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NEWSLETTER

of the Coal Research Forum

EDITOR'S COMMENTS:

Welcome to the May edition of the CRF Newsletter. When I began the first draft of this editorial, we were just starting to get inundated with wall-to-wall media coverage of the then forthcoming general election campaign. At the time I, like many, speculated that it could be a hung parliament. I felt that given the present state of the nation many people hoped we would get a Government, which would work together for the common good. However, I felt that if such a hung parliament were to happen it just would not work. Well, after the results are out and the dust has at last settled it seems I was right on the first count but wrong on the second. OK, so it's not a full coalition as during WW2 and it is early days yet but let's just hope that it does work because we all need it to.

Of particular concern to many of our readers is how the new coalition Government will address what seem to be the perennial problems of plugging the potential UK energy gap; addressing climate change and developing new and environmentally friendly technologies. Will we get fast-tracked new nuclear power stations? Will we get a credible CCS demonstration plant up and running soon? Can we get wind and tidal systems to provide a significant part of our energy needs? Can we do all of these, or even some of these things, and still get the nations finances back onto an even keel? Who would want to be a politician? Or are these just a bunch of silly questions!

Now to much more important things! I would like to remind you all that the 8th European Conference on Coal Research and Its Applications, (8th ECCRIA) is only four months away. Get your applications in soon and arrange your travel to sunny Leeds. The conference organisers have moved out of the Jurassic age and we now have a conference website where you can view the programme, make your reservations and choose your sessions already! The conference web site is here:

http://www.eccria.org/ibis/eccria-2010/homepage

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Joint Seminar of the Coal Research Forum and the Royal Society of Chemistry Energy Sector

21st Annual Meeting & Joint Meetings of the CRF Combustion & Environment Divisions

Held on 14th April 2010 at E.ON Engineering Ltd., Ratcliffe-on-Soar Technology Centre, Nottingham

The Technology Centre of E.ON Engineering Ltd. at Ratcliffe-on-Soar was the venue for the 21st Annual Meeting which was held in conjunction with a joint meeting of the Combustion and Environmental Divisions. A sizeable group of around 50 attendees had been attracted to the meeting which also included a visit to the Flue Gas Desulphurisation plant at Ratcliffe Power station.

The meeting opened with a welcome from Professor Allan Jones, the E.ON UK country director. Allan explained that he had been involved with the CRF from its inception in 1989 and that in his view it had stood the test of time in its usefulness by acting as a link between industry and academe and providing a voice for identifying and supporting coal R&D needs in the UK. This had been particularly important when the fate of coal R&D had been uncertain.

The first session, was a series of three presentations under the banner of the Coal Combustion Division entitled "Ash and By-Product Utilisation" and was chaired by Jon Gibbins. Jon was recently appointed as professor in power plant engineering and carbon capture at the Institute of Materials and Processes (IMP), which is part of the School of Engineering at the University of Edinburgh.

The first talk was given by Dr Richard Busby, Environment Manager of E.ON UK Ltd., entitled "Update on By-product Legislation". Richard opened his talk by posing the question "Who had made the biggest difference on waste management issues in the past five years". It was not the European Commissioner for the Environment, nor was it the UK Secretary of State for the Environment, it was not even the local authority – it was, wait for it, Bob the Builder! I think he meant us the general public. It seems there are initiatives around that encourage us to 'reduce, reuse, recycle' and these have been used in schools. This appeared to be news to many of us – certainly the expected response to 'Can we fix it?' seemed to fall on stony ground!

Richard then went on to explain the definitions of a waste and a by-product. The definitions are from the Waste Framework Directive which is now part of UK law. The directive became law on 12 December 2008 and provided the first definition of a by-product.

Waste means any substance or object which the holder discards or intends or is required to discard. The definition of by-product is more complicated however, and we were told that the following is the first such definition to appear in EU law:

"A substance or object, resulting from a production process, the primary aim of which is not the production of that item, may be regarded as not being waste referred to in point (1) of Article 3 but as being a ***by-product*** *only if the following conditions are met:*
a) further use of the substance or object is certain;
b) the substance or object can be used directly without any further processing other than normal industrial practice;
c) the substance or object is produced as an integral part of a production process;
d) further use is lawful, i.e. the substance or object fulfils all relevant product, environmental and health protection requirements for the specific use and will not lead to overall adverse environmental or human health impacts."

The need for a clear understanding of the definitions, as far as E.ON and other coal-fired power generators are concerned, is how two major materials, namely ash and gypsum, are

regarded by the regulatory authorities. The generators feel both ash and gypsum should be classified as by-products but the Environment Agency accepts that only gypsum, based on 100% sales, is a by-product.

The present situation is that both parties have agreed to disagree over the categorisation. It is expected that this discussion will be re-started by the end of 2010 which is when DEFRA has to transpose the Revised Framework Directive into UK law.

A further issue which is relevant to coal ash is the provision for what is termed end-of-waste status for a material. This can happen when certain specified wastes cease to be waste after steps are taken to recover or recycle the material. In addition other conditions have to apply; for example the material has to have a specific use, there has to be a market for it and it must cause no adverse environmental or human health impacts. In the case of coal ash and slag the environmental concerns relate to the leachability of certain elements from the ashes.

Richard then moved on to describe WRAP or the Waste and Resources Action Programme which aims to produce change for a better environment. WRAP works in England, Scotland, Wales and Northern Ireland to help businesses and individuals to reap the benefits of reducing waste, develop sustainable products and use resources in an efficient way. It also works with the public providing information and tools that support recycling and reduces food waste which, it is claimed, helps bring measurable gains to the economy and long term benefits to the environment.

WRAP also aims to produce a series of quality protocols which will meet the requirements of the "end-of-waste" criteria in the revised Waste Framework Directive. A number already exist but so far not one for coal ash. The development of the ash protocol has had a long, tortured history. The process restarted in earnest in January 2008 and the industry was part of the Technical Advisory Group (TAG) responsible for assessing any risks associated with use of PFA. It was agreed that the risks were insignificant, provided industry good practice guides followed (UKQAA, BRE CoP)

Richard then showed us a slide where the status of PFA/FBA was superimposed on the categories for Environmental regulation and Landfill tax. In the former it overlapped the 'Non-hazardous' and 'Inert' zones but in the Landfill tax it currently sits in the 'Inactive' zone. The costs of ash disposal are £2.50 per tonne in 2010/2011 if it is deemed 'Inactive'. However, the cost rocketed to £48.00 per tonne in 2010/2011 if it is regarded as 'Active' then on to £72 per tonne in 2013/2014.

The state of play as of April 2010 is that the UK Government will not progress with the Landfill Tax proposal. It states that only ash sent to monofill will be taxed at lower rate; active/inactive categories will be renamed higher/lower rates; tests for lower rates will be redefined and the lower rate will be guaranteed for the next two years.

As far as the Quality Protocol is concerned it agreed with EA to remove the waste stigma from ash destined for "bound" and "grout" applications, but there is a need to agree testing to demonstrate compliance. Documents have been sent to Europe for approval – it must not present "barriers to trade". The Joint Industry/EA characterisation exercise commenced on ash for "unbound" applications involving; Up flow percolation "column" experiments on a range of UK ashes and simultaneous conventional leachate tests. The EA hopes to be able to link the two.

Richard then went on to describe REACH. This is the Registration, Evaluation, Authorisation and Restriction of Chemicals, and is an EU regulation controlling chemicals and their safe use. It came into force on 1 June 2007. REACH aims to improve the protection of human health and the environment through the better and earlier identification of the properties of chemical substances. Under REACH, those who place chemicals on the market will be responsible for understanding and managing risks associated with their use.

The state of play for REACH is as follows: Substances had to be "pre-registered" by November 2008; 2,428 substances have been registered so far and the registration process is to be completed by the end of 2010. A Substance Information Exchange Fora, a (SIEF), has been established for groups of pre-registrants. SIEF charges for membership

and for sharing technical information. Substance Information Profiles (SIP's) define the boundaries of characteristics. Coal ashes are registered as "coal combustion products" with registration being managed through ECOBA and VGB. Gypsum registration is being managed by Eurogypsum. The cost of registration is €30k per substance, per legal entity.

At this point Richard drew his talk to a close having provided a very timely and well-received snapshot of the whole combustion by-product disposal 'maze'.

A well-rehearsed duo from SSE by the names of Mark Roberts and Guy Sharp gave the next presentation. It was entitled "Boiler and Combustion Systems Impact on FGD Plant Operation" and began with an illustration of their FGD plant in Ferrybridge. The system is a wet limestone/lime FGD in which a falling fine spray of limestone slurry meets an updraft of raw flue gas. The reaction between sulphur oxides and the limestone is encouraged by agitation and the incorporation of additional air to complete the oxidation process. The gypsum is then removed by filtration, dried and stored and the unused absorbent returned to the absorber tower.

The flue gas must meet certain requirements to be able to produce gypsum of acceptable quality from the FGD plant. These criteria are that the carbon-in-ash is not greater than 15% and the flue gas dust content is not greater than 50 mg/Nm^3. The main issue from high carbon in ash is its effect on the colour of gypsum which can be grey or sometimes tan. If the colour is unacceptably dark the gypsum has to be sent to landfill which is highly uneconomical. If the dust content is above limits for a period of time the FGD plant will trip and the flue gas will bypass the FGD system. This will lead to unacceptable dust and sulphur oxide emissions to the atmosphere.

To improve the control of coal ash quality an on-line instrument for the continuous measurement of carbon-in-ash has been acquired by SSE. It is known as the Greenbank G-CAM carbon-in-ash monitor. This is an advanced instrument which can handle all coal types being burned and is based on the latest microwave absorption and phase shift measurement techniques.

To obtain a more consistent boiler performance there are various optimisation techniques that can be adopted. These include pulverised fuel and air distribution testing and analysis; boiler and burner CFD modelling and coal mill performance assessment.

Overcoming dust spikes has been tackled by looking into the electrostatic precipitator (ESP) rapping routine to minimise re-entrainment of dislodged dust. Coal ash with higher than normal carbon also shows poor collection efficiency and can thereby produce lower than expected ESP performance.

In addition to meeting the best quality ash for gypsum production the plant and its operators have many other challenges to meet. These include meeting steam header temperatures without shortening the life of these expensive components; meeting the regulatory limits for NOx; being able to satisfactorily burn a varied diet of international coal, meeting the needs of the LP and HP turbines; coping with the demands of 'two-shifting' and the totally unpredictable and oft-encountered boiler leak.

Mark and Guy concluded their interesting talk by recapping on the multitude of requirements of a power plant such as Ferrybridge to optimise the production of gypsum.

The final paper of this session was from Maythem Mahmud who is in the process of completing his PhD at the University of Nottingham. He described some of his work under the title of "Applications for High Carbon Pulverised Fuel Ash".

The aim of the work was to extract and characterise high carbon fly ashes from a series of imported coals and biomass. He was then intending to identify applications for carbon-rich materials extracted from these fly ashes. The coals examined originated from the USA (Pittsburgh), South America, (Colombia) and Russia. Maythem also studied ash from a blend of 5% oats and a Russian coal. The characterisation included surface areas measurements of the carbon-rich fractions using a BET method and nitrogen and particle size analysis.

Maythem also described the methods he had used and developed to beneficiate the high carbon ash. These included incipient fluidisation (IF) and vitrification using microwaves. The IF method was found to produce a series of carbon-rich materials with LOI values ranging from 37% to 82% LOI from ashes which started out at between 8% and 36% LOI.

A series of tests using the high carbon ashes and cement were carried out and mineral oxide analysis data was shown using an ICP-AES technique. A series of carbon activation tests were carried out using steam at a high temperature. The activated chars were then analysed using a methylene blue adsorption test. The conclusion was that the activities of the carbons from fly ash were comparable to those of commercial carbons.

Maythem concluded his talk by suggesting that the carbon derived from high carbon fly ash could be made use of in certain commercial application.

The attendees then adjourned for a buffet lunch and a serious bout of networking!

Promptly at 1.00pm the CRF Environment Division meeting, entitled "Ash and By-Product Utilisation" and chaired by Dr. Trevor Drage, University of Nottingham, (Divisional Chairman designate) kicked off.

The first presentation was given by Mr. Andrew Cliff, from Lafarge at Ferrybridge and was entitled, "Lafarge Plasterboard Ltd. - Products, Processes and Technical Issues". Andrew presented a series of slides which showed in detail the process from the receipt of the raw material gypsum to the dispatch of the plaster board from their factory.

This was followed by Professor Ravindra Dhir of the University of Dundee who gave a presentation entitled "Overview of UK University Research on Ash Utilisation". Professor Dhir opened his talk by indicating that he and his two colleagues, Dr Jones and Dr McCarthy, had a combined research effort into coal ash of 90 years between them.

Professor Dhir divided his talk into two categories; developing simple fundamental concepts and developing challenging fly ash applications. Within each category Professor Dhir identified seven to ten different materials albeit a combination of, fly ashes, concretes, grouts and sands. As you can imagine, trying to distil and give a flavour of 40 years of dedicated study into fly ash was not easy. - but Professor Dhir did his best! He really packed the information into his allotted time and it showed the diversity and versatility of this little-regarded material. It is not my intention to summarise each and every item in the talk - I would recommend that you go to the CRF website and have a browse through the colourful and interesting slides that Professor Dhir brought with him. Each one has an interesting story to tell. However, I will summarise Professor Dhir's conclusions, which are as follows.

The Dundee University Concrete Technology Unit (CTU) model of working in partnership with all the stakeholders, including government and industry, has made it possible for its research to be innovative and practical and thereby facilitate maximising the use of fly ash as a valuable resource in concrete construction and, in so doing, it can claim to be a major player in enabling sustainable use of cement in concrete construction, in terms of reducing significantly its carbon footprint and enhancing concrete durability.

The final paper was given by Dr. Lindon Sear of the UK Quality Ash Association and was entitled "An Overview on UK Ash Production, Utilisation and Beneficiation". Lindon opened his talk by spelling out the annual current UK production of pulverised fuel ash, PFA, (5.3M tonnes), furnace bottom ash, FBA, (0.8M tonnes) and gypsum, (1.5M tonnes). Although these tonnages have been consistent for a number of years the situation is likely to change in the future. Some coal-fired plants are due to close in 2015 but the actual time of closure, based on 20,000 hours usage is difficult to predict. In addition, the availability of gas and the potential cost of coal firing with CCS make future availability of ash products unclear.

In 2008 the three major uses of PFA were 31% to landfill, 14% sent to land reclamation projects and 12% to aerated blocks. FBA, gypsum and cenospheres are all important industrial raw materials and virtually all of the production of these materials were consumed by industry.

A further availability issue is limited dry storage space and a mismatch of production to use with building being concentrated during the summer when ash production is low.

Aircrete block makers ran out of suitable ash in 2008 and 2009 and the demise of the UK steel industry limited the availability of blast furnace slag. Increased demand for <7% LOI ash could not be met- even during the recession!

Future scenarios include lower ash production with older plant struggling to meet LOI criteria. Ammoniated fly ash from SCR fitted plant may cause additional problems. How can these problems be addressed? Lindon speculated that maybe higher than 7% LOI ash could be used, or EN450-1 category C ash? Although possible he thought this would take years to achieve. Alternatives might be more processing and more dry storage also wet storage with dryer systems fitted.

On the regulatory issue as we had heard from Richard Busby, PFA and FBA will not get an easy ride. The Quality Protocol decides when ash ceases to be a waste and the PFA must be supplied to recognised standards. The EA will review the system every three years. Also since ash is not a waste and therefore a product it has to meet the REACH criteria. Further regulatory issues involving the Construction Product Regulations and Sustainable Construction standards will be introduced from 2015.

A summary of the issues facing the ash-producing industry is that it must produce a lower LOI ash, address ammonia slip and notify customers of future potential availability issues.

The increase in fly ash beneficiation plant is also likely to happen. The Rocktron process, where a number of product stream are produced, may also become more widely used. It has the advantage of being able to process old stockpiles of ash but it is a wet process so the drying costs can be significant.

Other solutions might be to store low LOI ash in the winter for use in the summer, or to store conditioned ash and then dry it, or possibly to have a well-place central processing facility to act as a distribution centre.

In conclusion, Lindon said that there are difficult times ahead for the ash industry from reduced production, quality issues, increased regulatory burden, supply and demand aspects and the capitalisation required for the solutions to work. The future for UKQAA requires it to continue to work at solving some of these problems and to get a realistic message across to the producers and users.

This brought the days formal presentations to a close and Professor John Patrick summarised the event and indicated that he had found it interesting and had learn something new from the talks and discussion. Following the closure of the meeting John invited those intending to visit the FGD plant meet the coach to take them the short journey to the power station.

Restoring credibility at the IPCC

26 February 2010
In the next few days, the world's leading authority on global warming plans to roll out a strategy to tackle a tough problem: restoring its own bruised reputation. A months-long crisis at the Intergovernmental Panel on Climate Change has upended the world's perception of global warming after hacked emails and other disclosures revealed deep divisions among scientists working with the United Nation-sponsored group. That has raised questions about the panel's objectivity in assessing one of today's most hotly debated scientific fields.

The problem stems from the IPCC's thorny mission: To take sophisticated and sometimes inconclusive science, and boil it down to usable advice for lawmakers. To meet that goal, scientists working with the IPCC say they sometimes faced institutional bias toward oversimplification, a Wall Street Journal examination shows.

Richard Alley, a geoscientist who helped write the IPCC's latest report, issued in 2007, described a trip that summer to Greenland's ice sheet with senators who urged him to be as specific as possible about the potential for sea-level rise. The point many of them made, he said: Give more explicit advice—because, if the sea rises, "the levee has to be built some height."

The tension within the IPCC stretches back a decade or more, according to interviews with scientists and a review of hundreds of IPCC documents and emails. It has complicated the panel's work on matters ranging from the study of tree rings to the proper use of massively complex climate computer models.

The IPCC has faced withering criticism. Emails hacked from a U.K. climate lab and posted online late last year appear to show scientists trying to discredit researchers who disagreed with their conclusion that humans are largely responsible for climate change. And last month, the IPCC admitted its celebrated 2007 report contained an error: a false claim that Himalayan glaciers could melt by 2035. The IPCC report got the date from a World Wildlife Fund report.

Even some who agree with the IPCC conclusion that humans are significantly contributing to climate change say the IPCC has morphed from a scientific analyst to a political actor. "It's very much an advocacy organisation that's couched in the role of advice," says Roger Pielke, a University of Colorado political scientist. He says many IPCC participants want "to compel action" instead of "just summarising science."

To restore its credibility, the IPCC will focus on enforcing rules already on the books, IPCC Chairman Rajendra Pachauri and other officials said in interviews. Scientific claims must be checked with several experts before being published. IPCC reports must reflect disagreements when consensus can't be reached. And people who write reports must refrain from advocating specific environmental actions—a political line the IPCC isn't supposed to cross.

Mr. Pachauri describes the IPCC's record as "impeccable." Still, he said, the IPCC's reforms will aim to "ensure that even the slightest possibility of someone not adhering to procedures is eliminated completely. We just have to act like monitors at every stage."

The IPCC shared a Nobel Peace Prize with former Vice President Al Gore in 2007 for its report that year declaring climate change "unequivocal" and "very likely" caused by emissions of greenhouse gases due to human activity. Formed in 1988, the group doesn't conduct or fund research, but filters the work of researchers world-wide.

About 30 paid staffers help thousands of scientists who volunteer to assemble voluminous "assessment reports" every five or six years. The goal is to be "policy-relevant" but "never policy-prescriptive," the IPCC says.

The IPCC's budget, about $7 million this year, comes mainly from contributions from the U.S. and other industrialised nations. Critics also allege a conflict of interest by Mr. Pachauri, the IPCC's chairman, who heads an energy-research institute in India and has done consulting work for multinationals.

Taken together, the organisation's troubles raise questions about its quality control in summarising science. But many scientists say the crisis doesn't undermine independent research demonstrating man's influence on the climate.

"There is a very broad and deep consensus that I buy into that we're producing too much CO_2 and it's going to cause problems eventually," said John H. Marburger III, former science adviser to President George W. Bush. Many details remain uncertain, he said, but "I think it's unequivocal that there is a human component."

The IPCC last month expressed "regret" for the erroneous Himalayan statement, traced originally to a magazine article. "The organisation has an impeccable record of having performed," Mr. Pachauri said, and its work "always includes the quantifications of uncertainties." Regarding conflict of interest, Mr. Pachauri said, "I don't take a single

penny" from the consulting work. Proceeds go to his energy institute and not to him personally, he said.

As climate change gained public attention in recent decades, some IPCC-affiliated scientists privately expressed concerns that conclusions were at risk through getting oversimplified. Keith Briffa, a climate scientist at East Anglia, expressed this worry in emails to colleagues in 1999, as work intensified on the IPCC's third major report, published in 2001. Mr. Briffa's particular concern: tree rings.

Scientists use tree rings and other proxies to assess temperatures thousands of years ago, before thermometers existed. Wider rings indicate greater growth, generally suggesting warmer temperatures, or higher precipitation, or both. Mr. Briffa pioneered the technique. "I know there is pressure to present a nice tidy story as regards 'apparent unprecedented warming in a thousand years or more,'" he wrote to other researchers in the email, among those hacked at East Anglia. "In reality the situation is not quite so simple," Mr. Briffa wrote. He didn't identify the source of the pressure. A university spokesman said Mr. Briffa wouldn't comment.

The problem: Using Mr. Briffa's tree-ring techniques, researchers in the '90s built charts suggesting temperatures in the late 20th century were the highest in a millennium. The charts were dubbed "hockey sticks" because they showed temperatures relatively flat for centuries, then angling higher recently. But Mr. Briffa fretted about a potential issue. Thermometers show temperatures have risen since the '60s, but tree-ring data does not move in tandem, and sometimes show the opposite effect. (Average annual temperatures reached the highest on record in 2005, according to U.S. government data. They fell the next three years, and rose in 2009. All those years remain among the warmest on record.) In his same 1999 email, Mr. Briffa said tree-ring data overall did show "unusually warm" conditions in recent decades. But, he added, "I believe that the recent warmth was probably matched about 1,000 years ago." In other words, maybe the chart shouldn't resemble a hockey stick.

The data were the subject of heated back-and-forth before the IPCC's 2001 report. John Christy, one of the section's lead authors, said at the time that he tried in vain to make sure the report reflected the uncertainty. Mr. Christy said in an interview that some of the pressure to downplay the uncertainty came from Michael Mann, a fellow lead author of that chapter, a scientist at Pennsylvania State University, and a developer of the original hockey-stick chart.

The "very prominent" use of the hockey-stick chart "overrules what tentativeness some of us actually intended," Mr. Christy wrote to the National Research Council in the U.S. a month after the report was published. Mr. Christy, a climate scientist at the University of Alabama in Huntsville, provided that email. "I was suspicious of the hockey stick," Mr. Christy said in an interview. Had Mr. Briffa's concerns been more widely known, "The story coming out of the [report] may have been different in tone and confidence."

Mr. Mann said in an email interview, "I was not pushing 'hard' for anything of the sort." The chapter's authors, he said, "engaged in a robust, good faith discussion of what the level of certainty was." Mr. Mann also noted that his original 1998 hockey-stick paper stressed the uncertainties involved in reconstructing past temperatures.

Complicating matters, a simplified version of the hockey-stick chart appeared prominently in the 2001 report's "summary for policy makers"—a 34-page distillation of the full report. Thomas Stocker, a climate scientist at the University of Bern and member of the team that wrote the summary, said the team wrestled with how to make the summary "faithful to the full report and yet still comprehensible" to policy makers.

The hockey-stick chart is "the textbook example" of "how difficult the job really is" to summarize the full report, said Mr. Stocker, one of the top scientists overseeing the IPCC's next report, due in 2013 and 2014.

In retrospect, he said, the simplified version should have had more detail. It could suggest a clearer conclusion than the actual chart appearing deeper in the full report. "I think that

was part of the problem—that we simplified it," he said. "It's not suppressing information, but it's making it harder for the rapid reader to have the full picture."

Another big issue: The accuracy of complex computer models that underpin the science. Run on supercomputers, these models try to predict how greenhouse-gas emissions might affect temperatures, and how temperatures might affect everything from glaciers to hurricanes.

In September 2000, Filippo Giorgi of the International Center for Theoretical Physics in Trieste, Italy, wrote a worried email. He said he felt pressure to cite simulations that hadn't yet been published in a scientific journal. He worried it showed a relaxation of standards.

The IPCC's rules "have been softened to the point that in this way the IPCC is not any more an assessment of published science (which is its proclaimed goal)," he wrote in the email. Mr. Giorgi added: "At this point there are very little rules and almost anything goes. I think this will set a dangerous precedent."

In an interview, Mr. Giorgi said the pressure he felt came from the panel overseeing his part of the report. The panel was co-chaired by Sir John Houghton, a scientist who previously had chaired the IPCC as a whole.

Mr. Houghton defended his panel's oversight. "Nobody was arguing for 'anything goes,'" he said this week. "Nobody was arguing for making choices that selected anything more dramatic or with a particular message," he said. "Everybody wanted to present the results in the most helpful as well as honest way."

Mr. Giorgi said that including the data ultimately did no harm, because the IPCC report included a disclaimer noting it hadn't appeared in a scientific journal. Eventually, he added, the work appeared in a journal.

Some researchers continued to feel pressure to boil down science as work began on the IPCC's fourth major report, published in 2007. Things that are "very difficult to quantify must be quantified to keep the policy makers happy," Mr. Alley, the geoscientist, who teaches at Penn State, said in an interview. "It's a very frustrating thing."

Mr. Alley walked that tightrope in helping write the chapter covering his speciality: the degree to which massive Greenland and Antarctic ice sheets might melt, raising sea levels. The problem, he said: "Ice-sheet models are not very good."

Many conversations with policy makers—including Mr. Gore, the senators in Greenland and Christian Gaudin, a French senator—left the clear impression that "we scientists had better get better numbers," said Mr. Alley, adding that he understands their desire for detail. So the scientists put numbers into the 2007 study, along with a big caveat—what Mr. Alley calls a "punt." The study took into account things like glacier melt in most of the world, but it noted that it excluded what's happening in the Greenland and Antarctic ice sheets, which "we cannot predict," Mr. Alley said. Inevitably, Mr. Alley said, some people have cited the numbers without that caveat.

A spokeswoman for Mr. Gore said he understands the uncertainties, and that he pointed out in statements "that there was essentially an asterisk" on the 2007 report's sea-level projections. "As he understands the situation from the ice-science community, the uncertainty in sea level applies in both directions," meaning sea-level rise could be greater or smaller than projected, the statement said.

In an interview, Mr. Gaudin, the French senator, recalled having lunch with Mr. Alley on a visit to Penn State where they discussed the interplay between scientists and politicians on the "big questions that interest society," notably climate change. Scientific reports, including the IPCC's, "need to have more precision," Mr. Gaudin said. It is "difficult for politicians to make a decision" otherwise.

Mr. Marburger, the former Bush science adviser, said he frequently heard policy makers express frustration at the lack of certainty in many areas of science, including climate.

"'Why can't we get better numbers?' Everybody asks that," he said. "But science rarely gives you the right answer. Science tells you what the situation is, but it doesn't tell you what to do."

http://online.wsj.com/article/SB10001424052748704188104575083681319834978.html

Using nature to reduce CO_2 levels

8 March 2010
A recent discovery in understanding how to chemically break down the greenhouse gas carbon dioxide into a useful form opens the doors for scientists to wonder what organism is out there -- or could be created -- to accomplish the task.

University of Michigan biological chemist Steve Ragsdale, along with research assistant Elizabeth Pierce and scientists led by Fraser Armstrong from the University of Oxford in the U.K., have figured out a way to efficiently turn carbon dioxide into carbon monoxide using visible light, like sunlight.

The results are reported in the recent online edition of the *Journal of the American Chemical Society*. Not only is it a demonstration that an abundant compound can be converted into a commercially useful compound with considerably less energy input than current methods, it also is a method not so different from what organisms regularly do.

"This is a first step in showing it's possible, and imagine microbes doing something similar," Ragsdale said. "I don't know of any organism that uses light energy to activate carbon dioxide and reduce it to carbon monoxide, but I can imagine either finding an organism that can do it, or genetically engineering one to channel light energy to coax it to do that."

In this collaboration between Ann Arbor and Oxford, Ragsdale's laboratory at the U-M Medical School does the biochemistry and microbiology experiments and Armstrong's lab performs the physical- and photochemical applications.

Ragsdale and his associates succeeded in using an enzyme-modified titanium oxide to get carbon dioxide's electrons excited and willing to jump to the enzyme, which then catalyzes the reduction of carbon dioxide to carbon monoxide. A photo-sensitiser that binds to the titanium allows the use of visible light for the process. The enzyme is more robust than other catalysts, willing to facilitate the conversion again and again. The trick: It can't come near oxygen.

"By using this enzyme, you put it into a solution that contains titanium dioxide in the presence of a photo-sensitizer," he said. "We looked for a way that seems like nature's way of doing it, which is more efficient." Armstrong notes that "essentially it shows what is possible were we to be able to mass-produce a catalyst with such properties".

The direct product carbon monoxide is a desirable chemical that can be used in other processes to produce electricity or hydrogen. Carbon monoxide also has significant fuel value and readily can be converted by known catalysts into hydrocarbons or into methanol for use as a liquid fuel. Although carbon monoxide serves as a source of energy and biomass for microbes, it is toxic for animals and this risk needs to be managed when it is generated or used in chemical reactions.

Research in Ragsdale's lab was funded by the National Institute of General Medical Sciences at the National Institutes of Health.

Ragsdale, a professor of biological chemistry at the U-M Medical School, is a fellow of the Michigan Memorial Phoenix Energy Institute, which develops, coordinates and promotes multidisciplinary energy research and education at U-M.

http://www.scienceblog.com/cms/asking-what-would-nature-do-leads-way-break-down-greenhouse-gas.html

New use for carbon nanotubes

8 March 2010
The storage and generation of electricity is a hotbed of scientific study around the world. New and improved methods of storing electricity have a myriad of potential uses from phones and laptops that run longer to new electric vehicles with much greater driving range.

At the centre of much of the research in the storage and generation of power in batteries and other devices are carbon nanotubes. The carbon nanotube has been studied for decades and new advances over the last few years have made the nanotubes easier to produce and have offered breakthroughs in the use of carbon nanotubes. Scientists at Rice University made a breakthrough in carbon nanotube processing in November of 2009 that uses processes similar to those that have been employed in the plastics industry to make the production of carbon nanotubes in bulk much easier.

Researchers in late 2009 also found that defective carbon nanotubes are more efficient at storing energy than carbon nanotubes that are uniform in size. In February 2010, Bayer announced that it was opening the world's largest carbon nanotube production facility to develop carbon nanotubes dubbed "Baytubes" using multi-wall carbon nanotube technology. The facility is expected to produce about 200 metric tons of nanotubes each year.

Now, a team of researchers at MIT have announced that they have made a new breakthrough for producing electricity with carbon nanotubes. The discovery may one day lead to a myriad of new devices such as sensors the size of dust that can be dispersed in air to monitor the environment or the tech might lead to implantable devices that produce their own power. The researchers discovered a phenomenon that was previously unknown that produces powerful waved of energy that shoots though carbon nanotubes, producing electricity.

The team of researchers called the phenomenon "thermopower waves." MIT's Michael Strano, the Charles and Hilda Roddey Professor of Chemical Engineering, and senior author of the paper reporting the findings said, "thermopower waves" opens up a new area of energy research, which is rare."

The thermal wave is a moving pulse of heat that travels along the microscopic carbon nanotubes and drives electrons along with it creating an electrical current. The team coated carbon nanotubes with a highly reactive fuel that produces heat as it decomposes. The fuel was ignited at one end of the nanotube with a laser beam or high-voltage spark.

The resulting ignition created a fast moving thermal wave that travels about 10,000 times faster than the normal speed of the reaction according to the team. The temperature of the ring of heat reaches about 3,000 Kelvin, pushing electrons along the tube creating a substantial electrical current. Strano says that the combustion waves have been mathematically studied for more than a hundred years, but he claims to be the first to predict that the combustion waves could be guided by a nanotube or nanowire and push an electrical current along the wire.

Strano says we were really surprised by the size of the resulting voltage peak." He continued saying, "There's something else happening here. We call it electron entrainment since part of the current appears to scale with wave velocity.

Strano says that since the discovery is so new it is hard to predict how it could be used in practical application. The team plans to conduct more research using different kinds of reactive materials for the fuel coating and the team suspects that by using other materials for the coating the front of the wave could oscillate to produce an alternating current. The team points out that most of the power generated with the new method is given off as light and heat and work is ongoing to make the process more efficient.

http://www.dailytech.com/MIT+Researchers+Discover+New+Electricity+Production+Method/article17841.htm

Proteins help the search for cleaner coal

16 February 2010
As big engineering fixes go, "clean coal" has proved an elusive concept. Carbon capture projects remain experimental, expensive and energy intensive. But working with some of the tiniest things in nature, scientists are engineering proteins found in living things to trap carbon dioxide from coal-fired power plants.

"Biomimetic design" is the idea of using nature as a template to create new technologies. Trees are among nature's most efficient carbon sequestration systems. They trap carbon dioxide and convert it to glucose, placing it in a form in which it stays stable for geologically significant durations.

But at the biochemical level, they are still too slow, according to Michael Drummond, a scientist at the University of North Texas who is trying to identify new "carbon capture" enzymes.

When plants spend about three and half seconds to convert carbon dioxide to glucose during photosynthesis, they are spending an inordinate amount of time. The problem is that an enzyme called RuBisCO, which catalyzes the process, is highly inefficient. But the basic idea of using biological molecules to capture atmospheric carbon is sound enough to get grants from the U.S. Department of Energy's Advanced Research Projects Agency-Energy.

Scientists are studying faster enzymes. One that is getting much new attention is carbonic anhydrase -- a protein found in blood, among other places, that captures carbon dioxide exhaled by cells. In one second, the enzyme can change a million molecules of the gas into harmless bicarbonate, according to Jonathan Carley, the vice president of business development at CO2 Solution, a Montreal-based company that is one among the few working on biomimetic design.

Scientists at CO2 Solution have been trying to engineer this enzyme to capture carbon dioxide from the harsh flue gas emitted by coal plants.

The traditional way to capture the gas is using a chemical called monoethanolamine. But the technique, developed nearly 60 years ago, is expensive. It takes $60 to capture a ton of carbon dioxide, and this doesn't include separation or storage, said Carley. The process also requires nearly 30 percent of the power generated by the power plant. The inefficiencies of the system have made carbon capture a commercially shunned technology.

Taking the cue from nature may prove to be the solution. With slight genetic modifications, a stable protein that can survive at high temperatures and be dissolved in a water-based solvent could be the answer. The technology from this company is meant to be incorporated into existing smokestacks so that retrofitting would be minimal, said Carley. "Carbonic anhydrase is nature's solution for capturing and releasing carbon dioxide," he said.

The aim, Carley said, is to reduce the cost of capturing a ton of carbon dioxide by 30 percent, such that the price of capture lines up with carbon credit pricing. "For instance, if 10 percent of emission comes from the USA, the savings for the USA for a 30 percent decrease in capture costs will be $36.2 million per day," said Ekrem Ozdemir, a researcher at the Izmir Institute of Technology in Turkey who is attempting to create stable carbonic anhydrase complexes.

The enzyme works by hydrating the gas, according to Ozdemir. Trapping carbon dioxide is the slowest step of the process. So, when equilibrium is reached between the gas in the atmosphere and dissolved carbon dioxide such that there is no further driving force for the reaction, having a stable enzyme reach out to grab more molecules will move it forward, Ozdemir said.

The enzyme, which is initially isolated from an organic source and then modified, is still in the research and development stage. But the technology should be available by 2013, Carley said.

Others, such as Connecticut-based United Technologies Research Center, are attempting to create a completely synthetic carbonic anhydrase that will survive flue emissions.

Drummond and his colleagues at the University of North Texas are trying to push the frontier in biomimetic design a bit further. They've found patterns in the three-dimensional makeup of catalytic proteins that bind well to carbon dioxide. The work should make it possible to identify other enzymes that can be used in carbon capture technologies, as well.

"Nature does seem to use one or more patterns to use carbon dioxide at the molecular level," said Drummond.

Proteins are, at a basic level, mechanical constructs where, if the grooves match, a reaction takes place. Recognizing the grooves would help identify the enzymes that use carbon dioxide in their reactions.

The technique used is prominent in drug discovery, in which researchers study the geometries of the drug where it interacts with the human body to predict similar drugs that may be effective in the fight against disease. The particular three-dimensional arrangement of the drug that allows the interaction is called a pharmacophore.

"The simplest metaphor is someone trying to open a lock," said John Van Drie, a drug researcher who has written about pharmacophores previously. "You try key after key, and from that, you get a general idea. You can use that general idea to find the key that fits."

But here, the scientists know what the key looks like. It is the two-pronged shape of the carbon dioxide molecule. They are trying to find the lock, which in this case is enzymes, such as carbonic anhydrase.

Drummond has identified two patterns that seem to be conserved and are likely to signal carbon dioxide binding sites in proteins. Using these patterns as queries in a protein data bank that holds the known structures of nearly 60,000 proteins should yield new results. "A protein could be really efficient at capturing carbon dioxide, even though its biological function has nothing to do with carbon dioxide," said Drummond. "In such a case, we could repurpose such a protein and put it to work removing CO2 from the air instead of doing whatever it does in living organisms."

And engineering these proteins to act as carbon dioxide sinks that produce a useful byproduct, such as lumber from trees, would be ideal, according to Drummond. "It'd be great if we can get it to not only hold CO2 but also spit out what can be used," he said.

http://www.nytimes.com/cwire/2010/02/15/15climatewire-injecting-tiny-proteins-into-the-hunt-for-cl-64718.html?pagewanted=1

Power crisis facing Britain claims energy company head

28 March 2010
Britain faces the worst energy crisis in Europe, according to the boss of one of the biggest power companies." The country has to build two large plants or more every single year," said Volker Beckers in his first interview since becoming chief executive of RWE Npower two months ago. "This has never happened in Britain's history, so there's no time to lose." Homeowners will end up footing much of the estimated £200 billion bill for the new plants through higher energy prices.

"The government faces the biggest challenge in Europe," said Beckers, whose company supplies power to 6.4m British homes. "In a world where capital is scarce and the economic case is unclear, it's not an easy sell to my board. Right now, I can't do it."

Within the next decade a quarter of Britain's fossil-fuel plants will be retired, to be replaced by more costly low-carbon alternatives. Offshore wind and nuclear are the government's favoured options. The £200 billion bill for pipes, plants and turbines predicted by Ofgem, the regulator, translates to a cost of £8,000 for each of Britain's 25m households.

Both Labour and the Conservatives have said the state needs to take a more active role in guiding the makeover. They expect the industry to bear virtually all the upfront costs. However, the uncertainty over future energy prices and how much of the additional cost, such as for waste clean-up, will have to be shouldered makes it hard to proceed with big investments such as nuclear reactors, said Beckers. "At the moment nobody really knows the rules of the game. If the uncertainty prevails, investors will simply do what they understand best in this market and that is gas generation.

"That is exactly what we as a company have done in the past few years, but as a country it's not what gets the UK to the [carbon reduction] targets we have for 2020." He expressed particular concern about the development of nuclear power, a central plank of the government's low-carbon plans. As of now it gets no additional support while offshore wind, for example, receives renewable obligation certificates (ROCs), which in effect triple generators' income from the projects. "Why discriminate against nuclear in favour of renewables?" said Beckers. "Why give offshore wind ROCs and make nuclear stand on its own feet?"

Ministers have clung to the conviction that nuclear will be subsidy-free. It is clear why: Ofgem predicts that household bills, now an average of £1,100 a year, could rocket to £2,000 by 2017. Additional support for nuclear could push that even higher. The industry counters that insulation and other measures to cut consumption will soften price increases. Subsidy is only one aspect of the nuclear story that still needs to be worked out. Companies remain unclear how much they will have to pay into a nuclear waste clean-up fund, and when — if ever— a facility for deep geological disposal will be built.

Npower's German parent company could ultimately choose to put its money elsewhere. For example, 53 new nuclear plants are under construction round the world, with another 469 planned or proposed. In Britain, eight are on the drawing board. Half are planned by Horizon, the joint venture formed by Npower and its rival Eon last year. EDF Energy, the French giant, and its partner Centrica want to build the rest.

The government last week floated the idea of a low-carbon obligation, which would require energy groups to buy expensive clean power. The Tories proposed introducing a floor to the carbon price, which would kick in if the price of European pollution permits fell below a set level.

Npower plans to invest £1 billion a year through to 2018. Beyond that depends on more aid, whether it's called a subsidy or not.

Beckers said: "It's a big demand, especially while there are similar needs on the Continent. So the UK needs to make sure it has the highest level of attraction for investors."

http://business.timesonline.co.uk/tol/business/industry_sectors/natural_resources/article7078858.ece

A new approach to flue gas washing?

25 March 2010
Relatives of ingredients in hair-conditioning shampoos and fabric softeners show promise as a long-sought material to fight global warming by "scrubbing" carbon dioxide (CO_2) out of the flue gases from coal-burning electric power generating stations, scientists reported at the 239th National Meeting of the American Chemical Society (ACS) in San Francisco.

Their report, the first on use of these so-called aminosilicones in carbon dioxide capture, concluded that the material has the potential to remove 90% of CO_2 from simulated flue gas. The new "scrubber" material may be less expensive and more efficient than current

technologies for reducing emissions of carbon dioxide, the main "greenhouse" gas linked to global warming, the scientists say.

Robert Perry and colleagues pointed out that coal-burning electric power plants are a major source of the carbon dioxide that has been building up in Earth's atmosphere. An estimated 2.8 billion tons of the gas enters the atmosphere each year from the 8,000 coal-fired power plants in the United States alone. Those are among 50,000 coal-fired generating stations worldwide. Perry cited a critical need for practical technology to remove carbon dioxide from flue gases before it enters the atmosphere. The new scrubber material would meet the goal of the U.S. Department of Energy, which funded the research, of developing carbon capture technologies with at least a 90% CO_2 capture efficiency.

"We're very excited about this technology that may pave the way for a new process for carbon dioxide capture," Perry said. He is with GE Global Research in Niskayuna, N.Y. "The development of a low-cost solution for CO_2 capture would go a long way in helping to address our clean energy goals. In the future, the gases that come out of power-plant smokestacks will be virtually free of carbon dioxide emissions."

Perry and colleagues hope to overcome the high costs and inefficiency of current CO_2 capture methods with a new type of aminosilicone, a group of materials widely used in fabric softeners, hair conditioners, and flexible high-temperature plastics. In laboratory-scale tests using a device to simulate flue gas conditions of continuously streaming gas and relevant temperatures, the new material captured more than 90 percent of the CO_2 added to the system.

If future tests at the pilot-scale in a power plant prove successful, the material would be used as part of a larger, active absorber system. In this scenario, the liquid aminosilicone solvent will absorb CO_2 and be transferred to a desorption unit where CO_2 would be removed from the aminosilicone and sequestered. The aminosilicone solvent would be recycled to react with more CO_2-rich flue gas.

http://www.sciencedaily.com/releases/2010/03/100324141953.htm

Are carbon nanostructures a panacea or a poison?

1 April 2010
A Los Alamos National Laboratory toxicologist and a multidisciplinary team of researchers have documented potential cellular damage from "fullerenes" -- soccer-ball-shaped, cage-like molecules composed of 60 carbon atoms. The team also noted that this particular type of damage might hold hope for treatment of Parkinson's disease, Alzheimer's disease, or even cancer.

The research recently appeared in *Toxicology and Applied Pharmacology* and represents the first-ever observation of this kind for spherical fullerenes, also known as buckyballs, which take their names from the late Buckminster Fuller because they resemble the geodesic dome concept that he popularized.

Engineered carbon nanoparticles, which include fullerenes, are increasing in use worldwide. Each buckyball is a skeletal cage of carbon about the size of a virus. They show potential for creating stronger, lighter structures or acting as tiny delivery mechanisms for designer drugs or antibiotics, among other uses. About four to five tons of carbon nanoparticles are manufactured annually.

"Nanomaterials are the 21st century revolution," said Los Alamos toxicologist Rashi Iyer, the principal research lead and co-author of the paper. "We are going to have to live with them and deal with them, and the question becomes, 'How are we going to maximize our use of these materials and minimize their impact on us and the environment?'"

Iyer and lead author Jun Gao, also a Los Alamos toxicologist, exposed cultured human skin cells to several distinct types of buckyballs. The differences in the buckyballs lay in the spatial arrangement of short branches of molecules coming off of the main buckyball

structure. One buckyball variation, called the "tris" configuration, had three molecular branches off the main structure on one hemisphere; another variation, called the "hexa" configuration, had six branches off the main structure in a roughly symmetrical arrangement; the last type was a plain buckyball.

The researchers found that cells exposed to the tris configuration underwent premature senescence -- what might be described as a state of suspended animation. In other words, the cells did not die as cells normally should, nor did they divide or grow. This arrest of the natural cellular life cycle after exposure to the tris-configured buckyballs may compromise normal organ development, leading to disease within a living organism. In short, the tris buckyballs were toxic to human skin cells.

Moreover, the cells exposed to the tris arrangement caused unique molecular level responses suggesting that tris-fullerenes may potentially interfere with normal immune responses induced by viruses. The team is now pursuing research to determine if cells exposed to this form of fullerenes may be more susceptible to viral infections.

Ironically, the discovery could also lead to a novel treatment strategy for combating several debilitating diseases. In diseases like Parkinson's or Alzheimer's, nerve cells die or degenerate to a non-functional state. A mechanism to induce senescence in specific nerve cells could delay or eliminate onset of the diseases. Similarly, a disease like cancer, which spreads and thrives through unregulated replication of cancer cells, might be fought through induced senescence. This strategy could stop the cells from dividing and provide doctors with more time to kill the abnormal cells.

Because of the minute size of nanomaterials, the primary hazard associated with them has been potential inhalation -- similar to the concern over asbestos exposure.

"Already, from a toxicological point of view, this research is useful because it shows that if you have the choice to use a tris- or a hexa-arrangement for an application involving buckyballs, the hexa-arrangement is probably the better choice," said Iyer. "These studies may provide guidance for new nanomaterial design and development."

These results were offshoots from a study (Shreve, Wang, and Iyer) funded to understand the interactions between buckyballs and biological membranes. Los Alamos National Laboratory has taken a proactive role by initiating a nanomaterial bio-assessment program with the intention of keeping its nanomaterial workers safe while facilitating the discovery of high-function, low-bioimpact nanomaterials with the potential to benefit national security missions. In addition to Gao and Iyer, the LANL program includes Jennifer Hollingsworth, Yi Jiang, Jian Song, Paul Welch, Hsing Lin Wang, Srinivas Iyer, and Gabriel Montaño.

Los Alamos National Laboratory researchers will continue to attempt to understand the potential effects of exposure to nanomaterials in much the same way that Los Alamos was a worldwide leader in understanding the effects of radiation during the Lab's early history. Los Alamos workers using nanomaterials will continue to follow protocols that provide the highest degree of protection from potential exposure.

Meantime, Los Alamos research into nanomaterials provides a cautionary tale for nanomaterial use, as well as early foundations for worker protection. Right now, there are no federal regulations for the use of nanomaterials. Disclosure of use by companies or individuals is voluntary. As nanomaterial use increases, understanding of their potential hazards should also increase.

http://www.sciencedaily.com/releases/2010/03/100331151146.htm

Petrol from pollution?

29 March 2010
Researchers from the South West are working on a £1.4 million project that could take carbon dioxide from the air and turn it into car fuel.

Scientists and engineers from the University of the West of England are collaborating with colleagues from the University of Bath, who are leading the research, and colleagues from the University of Bristol.

The project aims to develop porous materials that can absorb the gas that causes global warming and convert it into chemicals that can be used to make car fuel or plastics in a process powered by renewable solar energy.

The researchers hope that in the future the porous materials could be used to line factory chimneys to take carbon dioxide pollutants from the air, reducing the effects of climate change.

Dr Frank Marken, Senior Lecturer in Chemistry (University of Bath) said: "Current processes rely on using separate technology to capture and utilise the CO_2, which makes the process very inefficient. By combining the processes the efficiency can be improved and the energy required to drive the CO_2 reduction is minimised.

"It will be a massive challenge but we have a strong inter-disciplinary team that includes chemists, chemical engineers, biologists, and life-cycle analysts."

Dr Petra Cameron, RCUK Fellow from the Department of Chemistry (University of Bath), said: "We hope that the use of renewable energy to recycle CO_2 will be an effective way to reduce the amount of CO_2 in the atmosphere."

The Bath-Bristol collaboration brings together scientists from a range of disciplines, including researchers from Bath's Institute for Sustainable Energy and the Environment (I-SEE), the School of Chemistry at the University of Bristol, and the Bristol Robotics Laboratory (BRL) and School of Life Sciences at the University of the West of England.

Dr Ioannis Ieropoulos, (BRL), said, "One of great advantages of this project is that it will exploit the natural abilities of microorganisms to reduce CO_2 in the atmosphere and at the same time produce electricity or hydrogen, as required."

Dr David Fermin from the University of Bristol said: "Currently, there are no large-scale technologies available for capturing and processing CO_2 from air. The facts are that CO_2 is rather diluted in the atmosphere and its chemical reactivity is very low. By combining clever material design with heterogeneous catalysis, electrocatalysis and biocatalysis, we aim at developing an effective carbon neutral technology."

The project, funded by the Engineering & Physical Sciences Research Council (EPSRC), is in its early stages, but the researchers predict the new technology could make a real difference in the fight against climate change.

The project is part of Research Councils UK (RCUK) cross-Council programme 'Nanoscience: through Engineering to Application'.

http://www.sciencedaily.com/releases/2010/03/100324184556.htm

Environmentalists up in arms over aid plans for coal power

1 April 2010
The European Union is fine-tuning plans to allow millions of euros of state subsidies for new coal-fired power plants, a policy that campaigners say undermines EU environmental ambitions.

For four years from January 2013, EU governments can provide up to 15 percent of the cost of new coal-fired plants, provided they have the potential to retrofit carbon-trapping technology some time in the future, a leaked EU document shows. A European Commission spokesman said the EC was discussing the issue internally, but he declined to comment further.

The move comes amid high tensions over coal's climate impact, with the United States and Britain threatening to withhold support for a $3.75 billion World Bank loan for a coal-fired power plant in South Africa.

To qualify for aid, the European plants would have to be capable of retrofitting carbon capture and storage (CCS) technology, a cutting-edge technique to trap carbon dioxide emissions and lock them in underground caverns. But the costly infrastructure does not have to be built. The plants must merely be "CCS ready".

"CCS ready means that ... suitable storage sites are available and set aside; transport facilities are technically and economically feasible and it is technically and economically feasible to retrofit for CO_2 capture," reads the document, seen by Reuters on Thursday. Campaigners say in practice that might mean nothing more than having an empty field alongside the plant, as the rules imply no legal commitment.

Details of the plan have only just emerged, despite the principle being agreed in December 2008 to win Germany's support for laws in the EU's "Climate and Energy Package". "This is the worst thing to come out of that deal in 2008, and results from a last-minute push by (German Chancellor) Angela Merkel," said Sanjeev Kumar of green think tank E3G. "This goes against everything the EU stands for on climate, but there is still a chance for governments to kill this."

European governments are already reviewing their support for new coal-fired plants amid public fears of climate change and protests in Britain, Germany and the Netherlands. "This is something the UK opposed at the time and is not something that we in the UK would make use of," a spokeswoman for Britain's Department of Energy and Climate Change said.

The British government's "framework for clean coal" aims to deliver four commercial-scale CCS demonstrations and ensure that no new coal-fired power stations are built in Britain without CCS, she added. Germany is reviewing its energy strategy, and if it chooses to soften its planned phase-out of nuclear power then new coal plants might not be such a priority as in 2008, said a diplomat familiar with the dossier.

One reason state aid can be accepted in the EU is if it improves environmental protection, but environmentalists question whether even the most efficient coal plants meet that criterion.

http://uk.reuters.com/article/idUKLDE62U0TD20100401?pageNumber=2&virtualBrandChannel=0

Firms get funding for carbon capture designs

12 March 2010

Energy firm E.ON has been awarded a share of a £90m pot to develop designs for a carbon capture and storage (CCS) facility at Kingsnorth in Kent. Scottish Power also won funding and the two firms will now compete to build the UK's first (CCS) coal-fired power plant in Kent or Clackmannanshire, Scotland. Four coal-fired power stations which demonstrate commercial-scale CCS will be built, according to the government.

Dr Paul Golby, chief executive of E.ON UK, welcomed the decision. He said: "This is excellent news for the development of clean coal in the UK coming as it does hard on the heels of our announcement about our scoping application for the Kingsnorth CO_2 pipeline. "It's absolutely vital that we get CCS right and it's especially heartening to see that we're now getting some real movement here in the UK. ”We should always remember that the long game with CCS is not just about Kingsnorth, it's about a worldwide battle against climate change."

The undisclosed amount of money each firm won, which has been drawn from a £90m pot, will support engineering and design work for the CCS projects at Kingsnorth and Longannet, Clackmannanshire, over the next 12 months. CCS technology captures the carbon released when coal burns. Hundreds of environmental campaigners camped near

Kingsnorth, on the Hoo Peninsula, in 2008 as part of a Camp for Climate Action protest against plans to build a new coal-fired power station at the site.

In October E.ON said its plans had been put on hold for up to three years because electricity demand had fallen during the global recession. The Government has promised that no new coal-fired power stations will be allowed to be built without CCS technology. Ed Miliband, Energy and Climate Change Secretary, said: "CCS is the only technology that tackles carbon emissions from fossil fuel power stations, and given the world's dependence on coal, is a vital technology to securing the world's future energy needs and tackling climate change.

"These two promising projects are at the forefront of the UK's efforts to build one of the first commercial-scale clean coal plants in the world. "The award of design-stage funding demonstrates our commitment to this breakthrough technology. It has the potential to support tens of thousands of jobs and bring billions to the economy."

http://news.bbc.co.uk/1/hi/england/kent/8565225.stm

Cash incentives on offer for small-scale green energy projects

1 April 2010.
A government scheme offering cash incentives for small-scale green energy projects has come into effect. The feed-in tariffs cash-back scheme will give subsidies to families, businesses, farmers and communities who generate their own green electricity. The scheme will offer incentives on renewable installations up to 5MW in size - equivalent to two large commercial wind turbines. The tariffs will vary by technology and scale of installation. Solar panels, micro-wind turbines, water turbines, anaerobic digesters and solar arrays are all eligible for the scheme.

UK Energy and Climate Change Secretary Ed Milliband said: "The guarantee of getting an income on top of saving on energy bills will be an incentive to householders and communities wanting to make the move to low carbon living. "The feed-in tariff will change the way householders and communities think about their future energy needs, making the payback for investment far shorter than in the past."

A YouGov survey for Friends of the Earth, the Renewable Energy Association and the Co-operative Group, published earlier this year, found that 71% of homeowners said they would consider installing green energy systems if the cash-back scheme was generous enough. Environmental campaigners welcomed the move, although some argue it does not go far enough. Friends of the Earth (FoE) said the tariffs did not offer a sufficient level of support for larger projects for communities, farms or businesses. FoE green homes campaigner Dave Timms added: "We need more support for whole communities, not just individual households." Some concerns have also been voiced about the possible impact on the rural landscape.

"There's a 'wind grab' going on behind the scenes," said Peter Strang Steel, who runs a property property acquisition company in the south east of Scotland "Farmers and landowners are frantically putting in planning applications for individual turbines and turbine clusters up and down the country."

http://news.bbc.co.uk/1/hi/scotland/8596348.stm

Coal Tax Markers

An interesting contribution to this newsletter comes from John Patrick who found this article in the January 2010 edition of MASCOT the Magazine of the Midget and Sprite Club.

This time of year is usually a bit quiet with regard to Spridgets. People either seem to be refreshing their cars, for next year, or hiding in the warmth of their home as far away from the cold of their garages. So for something a little different here is something to consider

looking out for when the Spridget sees the light of day. It is aimed at those members living in counties, surrounding London, on the edge of the Metropolitan Police District.

In days of old when knights were bold, coal was brought to London by sea and river and duties were levied at unloading. Then railways and canals changed all of that so an alternative means had to be brought in to collect duties. Eventually in 1851 the London Coal Duties Act 14 & 15 Vict cap 146 saw the placement of boundary marks set at 20 miles from the G.P.O. in London wherever railway, canal, or road crossed the 20 mile limit. At this point coal coming into London was duty payable. Apparently, a refund was obtainable if the coal went the other way! Then in 1861 the area for collection of Coal duties was amended by the Coal & Wine Duties Continuance Act 24 & 25 Vict Cap 42 to coincide with that of the Metropolitan Police District. The boundary marks were moved to the new boundary and new types of posts, plaques, and obelisks were added. The ACT 24 & 25 means the posts were set up following the Act of Parliament in the 24th and 25th year of the reign of Queen Victoria and the Cap 42 refers to Chapter 42 of that Act and this legal reference can, usually, be found on the marker. These days the markers are maintained by the local council.

Further note from the editor! "I, like most of you, I guess, had not heard of these before so I delved a little further – with the following results. I hope you found my efforts worthwhile!"

Coal sold in the City of London had been taxed since mediaeval times and, as it was all brought in by sea to one or two riverside wharfs, the collection of the duty had been relatively easy. A similar duty was collected on all wine landed in London. By the nineteenth century, however, there was increasing trade by canal and rail, and various acts of parliament extended the catchment area to a radius of about twenty miles from London. The City is a small (one square mile) but influential part of London and in 1851 an Act was passed specifying the points, far beyond its boundaries, where the collections could be made. Marker posts, inscribed with this legal authority, were erected. About two hundred have survived. Following enlargement of the Metropolitan Police District (which, paradoxically, did not include the City of London) in 1861 a further Act was passed and new marker posts were set to show the boundary inside which the duty was payable. Most of these later posts survive.

Not all of the duty collection points were staffed by tax collectors but on well-used routes with heavy coal traffic, such as on the Grand Union Canal at Grove Park, Hertfordshire, permanent toll houses were built. In other cases local coal merchants or, after the bulk of the traffic had passed to the railway, the railway companies calculated the sums due and passed the money to the Corporation. The railway companies were allowed to offset the coal they used for their engines, but only when employed on coal trains.

The erection of these posts was very much a last ditch attempt to retain the tax in the face of growing opposition. The tax had been running for at least two hundred years but within twenty years of the posts going up it was abolished. The Industrial Revolution was in full swing, London was expanding rapidly. The outer suburbs were becoming towns and their residents beginning to resent paying a tax which had very little direct benefit for them. One extreme case is Caterham which lay (and still lies) outside the Metropolitan Police District (MPD) but if

coals were to be brought there by rail they had to pass through the MPD and presumably were subject to the tax.

The powers to extract these taxes were abolished in 1889, notwithstanding the City had fought against the abolition moves with some underhand tactics: a parliamentary select committee sitting in 1887 found that signatures on a petition in support of keeping the tax had been forged.

This link shows an illustration of a coal marker post:

http://www.cityoflondon.gov.uk/Corporation/LGNL_Services/Leisure_and_culture/Local_history_and_heritage/coal_posts.htm

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

The annual feature on new RFCS projects continues to be absent from this edition of the newsletter as information on newly funded projects has not yet been released to the general public.

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.

CALENDAR OF COAL RESEARCH MEETINGS AND EVENTS

Date	Title	Location	Contact
6th-10th June 2010	35th international technical conference on clean coal & fuel systems	Clearwater, FL, USA	Barbara A. Sakkestad, Coal Technology Association, 601 Suffield Drive, Gaithersburg, MD 20878, USA Email: BarbaraSak@aol.com

1st-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 – 8th September 2010	**8th European Conference on Coal Research & Its Applications**	**University of Leeds**	**See conference website** **Conference website (www.eccria.org)**
14th – 15th October 2010	**Coal Research Forum, Coal Preparation Division, joint with the Mineral Engineering Society Southern Group and the South Midlands Institute of Materials, Minerals and Mining**	**Nottingham**	**Mr Andrew Howells** **E-mail: hon.sec.mes@lineone.net**
10th November 2010	**Coal Research Forum, Combustion Division Meeting, joint with the Royal Society of Chemistry Energy Sector, "Technical and Economic Aspects of Co-combustion of Biomass**	**University of Leeds**	**Prof J R Gibbins** **E-mail : jon.gibbins@ed.ac.uk** **Tel : 0131-650-4867**
Provisionally early - mid 2011	**The European Industrial Emissions Directive (IED)**	**Venue in London to be announced**	**Coal Research Forum (Environment Division) joint with the Combustion Engineering Association and the Royal Society of Chemistry Energy Sector and Environmental Chemistry Group** **Dr Trevor Drage** **E-mail:** **trevor.drage@nottingham.ac.uk** **Tel: 0115 951 4099**