to meet the challenging energy and environmental questions facing society."

From January 2010, the centre's director will be Jon Price who, since 2007, has been managing director of Climate Strategies, hosted at Cambridge University's Centre for Energy Studies.

"Joining CLCF at this time represents a hugely exciting opportunity; The United Nations' meetings to be held in Copenhagen in December will be a major event for climate change policy, hopefully resulting in progress on multilateral agreements," Price said. "With world attention on the outcome of these talks we will have great opportunities to put CLCF at the forefront of practical measures to reduce carbon — going beyond policy and helping to deliver legally binding emissions reductions on a regional, national and international level — through the practical applications of products derived from new low-carbon technologies. The centre will provide a unique conduit for the region's academic and business communities to collaborate and increase their joint understanding of practical applications of clean technologies."

http://www.greenbang.com/50-million-centre-targets-climate-low-carbon-research_11992.html

Student Bursaries for 2010-2011

Up to 6 travel and subsistence bursaries for up to £300 are on offer to bona-fide full-time students wishing to attend appropriate National and International coal-related conferences, such as the "8th European Conference on Coal Research and its Applications" to be held at University of Leeds in September 2010, (please see the Calendar of Coal Research Events for details of both this and other 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
School of Chemical & Environmental Engineering
The University of Nottingham
University Park
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 current EPSRC Energy Projects

(as of 1 January 2010)

Climate Change

Grant Title	Investigator	Value (£)
Carbon Calculations over the Life Cycle of IndustrIal Activities (CCaLC)	Professor A Azapagic	979,435
Challenges and Opportunities for the UK in Moving Towards a Low-Carbon Future	Dr G Walker	522,732
Fuel Cell Technology, Enabling a Robust Clean Energy Economy	Professor J Irvine	533,875
Sand Transport in Oscillatory Flow In The Sheet Flow Regime	Professor T O'Donoghue	312,027
SCORCHIO: Sustainable Cities: Options for Responsing to Climate cHange Impacts and Outcomes	Professor S Sharples	60,497
SCORCHIO: Sustainable Cities: Options for Responsing to Climate cHange Impacts and Outcomes	Professor J Hall	124,385
SCORCHIO: Sustainable Cities: Options for Responsing to Climate cHange Impacts and Outcomes	Professor GJ Levermore	319,234

The Development of a Local Urban Climate Model and its Application to the Intelligent Development of Cities (LUCID)	Professor SE Belcher	238,330
The Development of a Local Urban Climate Model and its Application to the Intelligent Development of Cities (LUCID)	Professor M Davies	608,174
The Development of a Local Urban Climate Model and its Application to the Intelligent Development of Cities (LUCID)	Professor M Kolokotroni	179,953

Towards a Sustainable Energy Economy

Grant Title	Investigator	Value (£)
Advanced Bio-Photovoltaic Devices for Solar Energy Conversion	Dr A Fisher	1,170,275
Advanced Bio-Photovoltaic Devices for Solar Energy Conversion	Professor LM Peter	353,538
Artificial Photosynthesis: Solar Fuels	Professor RJ Cogdell	1,606,485
AURA-NMS: Autonomous Regional Active Network Management System	Professor TC Green	2,512,336
BMT-CES: Biofuel Micro-Trigeneration with Cryogenic Energy Storage	Professor AP Roskilly	678,201
BMT-CES: Biofuel Micro-Trigeneration with Cryogenic Energy Storage	Professor Y Ding	351,194
Carbon Dioxide and Alkanes as Electron-sink and Source in a Solar Nanocell: towards Tandem Photosynthesis of Carbon Monoxide and Methanol	Professor R Perutz	369,069
Carbon Dioxide and Alkanes as Electron-sink and Source in a Solar Nanocell: towards Tandem Photosynthesis of Carbon Monoxide and Methanol	Professor M George	328,660
Carbon Dioxide and Alkanes as Electron-sink and Source in a Solar Nanocell: towards Tandem Photosynthesis of Carbon Monoxide and Methanol	Professor CJ Pickett	678,849
Carbon Dioxide and Alkanes as Electron-sink and Source in a Solar Nanocell: towards Tandem Photosynthesis of Carbon Monoxide and Methanol	Professor WR Flavell	312,239
Delivering sustainable water systems by optimising existing infrastructure via improved knowledge, understanding and technology - project NEPTUNE	Professor NJD Graham	2,326,981

Designing Novel High Capacity Multicomponent Hydrides for Near-Ambient Solid State Hydrogen Stores	Dr G Walker	442,190
DIAMOND: Decommissioning, Immobilisation And Management Of Nuclear wastes for Disposal	Professor SR Biggs	4,276,704
Energy Efficient Cities	Professor I Leslie	2,862,120
EPSRC - Energy Research Senior Fellow	Professor NP Brandon	1,029,817
Future reliable renewable energy conversion systems & networks: A collaborative UK-China project.	Professor GY Tian	236,601
Future reliable renewable energy conversion systems & networks: A collaborative UK-China project.	Professor GM Asher	121,794
Future reliable renewable energy conversion systems & networks: A collaborative UK-China project.	Professor P Mawby	115,683
Future reliable renewable energy conversion systems & networks: A collaborative UK-China project.	Professor P Tavner	310,586
Future reliable renewable energy conversion systems & networks: A collaborative UK-China project.	Dr M Mueller	98,661
High stability and high efficiency printable photovoltaics (OPV) for large-scale energy production	Professor DDC Bradley	887,240
Impact of DMF on Engine Performance and Emissions as a New Generation of Sustainable Biofuel	Professor H Xu	519,808
Intensification of syngas cleaning and hydrogen separation	Professor G Akay	150,892
Measuring and Evaluating the Travel, Physical Activity and Carbon Impacts of Connect2	Professor JM Preston	2,293,909
Mop fan and electrofilter: An innovative approach for cleaning product gases from biomass gasification	Dr H LIU	174,695
New and Renewable Solar Routes to Hydrogen Energy	Professor NP Brandon	4,191,875
Optimisation of Biomass/Coal Co-Firing Processes through Integrated Measurement and Computational Modelling	Professor Y Yan	411,147
Optimisation of Biomass/Coal Co-Firing Processes through Integrated Measurement and Computational Modelling	Professor M Pourkashanian	369,042

Optimisation of Biomass/Coal Co-Firing Processes through Integrated Measurement and Computational Modelling	Dr E Lester	88,814
PERFORMANCE COMPARISON OF TRADITIONAL AND EMERGING DOUBLY-FED GENERATOR TOPOLOGIES FOR GRID-CONNECTED WIND POWER APPLICATIONS	Dr M Jovanovic	132,897
PERFORMANCE COMPARISON OF TRADITIONAL AND EMERGING DOUBLY-FED GENERATOR TOPOLOGIES FOR GRID-CONNECTED WIND POWER APPLICATIONS	Dr DJ Atkinson	135,327
Power Networks Research Academy	Professor S McArthur	1,119,084
Sustainability Assessment of Nuclear Power: An Integrated Approach (SPRIng)	Professor A Azapagic	2,123,000
Thermal Conductivity Enhancement of High-Temperature Thermal Energy Stores For Use with Solar Power Plants	Dr CY Zhao	712,780
Transition pathways to a low carbon economy	Professor GP Hammond	2,110,867
UK-China Joint Research Consortium on Sustainable Electric Power Supply	Professor H Wang	1,064,308
Understanding walking and cycling	Professor CG Pooley	958,923

Energy

Grant Title	Investigator	Value (£)
A Feasibility Study Of A Silicon Enabled Hydrogen Fuel Economy	Professor J Foord	324,398
A novel device architecture for high-performance organic solar cells	Professor H Sirringhaus	133,811
Advanced Analysis of Building Energy Performance using Computational Intelligence Approaches	Dr T Schnier	254,261
Biomimetic hybrid semiconductor photovoltaic devices	Dr LR Wilson	157,679
Chair in Decommissioning Engineering	Professor TB Kelly	275,577
Chair in Power System Engineering	Professor D Kirschen	818,336
Chair in Radiation Chemistry	Professor SM Pimblott	270,054
COincident Probabilistic climate change weather data for a Sustainable built	Professor S Sharples	81,564

Environment (COPSE)		
COincident Probabilistic climate change weather data for a Sustainable built Environment (COPSE)	Professor C Underwood	84,790
COincident Probabilistic climate change weather data for a Sustainable built Environment (COPSE)	Professor GJ Levermore	374,360
COincident Probabilistic climate change weather data for a Sustainable built Environment (COPSE)	Professor T Muneer	87,294
COincident Probabilistic climate change weather data for a Sustainable built Environment (COPSE)	Dr MH Nikolopoulou	101,418
Decision support for building adaptation in a low-carbon climate change future	Professor PFG Banfill	633,471
Delivering Low Carbon Anaerobic Wastewater Treatment and Renewable Energy Production	Dr E Cartmell	199,108
Enhanced biomass production and energy conversion for use in water-scarce areas of India	Dr MJ Tierney	74,531
Enhanced biomass production and energy conversion for use in water-scarce areas of India	Dr PA Davies	716,657
Enhanced biomass production and energy conversion for use in water-scarce areas of India	Professor RE Critoph	294,073
Enhanced Management and Performance for a Sustainable UK Energy Infrastructure	Professor S Swingler	2,484,941
EPSRC Energy Project Manager	Professor RK Aggarwal	94,425
EPSRC Star Academic Proposal	Professor J McDonald	709,745
Feasibility study for a new gas separation process, with application to carbon dioxide capture	Dr MB Sweatman	272,702
Feasibility Study of the Potential for Electric Vehicle Batteries to be Used for Network Support	Professor DG Infield	153,752
High Throughput Synthesis and Screening of Novel Hydrogen Storage Materials	Professor P Edwards	485,413
High Throughput Synthesis and Screening of Novel Hydrogen Storage Materials	Professor WIF David	243,193
Iron Pyrite / a super absorber for PV solar energy	Professor SJC Irvine	177,843

Keeping the Nuclear Option Open	Professor RW Grimes	6,114,715
Killing two birds with one stone: Can fuel cells operate on a high energy density fuel derived from coal?	Professor A Kucernak	188,049
Measurement, Modelling, Mapping and Managenmment (4M): An Evidence-Based Methodology for Understanding and Shrinking the Urban Carbon Footprint	Professor K Lomas	2,549,426
Real-time wave field mapping for the offshore renewable energy industry	Dr T Bruce	237,809
SCORE - (S)tove for (CO)oking, (R)efrigeration and (E)lectricity supply: an affordable appliance for remote and rural communities	Dr AJ Jaworski	407,068
SCORE - (S)tove for (CO)oking, (R)efrigeration and (E)lectricity supply: an affordable appliance for remote and rural communities	Dr KR Pullen	229,346
SCORE - (S)tove for (CO)oking, (R)efrigeration and (E)lectricity supply: an affordable appliance for remote and rural communities	Professor C Lawn	302,238
SCORE - (S)tove for (CO)oking, (R)efrigeration and (E)lectricity supply: an affordable appliance for remote and rural communities	Professor CM Johnson	617,864
Screening New families of Metal Organic Frameworks for Hydrogen Storage	Professor ZX Guo	89,654
Screening New families of Metal Organic Frameworks for Hydrogen Storage	Dr C Redshaw	177,996
Squeezing hydrogen out of biomass; new catalysts for clean energy generation.	Professor M Wills	185,603
SUPERGEN - The Energy Storage Consortium	Professor MS Islam	2,156,535
SUPERGEN 1 Renewal Core - FlexNet: Renewal of the Supergen consortium on Future Network Technologies	Professor J McDonald	6,974,971
SUPERGEN 2 - Conventional Power Plant Lifetime Extension Consortium - CORE	Professor RC Thomson	4,295,009
SUPERGEN BIOMASS BIOFUELS AND ENERGY CROPS II CORE	Professor JM Jones	6,387,325
Supergen Marine - Core	Professor R Wallace	5,539,980
SUPERGEN Photovoltaic Materials for the 21st Century	Professor K Durose	6,270,876
The Supergen5 Biological Fuel Cells Consortium	Professor FA Armstrong	2,022,490

The Use of Probabilistic Climate Data to Future-Proof Design Decisions in the Buildings Sector	Dr D Coley	519,402
The use of probabilistic climate scenarios in building environmental performance simulation	Professor VI Hanby	261,684
The use of probabilistic climate scenarios in building environmental performance simulation	Professor P Jones	53,197
The Use of Probabilistic Climate Scenarios in Decision Making for Adaptation of Building and Property Drainage	Dr L Jack	299,674
United Kingdom Sustainable Hydrogen Energy Consortium (UK-SHEC) CORE PROGRAMME	Dr T Mays	5,965,477
Wind Energy Technologies	Professor P Tavner	2,552,788

CALENDAR OF COAL RESEARCH MEETINGS AND EVENTS

Date	Title	Location	Contact
26th January 2010	"Mapping Power Technology in Scotland to 2020"	Marriott Hotel, Glasgow, Scotland	Industry and Power Association Tel : 01355-272630 E-mail : admin@ipa-scotland.org.uk
24th March 2010	The Royal Society of Chemistry Environmental Chemistry Group 2010 Distinguished Guest Lecture, "King Coal : Future Prospects for Growth, Use and Clean Technologies"	Burlington House, London	Dr. Leo Salter, Tel : 01209-616260 Fax : 01209-616230 E-mail : leo.salter@cornwall.ac.uk
24th March 2010	British Flame Meeting on "Waste Energy Utilisation"	Corus Swinden Technology Centre, Rotherham	Mr. J Rhine, Tel : 0121-441-3865 E-mail : jmrbf@aol.com
14th April 2010, (to be confirmed)	**The CRF Annual Meeting together with a joint Combustion/ Environment Divisional Meeting.**	**E.ON Engineering Ltd. Ratcliffe Power Station, Nottinghamshire**	**Dr.D.J.A.McCaffrey, CRF Secretary. E-mail : mail@coalresearchforum.org**
25th to 30th April 2010	XVI international coal preparation congress	Lexington, KY, USA	Coal Preparation Society of America, PO Box 309, Blacksburg, VA 24063, USA www.icpc2010.com
1st to 6th August 2010	33rd international symposium on combustion	Beijing, China	The Combustion Institute, 5001 Baum Boulevard, Suite 635, Pittsburgh, PA 15213-1851, USA Tel: 1 412 687 1366 Fax: 1 412 687 0340 Internet: www.combustioninstitute.org/conferences.htm
30th August to 2nd September 2010	8th MEGA symposium	Baltimore, MD, USA	Carrie Hartz, Air & Waste Management Association, One Gateway Center, 3rd Floor, 420 Fort Duquesne Blvd. Pittsburgh, PA 15222-1435, USA

			Tel: +1 412 904 6008 Fax: +1 412 232 3450 Email: chartz@awma.org Internet: www.megasymposium.org
6th to 8th September 2010	**8th European Conference on Coal Research & Its Applications**	**University of Leeds**	**Registration and submission of abstracts through the Conference website, www.eccria.org**
20th/21st October 2010, to be confirmed	**Coal Research Forum (Coal Preparation Division) joint seminar with the Mineral Engineering Society Southern Group and the South Midlands Institute of Materials, Minerals and Mining**	**To be announced**	**Mr Andrew Howells** **E-mail: hon.sec.mes@lineone.net**