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NEWSLETTER

of the Coal Research Forum

EDITOR'S COMMENTS:
It seems that the long awaited moves into cleaner coal technology in the UK are about to happen, although don't hold your breathe as they are still some way off as yet. Both RWEnpower and E.ON have announced that they will be performing feasibility studies into clean coal plant with CO_2 capture capability. E.ON hope to have their plant at Killingholme operational by 2011 and RWE their plant at Tilbury by 2016. I wonder who will be writing these comments then!!

This edition contains notes from the Coal Combustion Division's trip to Killingholme to view and hear about combined cycle gas turbine plant and the possible future generation picture as seen by one of the UK's generators. There is also a reminder that the main event in the Coal research Forums calendar is not far away. The sixth conference, shortened to the 6th ECCRIA, is to be held at the campus of the University of Kent in Canterbury from the 5th to the 7th September. Please note there is also a one-day workshop on image analysis organised by Robert Davidson of the IEA Clean Coal Centre to precede the conference (4th September) - and at no extra cost! What wonderful value! Please contact Robert at the e-mail address given in the events section of the newsletter. Don't miss out on this important event. I'll see you in Canterbury.

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Coal Combustion Divisional Meeting
Killingholme CCGT Station
8th March 2006

The Coal Research Forum's Coal Combustion Division once again made its annual pilgrimage to some far-flung energy plant in the UK. Well, not so much far-flung, more tucked away so nobody could find it, I think. At least that is what might be said of Killingholme CCGT station out in the flatlands of Lincolnshire. We couldn't even use the usual ploy of heading for the nearest stack as the area was awash with them! Anyway, most of those who set off for Killingholme got there. Sympathy must go to Paul Kilgallon whose vehicle let him down on the way there – rotten weather for that to happen too.

Time again for the tried-and-tested format of chat in the morning, have a nice lunch and then visit an interesting plant in the afternoon. The venue was perhaps greeted in some quarters with a raised eyebrow or two – gas-fired plant? CCGT? This is the Coal Combustion Division, isn't it? Certainly the number of attendees was well down on most previous ventures, but coal does have a future and it may well be the fuel that feeds the GT's at places like Killingholme in a years or threes time. Granted it will have been processed before being burned but IGCC plant in the UK is not that far off and hey, let's see what's happening there now!

Those who came were warmly welcomed by Trish Dixon and Peter O'Grady of E.ON UK and the 15 of us were soon ensconced in what appeared to be the Board Room. After a brief welcome from yours truly wearing, my Coal Combustion Division Chairman's hat, it was down to Production Manager, Peter O'Grady to provide us with background information on who E.ON are and how the Killingholme CCGT station fits into the E.ON UK power plant portfolio. E.ON is the world's largest privately owned energy provider, employing around 67,000 people in Scandinavia, the Baltic States, Central Europe, the United Kingdom and the United States. The headquarters of the company are in Dusseldorf, Germany.

E.ON UK plc trades electricity and gas in UK markets and is based in Coventry. Through its Powergen, (soon to be rebranded as E.ON), brand it sells electricity and gas directly and through the internet to small and medium enterprises and domestic customers. Its generation business produces enough electricity to cater for the needs of around eight million homes from a portfolio of gas-, coal- and oil-fired power stations.

Killingholme is a 900MW combined cycle gas turbine (CCGT) power station which was built in 1993. The station is located on a 50 acre site near the River Humber and is supplied by North Sea natural gas via a 52km underground pipeline. Gas is consumed at a rate of 6.3 million cubic feet per hour. It has two generating modules each incorporating two 144MW gas turbines, two heat recovery steam generators and one 168MW steam turbine.

The station was mothballed in 2002/03 due to the low electricity prices at that time and was restored to service in August 2005. It is believed to be the first gas-fired power station to be completely restored after an extended period out of service.

Interestingly, Killingholme is also connected to what is known as CDC (Cottam Development Centre). This is a 400MW single unit CCGT located at Cottam in Nottinghamshire. It was originally built as a test-bed for different gas turbines jointly owned by what was then Powergen and Siemens but with transfer of ownership of Cottam the unit simply operates as a generator of electricity. The

station's control system has also been updated so that it can be controlled remotely by staff 40 miles away at Killingholme.

After fielding a few questions on the possible future direction for power generation in general in the UK and that of E.ON and Killingholme in particular Peter handed over to the next presenter who was Greg Kelsall of Alstom Power.

His paper, jointly authored with Peter Flohr, was entitled "Fuel flexibility in gas turbines" and Greg began by illustrating the range of gas turbines currently available from Alstom Power. They included the GT8C2 rated at around 60MW to the GT26 at more than 280MW. As well as the normal pipeline quality, fuel gases which have been successfully fired included those of low CV such as steel plant gas and syngas (~2 to 14MJ/kg) and diluted gases with CV's down to 20MJ/kg.

A brief history was then provided of the development of pre-mixed combustion followed, starting around 1939 with the diffusion burner in a silo-type combustor and progressing through first and second generation premixed burners in the 1980's to 1990's. Single and sequential combustion followed in the mid-1990's and is the current technology of today. NOx emissions are well below 25ppm at 15% oxygen for these GTs.

Greg then described a number of case studies which showed the flexibility of the Alstom GT equipment. The use of dry oil as fuel resulted in a saving in water usage, lower O&M costs and this was achieved without any changes to unit operations such as firing temperature, operation on gas, the fuel distribution system, burners or emissions. Alstom's expertise when firing gases containing ethane, propane, butane and various amounts of inerts was then discussed. This is an increasingly common requirement and has involved the development of systems which are capable of meeting customer expectations. Sequential combustion has enabled such varied fuels to be burned satisfactorily without any increase in NOx. Syngas has also been burned satisfactorily in a large number of plants worldwide at very high availability using Alstoms EV MBTU burner. The range of syngas successfully fired contained hydrogen ranging from 28% to 45%, CO from 29% to 46% and nitrogen from <1% to 38%. All units are producing satisfactorily low emission levels. Similar good emissions performance was reported on a unit firing very low CV gas, ~2.1MJ/kg. This unit in a Chinese steelworks burns blast furnace and coke oven gases.

Greg then summarised future developments as he saw them. These involve increasing efficiency from new IGCC designs which could use Alstom technology for the GT. Other technology areas included carbon capture and sequestration, hydrogen fuelled GT burner and benchmarking against existing technologies. Alstom are involved in EU funded projects in some of these areas.

Greg concluded his talk by highlighting Alstoms experience of firing a wide range of fuel types in their GT systems. Their ability to build to customer requirements and non-standard fuels to produce units of high reliability and availability was also stressed. Finally, Greg reminded us that the day of GT's coupled to CO_2 capture are now a reality.

The second talk was given by Stuart James of E.ON UK's who is based at Power Technology at Ratcliffe-on-Soar. His talk was entitled "Impact of syngas on existing CCGT plant". The presentation was based on a DTI-funded project which also involved Jacobs, the University of Nottingham, Mitsui Babcock Energy, Watergrid, EPRI and Power Asset Modelling Ltd.

The E.ON plant chosen for the evaluation was Connah's Quay and Stuart described the existing layout with respect to the gas turbine, HRSG, steam turbine and generator. Two fuel compositions were selected, (A = 50% H_2, 35% CO_2, balance = N_2) and (B = 80% H_2 5% CO_2, balance = N_2) and two locations of the gasifier module, i.e. local to or remote from the plant. The only impact of location was the temperature of the gas. Gas temperature assumptions were; local to the plant = 300^{O}C and remote from the plant = 25^{O}C.

Stuart then reminded the audience of the properties of hydrogen compared with methane. H_2 has a much higher flame speed, a much wider flammability range, a much lower ignition energy and a much lower heating value on a volumetric basis. The high hydrogen gas, B, has a much higher Wobbe Index than gas A and to ensure that they will burn in a similar manner it needs to be diluted. Diluents which have been used are water, steam or nitrogen. Water/steam has been used historically but has an adverse impact on the life of combustion and hot gas path components. It also results in an efficiency penalty to the system. Nitrogen has less impact on component life and is readily available from the ASU although some compression is required. For the purposes of this study, nitrogen was chosen as the diluent when firing syngas and water when using the natural gas back-up fuel or when co-firing. It was calculated that by increasing the nitrogen content of syngas B from 15% to 45% the Wobbe index fell from 17 to 6.5 which is close to that of syngas A whose Wobbe Index was 7.

Stuart then listed the modifications needed to allow the operation of Connah's Quay plant using both gases in a capped and uncapped load conditions. In the capped load condition, modifications to the gas turbine combustion system, the fuel skid,the turbine section and the safety systems and C&I systems were needed. The only other changes that were needed were in the water treatment plant. In the uncapped load condition changes were needed in all parts of the plant, i.e. gas turbine, HRSG, steam turbine, water treatment plant and electrical system. The costs for these modifications were estimated to be ~£12M for the capped load condition and ~£36M for the uncapped load condition. Efficiency improvements of just under 1% to almost 2% were calculated with the present efficiency rating of ~53.7% being lifted to a maximum of nearly 54.5%.

Stuart then showed the effect of the cost of traded carbon emission on cost of generation where parity was achieved at a cost of £35/te of CO_2. More promisingly, the cost of natural gas with generation showed parity at a cost of 42.7p per therm. Those were the days, my friend!!

Stuart closed his talk by summarising the main points of the project and confirming that the conversion would be worthwhile if the price of natural gas rises(sic) above ~43pence per therm and stays there! and as a hedge against the price volatility of natural gas.

The last presentation was given by Dr Karen Steel of the University of Nottingham and was entitled "Ultra clean coal for power generation". This is a topic that several research groups throughout the world have been involved with for a number of years. Karen began by summarising the UK Governments aims in terms of CO_2 reduction of 60% by the year 2050. This is to be achieved by improvements in efficiency and reductions in energy use unless CO_2 capture and storage is viable. One of the most promising next generation of cleaner coal power generators is thought to be IGCC with carbon capture and storage and Karen described such a system.

Moving into the main theme of her talk Karen described three of the most promising ultra clean coal (UCC) technologies. Work has been done in Australia

by CSIRO using high temperature sodium hydroxide solutions (240^{O}C). Acid treatment is then carried out to dissolve the minerals. Mineral matter can be reduced to ~0.2%. The sodium hydroxide is regenerated with calcium oxide. The process has been taken to pilot scale and tonnage quantities of the clean coal have been produced.

In Japan a solvent refining technique has been used to produce what is known as Hypercoal. The coal is treated with an organic solvent to dissolve it and the solution is then separated from the insoluble material. The solvent is removed and virtually ash-free coal, (ash content ~0.02%) is obtained. Distillation is used to recover the solvent. So far laboratory scale tests have been carried out and kilogramme quantities of the Hypercoal have been produced.

Karen's own work at the University of Nottingham involves the treatment of fine coal with hydrofluoric acid and iron solutions to dissolve out the mineral matter. The mineral content may be reduced to ~0.1%. In addition, high purity silica is obtained from the coal as a by product and the reagents are recovered by pyrohydrolysis. Bench scale tests have so far been carried out and ~100gramme quantities of UCC have been produced. Studies on the remaining mineral matter in the ultra clean coal revealed most of it to be finely disseminated, micron sized particles of TiO_2, FeS_2 and SiO_2. Traces of sodium, magnesium and calcium were also present. The sulphur content had been reduced from 2.5% to 1.3% and the mercury from 0.52ppm to 0.31ppm. The absence of mineral matter appeared to improve the combustion behaviour of UCC as it was demonstrated by using thermogravimetric analysis that its burnout temperature was lower than that of the base coal. No adverse effects were seen on the calorific value as on a dry, ash-free basis the results were very similar for both samples.

In closing, Karen summarised her talk and indicated that UCC could be considered for use in a gas turbine. She recognised that further work was necessary to achieve this but felt it was possible. UCC could be used in more conventional plant and the removal of mineral matter can alleviate down stream ash collection and disposal problems. On this slightly controversial note the discussion section was concluded.

After a very pleasant lunch the group was divided into three smaller groups and, suitably kitted out with PPE, we headed onto the plant. Although the weather was still inclement we were able to see all of the key features of the plant. We started in the Gas Turbine House. At the risk of developing a crick in the neck it proved possible to look up into the combustion chamber of one of the gas turbines! Moving on we saw large banks of tubing in the heat recovery steam generator section of the Boiler House where the second part of the 'combined cycle' starts. Inside the Steam Turbine House we saw high pressure steam pipes leading to the steam turbine and beyond that were the electricity generators.

Moving on into the tranquil environment of the control room, your editor, (an ageing, former employee of a power plant equipment supplier), began looking for the guy with the pointy ears. It looked a bit like the bridge of the Starship Enterprise to me! Everything seemed to be computer controlled, and it probably was. My concerns as to what would happen if the systems crashed, as is always happening on my PC were, apparently, unfounded as back-up systems and data collection systems are in place to keep it on-line. What was also impressive was the view of the control room at the CDC forty miles away which we could see in real time and it looked like it was just next door!

Back at the Board Room we were refreshed with tea and after thanking the E.ON personnel once more for providing a thoroughly entertaining day our small band set of home.

Coal Conversion Divisional Meeting
Corus Works, Scunthorpe,
27th April 2006

The Coal Conversion Divisional meeting held at the Corus Works, Scunthorpe on April 27th was, for the first time, a joint meeting with the Coke Oven Managers` Association (COMA), the subject of the meeting being "Carbon Deposition in Coke Ovens". The meeting was organized by Dr Ruth Poultney on behalf of the Coal Conversion Division.

The meeting followed the usual COMA practice of being held in the early evening with a scheduled start time of 5.30. After a short COMA business meeting, the first presentation entitled "Carbon Deposits: Formation, Nature and Characterisation" by John W Patrick and Richelieu Barranco, Nottingham Fuel and Energy Centre, School of Chemical, Environmental and Mining Engineering, University of Nottingham, was given by Professor John Patrick. The talk commenced with an introduction describing the different types of carbon deposits, both beneficial and troublesome, which were found in various situations. A brief review was presented of the extensive literature on the formation of carbon deposits by, essentially, the pyrolysis of hydrocarbons; a complex process involving primarily gas phase decomposition. The differences in the nature of carbon deposits formed in the gas phase and at a surface were described and factors influencing deposit formation and their relevance to carbon deposition in coke oven operations was highlighted.

Characterisation of carbon deposits is generally by means of X-ray diffraction and optical microscopy and examples were presented of the use of both optical and scanning electron microscopy to determine differences in the nature of carbon deposits from commercial coke ovens. The work described forms part of an EU, Research Fund for Coal and Steel (RFCS) project coordinated by Corus R D & T, Teesside Technology Centre, and to-date it has demonstrated the variability of the carbon deposits with spherulitic carbon generally appearing as the initial deposit at the wall surface with a transition to a deposit, laminar in nature, which forms the majority of the deposit. This work is continuing with the examination of more deposits from coke ovens, backed up with laboratory scale experimentation of carbon deposits formed by the cracking of coal carbonization volatiles.

A second presentation, "Carbon Growth and Control at Dawes Lane Coke Ovens" was given by Nick Willerton, Manufacturing Manager, Dawes Lane Coke Ovens, Corus, Scunthorpe. In this talk, data from the works were presented and carbon deposits on oven walls, the oven roof, ascension pipe bases and the charge holes were described, backed up with some excellent photographic examples taken from operating ovens. The practical explanation for the deposition of roof carbon was known to be a consequence of oven undercharging, that at the ascension pipe bases was attributed to poor alternating pressure control in the ascension pipes and that at the charge holes was associated with coal sticking during the charging operation. The consequence of carbon deposits was loss of output, damage to oven chambers, damage to machines, environmental issues and a lot of hard physical effort. The presentation finished with the conclusion that control of oven operations was of the utmost importance and prevention, even through compromise is a far better option.

A lively discussion followed from a well informed and interested audience before the meeting was closed.

The meeting was held in the modern well-equipped conference centre at the Corus Scunthorpe works and was so well attended that additional seating had to be acquired before the meeting could commence. A tour of the Dawes Lane Coke Ovens was available in the afternoon prior to the meeting and an excellent buffet was provided at the conclusion of the meeting. Thanks are due to COMA and to Baird Cross, Manager of the Dawes Lane Coke Ovens for all these arrangements and it is a pity that so few of the 35-40 attendees were from the Coal Research Forum. The CRF membership should be aware that they missed an informative day out and most generous hospitality.

6th European Conference on Coal Research & Its Applications 5th – 7th September 2006

The 6th biennial Coal Research Forum Conference is appearing over the horizon once more and if you haven't submitted your abstract by now I'm afraid you've missed the boat as far as an oral presentation is concerned. However, you still have plenty of time to attend the conference in the stress-free mode of a non-speaker.

This year we are convening at the University of Kent's campus in Canterbury where our host and local organiser is Professor Yong Yan. Already much work has been done behind the scenes and the organising committee has created what look to be a very interesting programme. Mindful of trying to fit a quart into a pint pot as happened in Edinburgh in 2004, the committee has decided to adopt parallel sessions for this conference. This will ensure that the attendees will at all time be alert, attentive and not suffering from any caffeine-deficiency!

The Final Registration and Programme will be available very soon and can be obtained by e-mailing myself, alan.thompson@nottingham.ac.uk In the meantime, the first conference announcement is also available from myself if required.

Coal Cleans Up

15 February 2006
Coal powered more than half of the nation's peak electricity demand this winter and will form an important part of the Energy Review's analysis, Malcolm Wicks told the industry today.

Speaking at the Coal UK conference in London, the Energy Minister said:

"This winter has demonstrated the value of coal as part of our diverse generating mix. Against expectations, and as the price of gas spiralled, coal has been meeting 50% of average weekday demand, stepping in to keep electricity flowing to our homes, factories and offices. Normally, coal would average only 40% of supply at this time of year. This flexibility, built on the diversity of our energy sources, is an important strength of our energy market.

"But cleaner generation is essential if coal is to survive the shift to sustainable forms of energy. I am encouraged that more than two-thirds of the UK's coal-fired power stations have signed up to meet tough new limits on sulphur and nitrogen emissions. Nevertheless, current projections in the Energy Review show that by 2020 coal may only account for 16% of our electricity.

"The biggest barrier to coal's future is carbon dioxide and its contribution to climate change. It is this which is driving the development of carbon abatement technologies the world over. Carbon capture and storage, for example, has the potential to eliminate up to 95% of CO2 emissions, cleaning up the environmental impact of traditional fossil fuels such as coal.

"For the UK this need not necessarily be a future based solely on imports. We still have substantial coal reserves and there are arguments for maintaining production from them, both opencast and deep mine, provided that they can be made economically viable. The mining sector continues to make a significant contribution to the nation, in terms of employment, often in areas of relative deprivation, and it maintains important specialist mining and engineering skills, which are of international value."

http://www.gnn.gov.uk/environment/detail.asp?ReleaseID=187729&NewsAreaID=2&NavigatedFromDepartment=False

Energy Review Moves To Next Phase

14 April 2006
After meeting over 500 energy and environment experts, receiving more than 2,000 written responses and listening to the views of the public the Energy Review consultation, which is now closed, moves to its next crucial phase, Malcolm Wicks said today.

The Energy Minister said:

"The public consultation launched three months ago has sparked some heated debate with valuable contributions from environmentalists, energy groups, the public, and business. It is now time for us to analyse this evidence, incorporate it together with our own analysis and thinking to prepare a report for the Prime Minister by the Summer.

"In the coming months, the decisions we need to take will determine energy strategy up to the middle of the 21st century. The responses we've received demonstrate the diversity of views on all aspects of future energy policy including renewables, nuclear, coal, oil and gas, as well as energy efficiency.

"Climate change, declining domestic production, increased prices and an increased reliance on overseas sources have forced the issue. Our response must be underpinned by our key energy policy goals: to cut the UK's CO2 emissions, to maintain reliabiltity of supply, to promote competitive markets and to end the cruel correlation between being old and being cold."

The key questions posed by the consultation document were:

* What more could the Government do on the demand or supply side for energy to ensure that the UK's long-term goal of reducing carbon emissions is met?

* With the UK becoming a net energy importer and with big investments to be made over the next twenty years in generating capacity and networks, what further steps, if any, should the Government take to develop our market

framework for delivering reliable energy supplies? In particular, we invite views on the implications of increased dependence on gas imports.

* The Energy White Paper left open the option of nuclear new build. Are there particular considerations that should apply to nuclear as the Government reexamines the issues bearing on new build, including long-term liabilities and waste management? If so, what are these, and how should the Government address them?

* Are there particular considerations that should apply to carbon abatement and other low-carbon technologies?

* What further steps should be taken towards meeting the Government's goals for ensuring that every home is adequately and affordably heated?

Comments were also invited on:

* The long-term potential of energy efficiency measures in the transport, residential, business and public sectors, and how best to achieve that potential.

* Implications in the medium and long term for the transmission and distribution networks of significant new build in gas and electricity generation infrastructure.

* Opportunities for more joint working with other countries on our energy policy goals.

* Potential measures to help bring forward technologies to replace fossil fuels in transport and heat generation in the medium and long term.

The issues will be looked at in the context of the Government's policies for competitiveness and sound public finances.

http://www.gnn.gov.uk/environment/detail.asp?ReleaseID=196335&NewsAreaID=2&NavigatedFromDepartment=False

One of the last symbols of the North East's former coal mining heritage disappears forever

BBC News 17 February 2006

Demolition will take place of a 90ft steel tower at the former Ellington Colliery in Northumberland. The colliery, which was the region's last remaining deep mine, closed a year ago after the pit flooded. Today, one of Ellington's headgear towers, which held the winding gear which lowered men into the pit, will be demolished and sold for scrap. Owner UK Coal said it was forced to end production at Ellington for safety reasons and 300 miners lost their jobs.

The colliery was sunk between 1910 and 1913. At the outbreak of World War I, the workforce was 800, but this soared to 1,200 in 1921 and to an all-time high of 2,179 at the time of the 1984 strike. It was closed by previous operator British Coal in 1994, then taken over by UK Coal, which was then RJB Mining, and resumed production in January 1995. Number one and three shafts have been filled. Number two shaft is being left open for monitoring purposes, to check on water and gases. The National Union of Mineworkers maintains reserves within the mine could be retrieved. But UK Coal has said safety concerns mean the site could never be reopened.

Energy gap: Crisis for humanity?

By Richard Black, BBC News website environment correspondent

It is perhaps too early to talk of an energy "crisis".

But take your pick from terms like "serious concern" and "major issue" and you will not be far from the positions which analysts are increasingly adopting. The reason for their concern can be found in a set of factors which are pulling in glaringly different directions:

- Demand for energy, in all its forms, is rising
- Supplies of key fuels - notably oil and gas - show signs of decline
- Mainstream climate science suggests that reducing greenhouse gas emissions within two decades would be a prudent thing to do
- Meanwhile the Earth's population continues to rise, with the majority of its six billion people hankering after a richer lifestyle - which means a greater consumption of energy.

Underlying the growing concern is the relentless pursuit of economic growth, which historically has been tied to energy consumption as closely as a horse is tethered to its cart. It is a vehicle which cannot continue to speed up indefinitely; it must at some point hit a barrier, of finite supply, unfeasibly high prices or abrupt climate change. The immediate question is whether the crash comes soon, or whether humanity has time to plan a comfortable way out. Even if it can, the planning is not necessarily going to be easy, or result in cheap solutions. Every energy source has its downside; there is no free lunch, wherever you look on the menu.

Runaway horse

The International Energy Agency (IEA) predicts a rise in global energy demand of 50-60% by 2030. If all else remained equal, that rising demand would be accommodated principally by fossil fuels, which have generally been the cheapest and most convenient available. But oil supplies show signs of running down; this, combined with concerns about rising demand and political instability, conspired to force prices up from $40 a barrel at the beginning of 2005 to $60 at its close. There is more oil out there, for sure; but the size of proven reserves is uncertain, with oil-producing countries and companies prone to exaggerate the size of their stocks. Currently uneconomic sources such as tar sands could be exploited; but at what cost?

Natural gas stocks - in recent times the fuel of choice for electricity generation are also showing signs of depletion, and there is growing concern in Western capitals about the political instability associated with oil and gas supplies from the Middle East and Russia. Coal, the fuel of the industrial revolution, remains relatively abundant; but here the climate issue raises its provocative head most volubly, because of all fuels, coal produces more greenhouse gas emissions for the energy it gives. Based partly on the predicted availability of cheap coal, the IEA forecasts a 50% rise in greenhouse gas emissions by 2030. Mainstream climate science, meanwhile, indicates that to avoid dangerous consequences of climate change, emissions should fall, not rise, by 50%. The economic and environmental horses are clearly pulling in mutually incompatible directions.

No climate curbs

It is a rare human that dons a hair shirt voluntarily; and in seeking to deal with climate change, we are, it seems, behaving to type. It took the world's most comfortably-off nations more than seven years to bring the Kyoto Protocol into force following its signing in 1997. An alternative "climate pact", the Asia-Pacific Partnership on Clean Development and Climate, emerged last year contending that technology alone would solve global warming. It recently concluded its first ministerial meeting by endorsing projections that under its aegis, emissions will at least double by 2050; economic growth is sacrosanct, and so consumption of coal and other fossil fuels must also continue to rise. Concern over climate change, then, is not on a global basis proving to be a driver for clean technology or for reducing demand for energy.

Price barriers

Rising prices or simply constraints on supplies of fossil fuels could, however, bring other fuels into the equation; and nuclear fission is at the head of the queue. According to the World Nuclear Association, there are now about 440 commercial reactors in the world, providing 16% of its electricity; for major developing countries such as India and China, nuclear power remains both a significant part of the electricity mix and a close companion to military programmes. But concerns over waste have set other countries such as Germany on a determinedly non-nuclear path. Waste apart, nuclear faces another potential obstacle; stocks of uranium are finite. Analysts differ over how soon a uranium deficit might emerge; some believe that a significant ramping up of nuclear capacity would exhaust economic reserves on a timescale of decades. That could be extended by adopting "fast breeder" reactors, which create more fissile material as they go. Too good to be true? Perhaps, because there is a major downside; the creation of plutonium, with its attendant dangers of proliferation. The other nuclear technology, fusion, is full of hope but even its most ardent supporters admit it is decades away.

Wind, waves and sunlight

Most of the energy we use on Earth comes directly or indirectly from the Sun. It is the Sun which stirs winds and the great water cycle, depositing rain on highlands and creating the potential for hydro-electric power; it is the Sun's energy which grew plants which decayed to form the coal and oil that we have extracted so determinedly in our industrial age. Is it now time, then, to use its energy directly, to blanket the Earth in photo-voltaic cells and silently power humankind's future? Certainly it could be done, with energy to spare; but at costs up to five times that of coal and gas, it is not going to be soon. Wind, wave and tidal power are all fine technologies, but their potential is limited, not least by the fact that they do not generate continuously. That could be overcome by storing energy. But there are few realistic ways of doing it; and the additional cost would quickly negate any advantage these technologies currently possess. Hydrogen, meanwhile, is touted as the great climate-friendly hope. But hydrogen is just a carrier of energy. It must be created, for example by using electricity to split water molecules, in which case replacing petrol-driven cars with hydrogen vehicles would vastly increase the global demand for electricity. No free lunch, indeed - but a desperately tortuous and risk-laden menu and a kitchen where political or environmental fires could flare up at any moment.

Algae - like a breath mint for smokestacks

Mark Clayton
BOSTON – Isaac Berzin is a big fan of algae. The tiny, single-celled plant, he says, could transform the world's energy needs and cut global warming. Overshadowed by a multibillion-dollar push into other "clean-coal" technologies, a handful of tiny companies are racing to create an even cleaner, greener process using the same slimy stuff that thrives in the world's oceans

Enter Dr. Berzin, a rocket scientist at Massachusetts Institute of Technology. About three years ago, while working on an experiment for growing algae on the International Space Station, he came up with the idea for using it to clean up power-plant exhaust. If he could find the right strain of algae, he figured he could turn the nation's greenhouse-gas-belching power plants into clean-green generators with an attached algae farm next door. "This is a big idea," Berzin says, "a really powerful idea." And one that's taken him to the top - a rooftop. Bolted onto the exhaust stacks of a brick-and-glass 20-megawatt power plant behind MIT's campus are rows of fat, clear tubes, each with green algae soup simmering inside. Fed a generous helping of CO_2-laden emissions, courtesy of the power plant's exhaust stack, the algae grow quickly even in the wan rays of a New England sun. The cleansed exhaust bubbles skyward, but with 40% less CO_2 (a larger cut than the Kyoto treaty mandates) and another bonus: 86% less nitrous oxide.

After the CO_2 is soaked up like a sponge, the algae is harvested daily. From that harvest, a combustible vegetable oil is squeezed out: biodiesel for automobiles. Berzin hands a visitor two vials - one with algal biodiesel, a clear, slightly yellowish liquid, the other with the dried green flakes that remained. Even that dried remnant can be further reprocessed to create ethanol, also used for transportation. Being a good Samaritan on air quality usually costs a bundle. But Berzin's pitch is one hard-nosed utility executives and climate-change skeptics might like: It can make a tidy profit. "You want to do good for the environment, of course, but we're not forcing people to do it for that reason - and that's the key," says the founder of GreenFuel Technologies, in Cambridge, Mass. "We're showing them how they can help the environment and make money at the same time." GreenFuel has already garnered $11 million in venture capital funding and is conducting a field trial at a 1,000 megawatt power plant owned by a major southwestern power company. Next year, GreenFuel expects two to seven more such demo projects scaling up to a full production system by 2009.

Even though it's early yet, and may be a long shot, "the technology is quite fascinating," says Barry Worthington, executive director of US Energy Association in Washington, which represents electric utilities, government agencies, and the oil and gas industry. One key is selecting an algae with a high oil density - about 50 percent of its weight. Because this kind of algae also grows so fast, it can produce 15,000 gallons of biodiesel per acre. Just 60 gallons are produced from soybeans, which along with corn are the major biodiesel crops today. Greenfuel isn't alone in the algae-to-oil race. Last month, Greenshift Corporation, a Mount Arlington, N.J., technology incubator company, licensed CO_2-gobbling algae technology that uses a screen-like algal filter. It was developed by David Bayless, a researcher at Ohio University. A prototype is capable of handling 140 cubic meters of flue gas per minute, an amount equal to the exhaust from 50 cars or a 3-megawatt power plant, Greenshift said in a statement.

For his part, Berzin calculates that just one 1,000 megawatt power plant using his system could produce more than 40 million gallons of biodiesel and 50 million gallons of ethanol a year. That would require a 2,000-acre "farm" of algae-filled tubes near the power plant. There are nearly 1,000 power plants nationwide with enough space nearby for a few hundred to a few thousand acres to grow algae and make a good profit, he says. Energy security advocates like the idea because algae can reduce US dependence on foreign oil. "There's a lot of interest in algae right now," says John Sheehan, who helped lead the National Renewable Energy Laboratory (NREL) research project into using algae on smokestack emissions until budget cuts ended the program in 1996. In 1990, Sheehan's NREL program calculated that just 15,000 square miles of desert (the Sonoran desert in California and Arizona is more than eight times that size) could grow enough algae to replace nearly all of the nation's current diesel requirements. "I've had quite a few phone calls recently about it," says Mr. Sheehan. "This is not an outlandish idea at all."

http://www.christiansciencemonitor.com/2006/0111/p01s03-sten.html

E.ON sets funding for new 'clean coal' UK plant

23rd January 2006
German utility E.ON has established a purse of over half a billion pounds to build the UK's first 'clean coal' power generation station. According to a report in the Telegraph newspaper in the UK, German energy outfit E.ON has earmarked GBP540 million to build the novel next-generation power facility. As an unfashionable power station fuel source because of its 'dirty' reputation, coal had been drifting out of mainstream thinking in the UK regarding future power generation. However, with gas prices increasing alarmingly and opposition to nuclear power remaining strong, 'clean coal' has emerged as a potential alternative. 'Clean coal' power stations use carbon extraction technology to reduce the harmful content of waste gases dispersed into the atmosphere. In its report the Telegraph suggests that E.ON is currently engaged in a feasibility study for the proposed plant, which would likely be located on the east coast of England. However, a firm timeframe for the completion of what would be the UK's first 'clean coal' station has not yet been established.
http://www.energy-business-review.com/article_news_print.asp?guid=627EC084-1C77-43E9-B9B8-19F066EAA130

RWE May Build $1.4 Billion `Clean Coal' Plant in U.K.

April 12 (Bloomberg) –
RWE AG may build a clean-coal power plant in southeast England for as much as 800 million pounds ($1.4 billion) to cut its emissions of carbon dioxide from electricity generation. The company is beginning a feasibility study for a 1,000-megawatt power plant at Tilbury with new technology to capture and store carbon dioxide emissions, RWE's Swindon, England-based npower subsidiary said today in a statement on its Web site. European utilities are studying how they can reduce emissions of carbon dioxide, a greenhouse gas considered responsible for global warming. A European Union trading program for carbon emissions permits began last year. The U.K. needs a diverse mix of energy generation to guarantee secure sources of electricity, Andy Duff, chief executive officer of RWEnpower, said in the statement. " We also need to dramatically reduce emissions of carbon dioxide to hit environmental targets aimed at tackling global warming," he said. The cost of a plant with the technology RWE is studying is 700 million to 800

million pounds, depending on the government providing the right regulatory framework, RWE spokeswoman Jennifer Corby said today in a telephone interview. The company already operates a 1,428-megawatt, coal-fired power plant at its Tilbury site. A new plant would use the existing infrastructure for connection to the grid and for coal deliveries, Corby said.
For more…..
http://www.bloomberg.com/apps/news?pid=10000100&sid=auPuxfJVcnxg&refer=germany

Sieves put a lid on greenhouse gas

April 26 2006, University of Queensland
Scientists are about to test microscopic sieves that trap environmentally destructive greenhouse gases before they escape coal-fired power stations and refineries. The new gas separation technology can be fitted to existing power stations and petrochemical plants to produce hydrogen, a clean energy carrier, and capture carbon dioxide, a greenhouse gas that worsens global warming. Brisbane and German scientists have teamed up in a $4.2 million project to build and test this technology. The Queensland Government today announced it would contribute $1.05 million to the project under its Smart State National and International Research Alliances program. The scientists working on the technology are from the Australian Research Council's (ARC) Centre for Functional Nanomaterials at The University of Queensland and a German industrial research institute, Forschungszentrum Jülich (FZJ). Professor Max Lu, the Director of the ARC Centre for Functional Nanomaterials, said the technology involved pumping synthesis gas from coal through a metal-supported molecular sieve in a pressurised chamber. Professor Lu said the nano sieve was coated with thin film of zirconium and titanium oxides which separated hydrogen from the greenhouse gases such as carbon dioxide. "The film we coat it in behaves like the sieve which has tiny nano-holes, one billionth of a metre, that allow the smaller hydrogen molecules to go through," Professor Lu said. "It will turn dirty coal use clean and leave hydrogen that can be used in many other sectors such as transportation using fuel cells."

Water would be the only by-product for coal power stations using the sieves as the carbon dioxide could be buried and hydrogen converted into electricity in fuel cells. The research is also supported by UQ, the Centre for Low Emission Technology which is backed by Queensland power and mining companies and FZJ, the German state of North Rhine Westphalia and German industrial partners. Project manager Dr Joe da Costa said UQ's molecular sieve technology was cheaper and had superior engineering performance compared to conventional gas separation technologies. Dr da Costa said it was important environmental technology especially given more than 80 percent of Australia's power came from coal-powered plants. "Many countries have good coal resources that can last at least for another 150 years but to use that more cleanly and efficiently you have to think about new technologies," Dr da Costa said. "Coal is very cheap and the technology will allow our society to meet our obligation to reduce the amount of carbon dioxide that's pumped into the atmosphere." This is the first project to flow from a 2004 energy technology agreement signed between Queensland and North Rhine Westphalia.
http://www.physorg.com/news65284632.html

Carbon market crashes

3 May 2006
International carbon markets have experienced a major slump after several industrial strongholds in the EU reported better-than-expected environmental performance.

France, the Netherlands, Czech Republic and the Walloon region of Belgium all revealed their carbon emissions were lower than the allocation they had received, leading to a dive in demand for credits from developing nations and others hoping to cash in on the carbon economy. The result was an unparalleled crash in carbon markets, with many carbon traders seeing their share value plummet and the price of carbon credits themselves falling by more than 50%. Gloomier predictions reported from within the trading houses by financial journals suggest credits might fall so far as to become valueless, making companies which trade in them valueless in the short term. They argue this would be a temporary situation, however, as industry and nations exaggerated their production of carbon when allocations were agreed to make early targets easier to reach.

When real cuts have to be made, meeting targets will become increasingly difficult and credits will once again rise in value. How well other European countries have fared in meeting their targets will also have a huge impact on the value of credits. Ironically Spain, recently seen as the world's most attractive country in which to invest in renewable energy (see related story), has bucked the trend and missed its own targets. Industrial powerhouses Germany and the UK are yet to announce their results. The ramifications of the slump are potentially disastrous for the environment, as developing countries encouraged to keep emissions low with the promise of cash for credits question whether it is worth their while and industrialised nations see a cheap way out of making any reductions.

http://www.edie.net/news/news_story.asp?id=11394&channel=0

Pumping coal - coming soon to the U.S. : cleaner diesel from dirty coal

May 15, 2006
Gunjan Sinha
The U.S. is plump with coal. The country has one quarter of the world's reserves, and coal accounts for about 50 percent of the nation's electricity. To cut the reliance on oil imports, why not also use it to power cars and trucks or to heat homes, too?

That may happen soon. This year Waste Management and Processors, Inc. (WMPI), will break ground for the first U.S. coal-to-diesel production facility, in Gilberton, Pa. The plant will process 1.4 million tons of waste coal a year to generate approximately 5,000 barrels a day of diesel fuel. Other states, such as Illinois, Virginia, Kentucky, Wyoming and West Virginia, are also considering coal-to-liquid facilities.

Interest in the technology is certainly welcome news to WMPI president John Rich, who has been trying to finance such a facility for more than a decade. "Coal to liquids hadn't taken off, because the price of crude was at $30 to $40 a barrel," Rich says. Oil at about $60 makes coal more attractive.

To create the fuel, coal is first mixed with oxygen and steam at high temperature and pressure to produce carbon monoxide and hydrogen. The second step, referred to as Fischer-Tropsch synthesis, uses a catalyst to transform the gas into a liquid synthetic crude, which is further refined. Along the way, mercury, sulfur, ammonia and other compounds are extracted for sale on the commodities market.

The type of technology required to gasify the coal depends on the starting material. Pennsylvania alone has an estimated 260 million tons of waste coal--coal discarded because of its low energy content. "For every two tons of coal mined, up to half ends up in the reject pile," Rich says. Existing nearby facilities are not equipped to burn it. WMPI will rely on approaches innovated by South African energy giant Sasol; those methods are optimized to work with energy-poor coal, which include lignite and bitumen.

The resultant fuel is cleaner than conventional, sulfur-free diesel. In comparison tests, Daimler-Chrysler showed that the coal-derived fuel spews 10 percent of the carbon monoxide and hydrocarbons and 70 percent of the particulates. The firm had plans to unveil a demonstration vehicle with a tweaked V-6 engine in April that cuts nitrogen oxides and other emissions even further, says Stefan Keppeler, senior manager of fuels research at the company.

Though relatively clean at the tailpipe, the fuel is dirty at its source. A similar coal-based power plant discharges about four million tons of carbon dioxide a year. In some facilities, the greenhouse gas can be repurposed--it can be pumped into oil fields or, in the case of WMPI's plant, sold to the beverage industry. Unless scientists develop methods to sequester CO_2 and find other uses for the gas, the technology might languish, warns Rudi Heydenrich, business unit manager at Sasol. The gasification step is also expensive, accounting for two thirds of the cost of a facility. "You need a structure where there is government support to ensure sustainable economics in the long run," Heydenrich remarks Under the Bush administration's Clean Coal Power Initiative, a $100-million federal loan guarantee jump-started the new WMPI facility. The state of Pennsylvania also chipped in with tax credits and a plan to buy up to half the plant's output to power its vehicles. Investors may contribute the additional $500 million necessary to build the plant. The initial cost of the fuel is expected to be about $54 a barrel.

Coal is not the only source of synthetic diesel; the fuel can be derived from natural gas and more cheaply, too. In fact, Qatar and Nigeria are building gas-to-liquid plants, and Sasol estimates that by 2014, gas-to-liquid fuel may account for at least 5 percent of the global market. But the U.S. does not have nearly as much natural gas as coal. And considering the vast coal reserves in China, which is also considering the technology, coal-derived diesel seems likely to play a bigger role in helping to liberate some countries from dependence on oil imports.

http://www.sciam.com/article.cfm?chanID=sa004&articleID=000DFF5E-9E57-1446-9A6283414B7F0000

Underground coal-gasification plant under construction at Majuba

31st March 2006 – Creamer Media's Engineering News On-line
Among power utility Eskom's various and much-needed programmes to increase its electricity output is an underground coal gasification (UCG) project at Majuba colliery, with a 15 000-m3/h (or 6-MW) pilot plant currently under construction.

The ultimate aim is to construct a 1 200-MW commercial facility, should it prove

viable to supply syngas to nearby Majuba power station for co-firing with coal, says Eskom fuels and combustion technologies corporate consultant Mark van der Riet.

UCG is a process whereby coal is converted on site into a combustible gas, which can be used as a fuel for power generation. This is done by igniting the coal in a created cavity underground, and maintaining the combustion by injecting air or oxygen, and/or steam through one of two boreholes – resulting in pressurised gas which can be tapped. Eskom has contracted Ergo Exergy Technologies, of Canada, to assist in applying its proprietary eUCG technology.

Eskom already noted the technology potential in 2001, with a prefeasibility study on the project completed in December 2003. This confirmed the potential for UCG at Majuba colliery, stating that the cofiring of gas in the Majuba boilers is technically feasible, and that the UCG gas is competitive with conventionally-mined coal. Van der Riet says the study also found the environmental risks of such a project to be low, especially in terms of groundwater impact and surface subsidence.

"The primary reserves for eUCG operations in the current exploration area alone are about 106-million tons." UCG is a proved method, he adds, noting that it was first conceived in 1868 in the UK by Sir William Siemens, with the former Soviet Union starting operation of commercial UCG plants in 1955. Angren, in Uzbekistan, remains in operation today. Van der Riet says the decline in the use of the technology in the former Soviet Union was due to oil and gas discoveries.

In the 1990s, commercial UCG operations started in China, designed to extract residual coal reserves from previously-worked underground coal-mines. In 1999, eUCG technology was successfully piloted in Chinchilla, Australia. (This project is in conservation mode at the moment.) Since then, many other countries have also considered and tested the technology, including India, Pakistan and New Zealand. Van der Riet says the possible benefits of UCG for Eskom is that the parastatal will now be able to make use of an unutilised coal reserve.

(The Majuba coal-mine was decommissioned ten years ago, as it was found to contain geologically- disrupted coal reserves.) UCG will also ensure reduced coal-mining, washing, transportation, and grinding and ash disposal for Eskom.

There will be less risk to life in terms of mining, less harmful emissions, less materials-handling, reasonable energy cost, as well as the fact that gas quality is more stable than coal quality. Van der Riet also notes that a big reward will be the potential application of the technology at Eskom's other sites. The current research phase of the project will step up to yet another research phase, with production increasing fourfold, followed by a demonstration phase with production again growing fourfold, with the commercial phase the fourth step in the process.

"The commercial decision will follow after a successful demonstration phase," explains Van der Riet. The technology holds massive potential, he adds, considering that Eskom has 45-billion tons of coal on record as not economically mineable. Using this technology, this coal may produce 350 GW of electricity.
http://www.engineeringnews.co.za/eng/news/breaking/?show=83280

Getting cagey about CO_2

27 March 2006: The Engineer

Petroleum engineers are developing technology designed to remove a potential obstacle to under-sea storage of carbon dioxide emissions. Carbon capture and

storage were high on the agenda in last week's Budget when Gordon Brown launched a consultation process to identify barriers to its widespread use. Prof Bahman Tohidi and his team at Heriot Watt University's Institute of Petroleum Engineering believe a natural physical process could solve the problem of CO_2 leakage after it has been buried.

Instead of allowing CO_2 emissions from power stations to escape to the atmosphere, it has been suggested they could be trapped and delivered by pipeline to a suitable underground storage site, such as an exhausted oil or gas field beneath the sea. However, if the cap rock holding the CO_2 leaked, this would pose a problem: the escaping gas would make the sea more acidic, raising the threat of an environmental disaster.

Tohidi believes that, if the conditions were right, any leaking CO_2 could form hydrates with the water, blocking the gaps between particles in the sediment and providing a secondary seal. 'Even if the cap rock breaks, this would prevent the CO_2 escaping into the ocean,' he said. 'It would provide security, and reduce worries about changing the ecology of the ocean.' Hydrates are a combination of water and gas molecules. The hydrogen bonds in water hold the molecules together in 'cages', with empty cavities between them that gas molecules fit into. The attractive forces between the gas and water molecules can stabilise the cage structure, causing ice to be formed at a higher temperature than usual.

If the molecules are quite large and round, such as in cyclopentane or tetrahydrofuran, then the ice forms at room temperature. Smaller molecules, as in CO_2 and methane, need higher pressure for the hydrates to form at ambient temperatures. The bottom of the ocean provides perfect conditions for CO_2 hydrate formation. At a typical seabed temperature of 4°C, they form at a pressure of 20 atmospheres, equivalent to a depth of 200m. In the seabed the hydrates can fill the cavities between the sediment, reducing permeability and preventing escape. 'We have designed a cylindrical cell with two sections, where the lower part is warmer than the upper,' Tohidi explained. 'This is similar to the sediments on the seabed, because they get warmer as you go deeper — a rise of 3°C for every 100m. We will inject CO_2 at the base, and monitor it as it moves up the cell with a series of sensors that measure resistivity.

'This way we will be able to look at hydrates forming, and sample the fluid at the top to see if CO_2 is coming out. At the moment we are relying on the cap rock to keep the CO_2 in. We hope to show that if the water is sufficiently deep there will be a secondary seal.' First results are expected within three months. They should also help to establish what conditions are required for sites to store CO_2, and provide a method of monitoring for leakages. A supplementary objective of the project is to look at methane hydrates. These exist in huge quantities underground — particularly in the coastal shelf — and some estimates put the figure at twice the amount of fossil fuels. Various projects are underway in, for example, Japan and the US, to investigate extracting gas from these reservoirs because of worries about the security of the fuel supply. CO_2 could be used as a safe way to extract the methane. As CO_2 hydrates are more thermodynamically stable than methane hydrates it should, in theory, be possible to inject CO_2 into the reservoir, where it displaces the methane in the hydrate structure.

'Several techniques have been proposed for removing the methane, but they all require it to dissociate into methane gas and water, thus replacing a solid with two fluids,' Tohidi said. 'As the methane hydrate is usually found in sediments, the sediment would be expected to subside. I'm not sure this is very safe — you might get a gas leak, or it could even destabilise the sea floor. If we can replace the methane with CO_2, then it should be a safer way of producing methane.'

Another thought is that hydrates themselves could be used for CO_2 storage. Although the ratio between water and CO_2 in the hydrate is only around 6:1, in practice this means one volume of hydrate is formed from 176 volumes of gas. 'The methane hydrate deposits have been stable for thousands of years, so why can't the CO_2 hydrates be similarly stable?' said Tohidi. 'If we could prove CO_2 hydrate is stable, it could be used as a sink for CO_2 storage in itself. The places that generate CO_2 are not necessarily close to reservoirs where it could be stored, so the more places you can store it, the better.'
http://83.219.63.174/Articles/293937/Getting+cagey+about+CO2.htm

U.S. energy research is declining

Mike Ivey
Given the decades-long warnings about a looming world energy crisis - punctuated by the recent spike in crude oil prices - you'd assume the U.S. has been ramping up its research and development spending on energy. Think again. Since 1980, energy research has fallen from 10% to 2% of total R&D spending. And while the Bush administration lists energy research as a "high priority national need" and points to its recent energy bill as evidence, the 2005 federal budget cuts another 11% from energy programs. This comes as other nations, such as France and Finland, have made startling advances in nuclear energy and dramatic reductions in carbon dioxide emissions - the pollution from burning oil, gasoline, coal or other fossil fuels and the major cause of global warming. Meanwhile, the U.S. with 5 percent of the world's population continues to consume a quarter of the world's finite supply of fossil fuels with no plan on how it will face the dramatic lifestyle changes that will come with the end of cheap oil. "The technology is there ... but the investment has been lacking," said Jane Davidson, professor of mechanical engineering at the University of Minnesota during an energy conference Tuesday at Monona Terrace. How lacking? Consider the U.S. is spending $67 billion annually on the war on terror vs. $3.4 billion on energy research, according to the National Science Foundation. Private sector pharmaceutical companies are investing 10 times as much in R&D as energy firms like Exxon Mobil or Chevron.

Need more numbers? The U.S spent $58 billion annually (inflation-adjusted) during Reagan's run-up on defense spending from 1981-89. It spent $23 billion in 1963-72 on Kennedy's Apollo project to put a man on the moon. "We could kick the fossil fuel habit in 10 years if we had the same kind of visionary leadership as JFK," says David Goodstein, author of "Out of Gas: The End of the Age of Oil." Whether that will happen remains up for debate following the two-day international conference. Hosted by the Nelson Institute for Environmental Studies at the UW-Madison, the event brought in some of the top energy experts in the world for a frank discussion of energy issues. "Right now we're conducting a giant science experiment on the only planet we've got," warned Goodstein. "Civilization as we know it could well end by the end of the century when our fossil fuels run out." But the conference wasn't all doom and gloom. One enlightening presentation came from Jean-Pierre Perves, a leading French atomic scientist and adviser to its Nuclear Energy Commission.

France - which has no reserves of coal, oil or natural gas to speak of - made a heavy investment into nuclear electric generation beginning in 1985. Today, the country of 60 million people gets 78% of its electricity from modern nuclear power plants. By comparison, the U.S. gets about 20% of its electricity from nuclear power plants. Wisconsin is about 18% nuclear. Shifting away from fossil fuel has also allowed France to reduce its total carbon dioxide emissions by 35%, a dramatic reduction considering the increase in electric consumption across Europe. "Going nuclear was the only way we could move forward so quickly on reducing emissions," Perves said, Advances in nuclear technology, including

reprocessing uranium-based fuel, has helped French significantly reduce the amount of radioactive waste. Much of the dangerous material can now be stored in glass canisters secured in clay soils. Finland is even a step further ahead, Perves said, opening a pressurized nuclear reactor in 2005 that is the most efficient plant developed to date. Meanwhile, the U.S. nuclear industry has been on hold, with no new plants opened since the early 1970s. Wisconsin remains under a moratorium on construction of any new nuclear plants, a law that dates to 1984. The lack of investment in nuclear energy is an ongoing frustration for UW-Madison nuclear professor Michael Corradini. He said much of the technology being used successfully in Europe was actually developed in this country. Corradini said Wisconsin could build a state-of-the-art nuclear power plant for about the same cost of the proposed new coal-burning facility in Oak Creek. "It's a political question in this country," he said. "There is no leadership." In addition to new sources of clean energy from the sun, wind or biofuels such as ethanol, conference attendees said there are great strides to be made in conservation or small-scale renewable energy projects like low-temperature solar heating. "Conservation remains the cheapest of all the alternatives," said Bob Smith, professor emeritus of civil and environmental engineering at the UW-Madison.

http://www.madison.com/tct/mad/topstories/index.php?ntid=83391&ntpid=1

Tailings

Old mine reopens to power trains
6th March 2006.

Coal is set to be dug once more from a former Staffordshire colliery. Newcastle-under-Lyme's mothballed Apedale Colliery is to supply coal again - this time to power steam trains on the East Lancashire Railway. Apedale was shut by the National Coal Board in 1969. It was then in private hands before closing in 1999. The site has lately become a mining museum retelling the story of the industry which employed 30,000 people in the county. Mine manager Russell Amos told BBC Radio Stoke there is still plenty of coal left at Apedale.
http://news.bbc.co.uk/1/hi/england/staffordshire/4779730.stm

Student Bursaries for 2006

Up to 6 travel bursaries for up to £300 are on offer to bona-fide full-time students wishing to attend appropriate coal-related conferences. To apply, please send the abstract submitted to the conference with a brief supporting letter from your supervisor to:

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

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

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

The projects listed which were above the 'Threshold' in the recent appraisal exercise in ranking order are listed below. The first nine appear to be confirmed with the next six provisional.

1. Clean coal technology R, D&D promotion and dissemination.
   Budget 350K Euro, Funding requested 200K Euro.

2. Intelligent monitoring and selective cleaning control of deposits in pulverised coal boilers.
   Budget 2.19M Euro, Funding requested 1.32M Euro.

3. New mechanisation and automation of longwall and driveage equipment.
   Budget 3.89M Euro, Funding requested 2.34M Euro.

4. Maximising carbon utilisation through improved raw material selection and process control.
   Budget 3.13M Euro, Funding requested 1.88M Euro.

5. Hydrogen separation in advanced gasification processes.
   Budget 2.61M Euro, Funding requested 1.56M Euro.

6. Coke oven operating limits.
   Budget 1.60M Euro, Funding requested 0.96M Euro.

7. Application of the biomass, oxyfuel and flameless combustion for the utilisation of pulverised coals for electricity generation.
   Budget 1.90M Euro, Funding requested 1.14M Euro.

8. Development of advanced large-scale low NOx oxy-fuel burner for PF combustion.
   Budget 1.74M Euro, Funding requested 1.04M Euro.

9. Abatement of emissions of trace pollutants by FGD from co-combustion and environmental characteristics of by-products.
   Budget 3.10M Euro, Funding requested 1.86M Euro.

10. Cost effective and environmental friendly oxyfuel combustion of hard coals.
    Budget 2.43M Euro, Funding requested 1.46M Euro.

10. Advanced diagnostic and control for optimal flexibility and performance of pc plants.
    Budget 3.13M Euro, Funding requested 1.88M Euro.

12. Advanced integrated flexible H2 ecoproduction from mixed solid fuels with near-zero CO_2 emissions.
    Budget 6.79M Euro, Funding requested 4.07M Euro.

14. Optimized coke oven gas use for clean and sustainable coke production.
    Budget 2.70M Euro, Funding requested 1.62M Euro.

14. High capacity sorbents for mercury capture in industrial combustion systems.
    Budget 2.46M Euro, Funding requested 1.48M Euro.

CALENDAR OF COAL RESEARCH MEETINGS AND EVENTS

Date	Title	Location	Contact
Wednesday 31st May 2006	Coal Research Forum Annual Meeting and Coal Utilisation Subject Group Annual Meeting, Coal Preparation Divisional Meeting	The Coal Authority Mansfield Nottinghamshire	Dr David J A McCaffrey The Coal Research Forum P.O. Box 154 Cheltenham, GL52 5YL Tel: 01242 236973 Fax: 01242 516672 E-mail: info@coalresearchforum.org Mr Andrew W Howells Norec Ltd., Ings Mill Dale Street, Ossett West Yorkshire, WF5 9HQ Tel: 01226-730440 Fax: 01226-730688 Email: andrew.howells@norec.ltd.uk
Wednesday 31st May to Thursday 1st June 2006	VGB Workshop 'Flue Gas Cleaning'	Nottingham, UK	Dr Hartmut Krueger, VGB Powertech e.V. Klinkestrasse 27-31 D45136 Essen, Germany Tel:+49 201 8128 324 Fax: +49 201 8128 364 Email: hartmut.krueger@vgb.org www.vgb.org/flue_gas_2006_e.html
Monday 4th September 2006	IEA Clean Coal Workshop on Image Analysis (immediately preceding the 6th ECCRIA)	The University of Kent, Canterbury	For details contact Robert Davidson at the Clean Coal Centre, robert@iea-coal.org.uk
Tuesday 5th to Thursday 7th September 2006	The Sixth European Conference on Coal Research and its Applications (6th ECCRIA)		Conference Secretary Dr A W Thompson, SChEME The University of Nottingham Nottingham, NG7 2RD Tel : 0115-951-4198 Fax : 0115-951-4115 Email : alan.thompson@nottingham.ac.uk