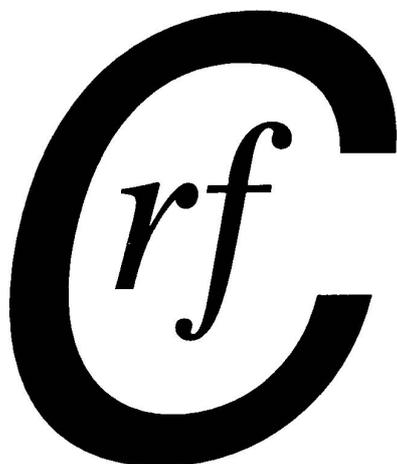


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# NEWSLETTER



*of the  
Coal Research  
Forum*

## **EDITOR'S COMMENTS:**

Records show that the early summer months this year in the UK were the wettest since records began over 200 years ago. This made me wonder about what some of you might recognise as a hobby horse of mine, that is, climate change. I then tried to summarise in my mind what I feel are broad public views based on what I had heard and read recently. Not terribly scientific, I grant you, but I think it is not too far from the truth.

To the question: Do you believe that the very wet summer is in any way to do with global warming? Probably a fair number would say, yes. Do you feel that the consequences of global warming are of concern? Again, probably most would also say, yes. Should anything be done about it? Most would agree that something should. Can anything be done about it? Quite a number would suggest some 'greener' option. However, when it becomes more specific, i.e. would you be happy to live near a wind turbine? More than likely No! What about putting one on a windy hilltop, again No! OK, would you be willing to pay more tax for the 'green' energy option? Many might say yes in principle but I doubt that they would accept big increases in the cost of gas/petrol/bus fares etc. Would you limit your air travel to reduce CO<sub>2</sub> levels? Mostly, no, I think. Do you feel guilty about your lifestyle? No! What about nuclear energy? Again many would say not really, thanks!

Finally, if we did all of these things in the UK would it make any difference to global CO<sub>2</sub> emissions? No says the editor!! So, in summary, Is global warming happening?, yes. Can anything be done to halt it?, probably no. Should we try to do anything about it? – maybe. Would it work? – not sure. Would it be money well spent? - Don't know.

Finally, the other really big issue with the general public is that they do not accept guidance and advice from Government/scientific bodies, (refer to the "safe to eat BSE meat, MMR vaccine and the current Northern Rock situation"). And on that rather inconclusive note I see I have almost overrun my allotted space and must now stop!

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**Advanced Power Generation Division Meeting**  
**“Zero emissions power plant”**  
**held at Rugeley Power Station**  
**International Power plc**  
**20<sup>th</sup> June 2007**

This meeting, hosted by International Power at Rugeley Power Station, was held in conjunction with the Coal Utilisation Subject Group of the Institution of Chemical Engineering. Six technical papers were presented three by generators including the host organisation, E.ON UK and RWEpower; two from equipment manufacturers Alstom Power and Doosan Babcock and one from a Government department, AEA Energy & Environment.

As part of the new-look Coal Research Forum website you will, no doubt, have noticed the section on Presentations from past meeting. The link to this web page is: -

<http://www.coalresearchforum.org/pastmeetings.html>

The availability of the presentations from this meeting (and others) means that the editor will no longer need to describe the presentations in detail for those unable to attend. However, it has been agreed that the editor, if present, will provide additional comments and questions not covered by the presentations. Unfortunately, in this case the editor was unavailable as he was on holiday!

The Annual General Meeting for 2007 was also held at this time and a shortened version of the report from this meeting is to be found in the section of presentations for the Rugeley meeting.

**International Conference on**  
**Coal Science and Technology**  
**University of Nottingham**  
**28<sup>th</sup> to 31<sup>st</sup> August 2007**

The 2007 ICCS&T was held at the East Midlands Conference Centre at the University of Nottingham. The weather was warm and dry as the band of international scientists gathered in the large and comfortable lecture theatre on Tuesday afternoon for the opening ceremony. A welcoming address was given by the Professor David Greenway, Pro Vice Chancellor of the University of Nottingham and Professor Colin Snape, also of the University of Nottingham, who was the chairman of the organising committee.

Three keynote addresses were given, Robert Davidson presenting for John Topper, IEA, gave a talk entitled "Major Recent Advances in Clean Coal Technology World Wide"; Professor Allan Jones, from E.ON UK, discussed "R&D Requirements for Keeping Coal in the Energy Mix in a Carbon Constrained World" and Nick Otter OBE of Alstom gave "A European Perspective on the Implementation of Clean Coal Technologies".

This was followed by a plenary lecture given by Professor Xie Kechang of the Taiyuan University of Technology, China on the "Fundamental Research and Innovation of Coal Chemical Technology in China".

The parallel sessions then began with topics such as general combustion, gasification, coal preparation and analytical methods featuring.

At the end of the formal sessions an evening reception was held in the Portland Building in University Park.

Wednesday morning's sessions included papers on oxyfuel firing, gas clean up, carbonisation and coking and the molecular structure of coal. The afternoon featured presentations on ash and mineral properties, emissions modelling and liquefaction and extraction.

The social events for the evening included a reception at the Council House hosted by The City of Nottingham (limited numbers) or a buffet at the Britannia Hotel overlooking Nottingham Castle.

Thursday morning brought contributions on the co-firing of biomass and wastes, trace elements, mercury and toxic metal control, pyrolysis and CO<sub>2</sub> capture, sequestration and utilisation. The afternoon session included papers on oxidation and spontaneous combustion and characterisation.

Poster sessions were held on the afternoons of Wednesday and Thursday and the Conference Dinner was held at Colwick Hall Hotel.

The final session on Friday morning included papers on beneficiation and bio-processing, carbon materials, SO<sub>x</sub> and NO<sub>x</sub> control and co-processing of biomass charcoal plastics and waste.

The final close out session involved Colin Snape announcing the venue for the 2009 ICCS&T conference as South Africa. Johannes van Heerden of Sasol then invited the audience to visit his homeland and attend the next conference.

Colin then announced the winners of the best oral papers and Professor John Patrick presented two joint first prizes, sponsored by the Coal Research Forum and the Coal Utilisation Subject Group, for the best two posters. These went to Katy le Manquais of the University of Nottingham for "Combustion Enhancing Additives for Coal Firing" and Anthe George of Imperial College for "A Life Cycle Analysis of Trace Elements in the Co-Combustion Process".

## **Clean Coal options being considered for Scotland**

17 May 2007

Scottish Power is looking at converting its two biggest power stations to clean coal technology, the company said on Thursday. If it goes ahead with the conversions at its Longannet and Cockenzie power plants in Scotland, carbon emissions from the plants would be cut by 20%, the company, owned by Spain's Iberdrola, said in a statement.

The new 'supercritical' turbines and boilers, which will burn coal at very-high temperatures and pressure, may be built inside the existing power stations in Fife and East Lothian which together supply about a quarter of Scotland's power. "Iberdrola is committed to developing the best environmental and technological practices," Chief Executive Ignacio Galan of parent company Iberdrola of Spain said in a statement from the Longannet plant. "The phased 19-month development foresees both stations continuing to operate at a reduced capacity while the new facility is constructed," he added.

If it goes ahead, work could start in 2009 with the transformed plants becoming operational in 2012. It would allow both plants to keep running for longer because they would not be forced to close by existing environmental legislation. The refitted stations would also be designed to use carbon capture technology being developed at Longannet, whereby carbon emissions from the station are to be pumped into underground coal seams to drive out methane gas which can then be used as a fuel. Iberdrola, a major player in the global wind energy market, completed its takeover of Scottish Power last month to create Europe's third largest electricity group.

[http://investing.reuters.co.uk/news/articleinvesting.aspx?type=allBreakingNews&storyID=2007-05-17T114939Z\\_01\\_L17577813\\_RTRIDST\\_0\\_SCOTTISH-POWER-CONVERSIONS.XML](http://investing.reuters.co.uk/news/articleinvesting.aspx?type=allBreakingNews&storyID=2007-05-17T114939Z_01_L17577813_RTRIDST_0_SCOTTISH-POWER-CONVERSIONS.XML)

## **CO<sub>2</sub> rises worse than expected**

21 May 2007

Researchers claim that the world's carbon dioxide emissions are growing more rapidly than even the worst-case climate scenario used by the Intergovernmental Panel on Climate Change. Led by Michael Raupach of the Australian Commonwealth Scientific and Industrial Research Organisation, the team looked at the growth of CO<sub>2</sub> emissions and found that growth suddenly accelerated in 2000.

In the 1990s, emissions grew by about 1% per year on average, but the number rose to 3.3% between 2000 and 2004, when the study ended. These increases were higher than those the IPCC drew up as its **"worst case scenario"**. By examining factors such as population, economic growth and energy and carbon efficiency the researchers were able to determine why CO<sub>2</sub> emissions accelerated after 2000. They concluded that the rise in CO<sub>2</sub> emissions is not due to a growth in global population, but a

reduction in global efficiency. "We are not getting more efficient at using CO<sub>2</sub> in the way we projected," explains co-author Corinne Le Quéré from the University of East Anglia in the UK.

From the 1970s to the 1990s, the world as a whole was becoming better at producing more energy for the same CO<sub>2</sub> emissions, and more GDP with less energy. But the trend reversed in 2000. "It's a problem because people are assuming we are heading towards a more energy efficient future and we are not," says Le Quéré. The researchers found that no part of the world reduced the amount of carbon used to produce energy between 2000 and 2004, despite widespread publicity in support of greener sources of energy. The analysis also showed that developing countries accounted for 73% of the growth in CO<sub>2</sub> emissions in 2004, but only 41% of total emissions. "If you follow anything to do with global policy or global economy these results will not be surprising," says Mike Hulme, director of the Tyndall Centre for Climate Change Research in the UK.

<http://environment.newscientist.com/channel/earth/dn11899-recent-cosub2sub-rises-exceed-worstcase-scenarios.html>

## **BP and Rio Tinto Agree to build low CO<sub>2</sub> power plants**

17 May 2007

BP Plc, a big hitter in the oil business is to join Rio Tinto, who is the world's second-largest mining group, to develop clean power generation plant which will be fitted with carbon capture and storage (CCS). Rio agreed to pay BP \$32 million for a 50% stake in a new company, to be called Hydrogen Energy, into which BP will transfer its existing carbon CCS operations.

It is accepted by many that the world will have to rely heavily on fossil fuels for decades and power generation facilities that store CO<sub>2</sub> in underground reservoirs, rather than emit it into the air, are likely to be the only way to tackle global warming.

Rio Tinto is a major producer of coal and sees CCS as a means to ensure future coal demand despite fears over global warming, which is blamed by many scientists on soaring CO<sub>2</sub> emissions. "It's an effort to open up new options for coal," Preston Chiaro, managing director of Rio Tinto Energy, told a conference call with reporters.

BP said Rio Tinto's participation would bring expertise in coal to the venture as well as investment for what would be a very capital-intensive business, with each plant costing around \$1 billion. BP already has two CCS facilities at planning stage -- one in the United States and another in Scotland.

The Scottish plant will separate natural gas into hydrogen and CO<sub>2</sub>. The hydrogen will be burnt to generate power, while the CO<sub>2</sub> will be pumped offshore and injected into mature oil fields, boosting reservoir pressure and prolonging oil production.

The U.S. plant will use petroleum coke -- a refinery by-product -- to generate power, while future plants developed by Hydrogen Energy will also look at coal plants. However, the extra cost involved in CCS compared with traditional power plants means the development of CCS depends on governments providing financial incentives such as tax breaks or CO<sub>2</sub> credits which can be sold on international markets.

The U.S. and European Union have said they are keen to see CCS projects developed, but neither has yet outlined a fiscal framework.

Some scientists have said the delay jeopardises aims to keep CO<sub>2</sub> concentrations in the atmosphere below levels that would lead to catastrophic climate change. "Society is going to have to move quickly than it has been (in developing fiscal frameworks for CCS)," said Steve Westwell, head of BP Alternative Energy, the oil group's low carbon power division.

<http://www.reuters.com/article/mergersNews/idUSL1717136120070517?pageNumber=2>

## **CO<sub>2</sub> Capture Project being developed in Norway by Alstom and Statoil**

21 June 2007

Alstom has signed a joint development contract with Norwegian gas and oil company Statoil, to test Alstom's chilled ammonia technology for CO<sub>2</sub> capture from flue gases particular to natural gas combined cycle (NGCC) power plants.

The objective of the agreement covers the design and construction of a 40MW test and product validation facility at Statoil's Mongstad refinery in Norway. This facility will be designed to capture at least 80,000 tons per year of CO<sub>2</sub> from flue gases from the refinery's cracker unit or from a new combined heat and power plant being built by Statoil and scheduled to be in operation by 2010. The test and product validation facility is expected to enter operation by 2009-2010 with the first operation and testing phase to last 12-18 months.

It is the intent of both parties that this facility will lead to technical advances and the construction of a larger CO<sub>2</sub> capture unit that may eventually capture over 2 million tons per year of CO<sub>2</sub> at Mongstad. Because of the recognition of CO<sub>2</sub> as the main greenhouse gas contributing to global warming, development of CO<sub>2</sub> capture systems is an important milestone towards carbon emissions reduction. Alstom's chilled ammonia technology holds great promise for controlling NGCC as well as other industry generated emissions economically and with a significantly low energy loss.

Research suggests that chilled ammonia-based CO<sub>2</sub> capture can remove up to 90% of the CO<sub>2</sub> from flue gases. Compared to several proposed techniques that can separate carbon dioxide from the other gases,

Alstom's chilled ammonia process greatly reduces the amount of energy used to capture CO<sub>2</sub>. This energy is referred to as an energy loss because the plant's energy output is reduced by the amount of energy needed to remove the CO<sub>2</sub>. Studies demonstrate that Alstom's technology may result in an energy loss of approximately 10% versus other methods of post-combustion CO<sub>2</sub> separation, which result in losses of nearly 30%.

Statoil's intention is to accelerate technological development with carbon capture and storage (CCS). Alstom and Statoil have been cooperating, in addition to other parties including the Electric Power Research Institute (EPRI), in the development of the chilled ammonia CO<sub>2</sub> capture technology since 2005. This deal follows an agreement made between Alstom and AEP (American Electric Power) in the US to develop the technology for application on utility coal-fired boilers and to carry out a pilot. Initial research and development of the Alstom chilled ammonia CO<sub>2</sub> capture technology has been jointly funded by Alstom, EPRI and Statoil. The first field tests will commence later this year at a 15,000 tons per year capture pilot plant to be located at the We Energies Pleasant Prairie power plant, Wisconsin, which is jointly funded by Alstom and EPRI.

For more visit...

<http://www.prdomain.com/companies/A/AlstomPower/newsreleases/200762241850.htm>

## **Uranium recovery from coal ash**

1 July 2007

South Africa–Spartan Resources of Toronto is going to evaluate the possibility of extracting uranium and other metals from waste material such as coal ash. Its partner in the project will be Akanani Investment of South Africa. Spartan will supply technical expertise and experience using technology developed by its strategic process engineering partner LYNTEK.

Akanani will assist in procuring suitable waste deposits, licences, permits and authorizations necessary for the program to advance. Akanani will also provide financial consulting services and liaison with the appropriate South African regulatory agencies. Spartan says its research has shown there are very large waste deposits of coal ash in South Africa produced by the burning of large amounts of low grade lignitic or brown coals for electric power generation.

Very little of the waste ash material produced is recycled into reusable products. Additional research on uranium and other heavy metal contents for the waste ash deposits is currently underway but initial studies have provided chemical analysis information on some lignitic coals having up to 400 ppm uranium (approximately 1.0 lb/tonne U<sub>3</sub>O<sub>8</sub>). Spartan specializes in non-conventional uranium extraction. Learn more at [www.SpartanRes.ca](http://www.SpartanRes.ca).

<http://www.canadianminingjournal.com/issues/ISArticle.asp?id=70785&issue=07012007>

## **China begins building first industrial Underground Coal Gasification project**

19 June, 2007

Construction began in May on China's first industrial-pilot underground coal gasification (UCG) project in the Northern Inner Mongolia Autonomous Region. Seven ignition and production wells reached the coalbed 200 meters below ground by May 23 in the project's \$112 million first phase. The project consists of underground drilling and ignition, above ground coal-gasification power generation, and chemical production. The plant is located at the Gonggou Coal Mine in Wulanchabu City and by 2010 will produce 1.5 million cu. m/d of syngas, 100,000 mty of methanol and methane and generate 32.4 million kwh/y of power. The city is developing a coal-chemical industry with its more than 15 billion tons in coal reserves. Methane isolated from the syngas will be used to produce town gas and generate electricity.

The project is a joint venture between China University of Mining and Technology and Hebei Xin'ao Group, which was founded in 1989 and has now become an energy distribution/equipment manufacturing, as well as chemical and biochemistry conglomerate. The group has a total asset of \$2.35 billion and offices in over 60 Chinese cities and the UK, USA and Australia. Xin'ao has been very active in producing and marketing coal-derived methanol and DME and is also moving into the design and construction of DME plants. The initial estimation of the project's profit ratio is 9.37% and its annual revenue will reach \$41 million. The local government will receive \$3.4 million in taxes annually.

China will also obtain six patents and two initial patent packages. The patents include: well-less UCG mining; ignition of an underground gasifier furnace; and parameter control in the oxygen-steam continuous gasification process. During the oxygen-steam continuous gasification process, syngas with over 40% hydrogen content will be generated and used to produce methanol. UCG is a coal mining technology that first appeared in the 1990s. Coal is regulated and burned underground. Through the burning process, flammable gases are produced and collected. It is said to be the second generation of the mining method, according to Industrial Info Resources research. It turns physical mining to chemical mining. Therefore it is safer, more cost effective, and more environmentally friendly. UCG provides a good alternative to those areas that are not suitable for physical coal excavation. It also minimizes the risk of surface collapse, and better protects the land resources around the mining area.

<http://www.marketwirecanada.com/2.0/release.do?id=743845>

## **China has overtaken the U.S. as World's No. 1 emitter of carbon dioxide says report**

20 June, 2007

China has overtaken the United States as the world's top producer of carbon dioxide emissions – the biggest man-made contributor to global warming – based on the latest widely accepted energy consumption data, a Dutch research group says. According to a report released Tuesday by

the Netherlands Environmental Assessment Agency, China overtook the U.S. in emissions of CO<sub>2</sub> by 8% in 2006. While China was 2% below the United States in 2005, voracious coal consumption and increased cement production caused the numbers to rise rapidly, the group said.

The study said China, which relies on coal for two-thirds of its energy needs and makes 44% of the world's cement, produced 6.2 billion metric tons of carbon dioxide in 2006. In comparison, the U.S., which gets half its electricity from coal, produced 5.8 billion metric tons of CO<sub>2</sub>, it said. The group's analysis makes sense and had been predicted to happen by 2009 or 2010, said experts from the United Nations and the U.S. Energy Information Administration, and outside academics.

Bert Metz, a senior researcher at the Dutch agency and a leading expert on efforts to battle global warming, said the analysis was done using methods and data that "are the best currently available." This means that "Chinese contributions to global CO<sub>2</sub> emissions are getting more important," Metz said in an e-mail to The Associated Press. Earlier figures indicated China would likely surpass the U.S. in greenhouse gas emissions as early as 2009, although other predictions said it could happen this year. Chinese environmental officials have said that while total emissions are going up, they are still less than one quarter of those of the United States on a per capita basis.

Because China's population of 1.3 billion people is more than four times that of the United States, China spews about 10,500 pounds of carbon dioxide per person, while in the United States it is nearly 42,500 pounds per person. Olivier said there was not much chance China will now lose its lead. "China's growth will saturate at some point," he said. But "for now, we don't see a trend (toward) this saturation yet." Olivier said the research was based on data on fossil fuel consumption from BP PLC's Review of Energy 2007, compiled by the British oil company, and cement production data through 2006 published by the U.S. Geological Survey. John Christensen, head of the U.N. Environment Program's Center on Energy, Climate and Sustainable Development in Denmark, said the figures did not come as a surprise. "The Dutch agency referred to BP statistics, which is the standard reference tool. We have no reason to doubt that the numbers are right. We have no reason to doubt the methodology," Christensen said. "It's been stated many times that China will overtake the U.S. in emissions." Other sources of carbon dioxide, such as deforestation and the flaring of gas in oil and gas production, are not included in the data. They also do not include methane from fuel production and agriculture and nitrous oxide from industry.

For more visit.....

<http://www.signonsandiego.com/news/world/20070620-1322-china-climatechange.html>

## **Coal and Black Liquor can produce energy from papermaking**

21 August 2007

Adding a little coal and processing the papermaking industry's black liquor waste into synthesis gas is a better choice than burning it for heat, improves the carbon footprint of coal-to-liquid processes, and can produce a fuel versatile enough to run a cooking stove or a truck, according to a team of Penn state engineers.

"Black liquor is routinely burned in a recovery boiler," says Andre Boehman, professor of fuel science. "But it has more energy value as a synthesis gas which is then used to create other fuels."

Black liquor is a combination of lignin from the wood, the chemicals used in papermaking and water. Normally, after burning, mills extract the inorganic chemicals and recycle them. Synthesis gas or syngas can be made from a variety of organic wastes and is a combination of hydrogen and carbon monoxide. The final product looked at by the researchers is DME or dimethyl ether.

"DME could be used as a fuel for cooking in the U.S. and Japan," says Boehman. "DME has recently grown in both production and use and is replacing coal for home heating and cooking in China."

DME is building new markets in both heat producing fuel applications and transportation. In Japan and China, some demonstration diesel trucks and buses already run on DME. Volvo has a third generation experimental truck that runs on DME and other companies are also testing vehicles.

"Penn State actually had the first transit vehicle use of DME," says Boehman, who is also treasurer of the International DME Association, a non-profit advocacy group. "A Penn State Staff Shuttle was fitted to run on the fuel and ferried faculty and staff around campus in 2002."

Graduate students carried out the research on co-processing of coal and biomass, during a class, Design Engineering for Energy and Geo-Environmental Systems, and Boehman reported the results at the 234th national meeting of the American Chemical Society on August 20 in Boston. The students looked at the efficiency of using black liquor as the feedstock for manufacturing synthesis gas and then DME, and realized that they needed the economy of scale for the process to be really efficient and economical. The capacity of paper mills for fuel production could be expanded by co-processing coal with the black liquor.

A potential approach is to combine the black liquor with a coal slurry and process that. Paper mill processes then treated this mixture with steam and only a little oxygen to convert the organic compounds into hydrogen and carbon monoxide. These products traditionally have then been used in the Fischer Tropsch method to produce a mixed petroleum-like product that must be further refined before use. The students suggest the DME

process because it is less energy intensive and produces a targeted product, DME, and while DME is a specialty fuel, its use is increasing worldwide.

Looking at a comparison of energy efficiency, the students found that gasoline and diesel fuel have the lowest energy cost to produce, but DME is not that far away in efficiency. DME is also much cleaner burning than either gasoline or diesel.

Converting black liquor and coal into DME also releases less carbon as carbon dioxide into the atmosphere than if coal alone was used to produce the fuel. Some of the carbon from these sources remains sequestered in solid form and do not add to global warming.

"Another reason we may want to co-process coal with black liquor is to stretch our coal reserve," says Boehman. "We have always known that coal reserves are finite, but now it appears we will not be able to mine all the available coal there is due to environmental concerns."

Graduate students in the course included Nicole Reed, Gregory K. Lilik, Jamie Clark, Qiziu Li and Chunmei Wang.

<http://www.sciencedaily.com/releases/2007/08/070820141055.htm>

## **Teaming up to advance energy research**

August 20, 2007

The power industry is risk averse. It usually has to partner with the public sector that provides funding and technical expertise. Fruitful partnerships are the result of industry's business sense combined with government's willingness to allow researchers to reach beyond their limits to innovate.

In the area of coal, the National Energy Technology Laboratory (NETL) is the go-to guy. The cornerstone of all NETL's undertakings right now is the FutureGen, which would be the most advanced coal-fired power plant ever invented. The agency's main ally is the FutureGen Alliance that is made up of major utilities made up of major utilities and coal companies. Various contractors, meanwhile, are assigned to bits and pieces of the deal.

"FutureGen incorporates many of the advanced technological developments we are working on," says Tom Sarkus, FutureGen project director for NETL in Pittsburgh. "It is the culmination of a number of our research and development initiatives. We really want to influence and to push for technological advancement. Industry wants to advance the technology but not to the degree of those in government. It knows how to design, construct and run the plants. The government also provides financial assistance to advance the technologies to a level that industry cannot do on its own."

FutureGen would be a zero-emission coal-fired power plant that could also capture and sequester carbon dioxide (CO<sub>2</sub>) emissions. It is a nearly \$1 billion undertaking. Of that, the coal industry will pony up \$250 million while foreign governments -- China, India and Korea are all involved -- will contribute \$80 million. The U.S. government will cover the roughly

\$700 million balance. The initial plant would generate 275 megawatts of electricity, which if successful, could be replicated around the country.

FutureGen got its start in 2000 and was officially launched in 2004. The goal is to be up and running by year-end 2012. Essentially, there are three basic elements to the project that include the capacity to gasify coal so that it would be cleansed of all the impurities before it leaves the smokestack as well as the abilities to develop hydrogen and to capture and bury CO<sub>2</sub>, all of which would address the global warming issue.

If the hydrogen can be separated from the other the elements, it could then be used to power everything from vehicles to electric generators. And, if the carbon could be sequestered and bottled up, then it would put a shine to coal's future - and perhaps win-over the environmental community. Pilot projects show that each feature is doable. But, the challenge is integrating each of those attributes into one generation facility. It's a noble goal. According to the Department of Energy, the United States mines more than 2.8 million tons of coal each day and if it did not, the nation would have double its natural gas production. Coal remains cheap and plentiful, with 250 years worth of reserves. It comprises 51% of the electricity generation.

### **The Elements**

Coal's prominence, however, is threatened by the strong emphasis on minimizing the release of heat-trapping emissions. According to the Congressional Research Service, coal is responsible for about a third of all CO<sub>2</sub> emissions. It also releases double the other pollutants regulated by the Clean Air Act that include sulphur dioxide and nitrogen oxide. "Let's face it: We are going to use coal," says Richard Bajura, director of West Virginia University's National Research Center for Coal and Energy. "I do think coal can be carbon neutral."

To build FutureGen and to particularly sequester CO<sub>2</sub>, "we must know what the technical risks are and how to finance them and what it will all cost," adds Ken Humphreys, director of carbon management at Columbus, Ohio-based Battelle, one of the leading private enterprises at work on the project. "We are on an aggressive path to move it from a pilot scale to a fully integrated scale. I don't see it as far off."

Those two experts agree that the immediate goal is to perfect the gasification technologies - the ones that convert coal to fuel gases before the sulphur, mercury and CO<sub>2</sub> would be removed. Right now that process is expensive and fraught with obstacles. But, if it can be proven, then the CO<sub>2</sub> would be more concentrated and therefore much easier to capture and store.

Four such coal gasification plants are now operating: two in the United States and two in Europe. Currently, there are about 30 projects on the drawing board, although no one expects more than a handful to actually reach fruition. American Electric Power, Duke and Southern are among the utilities pursuing the technology, all with huge coal fleets.

Xcel Energy has another project in mind. It wants to construct a coal gasification plant that has the ability to capture and store carbon, and to begin the process by 2010. It is now conducting feasibility studies and acquiring partners for a 350-megawatt plant that would cost as much as \$1 billion. The company said it expects the coal gasification elements to add 10-20 percent more to the typical price tag while the carbon sequestration features would contribute another 35-45 percent.

As for FutureGen, it is on target to meet its 2012 operational timeline. The FutureGen Alliance will make its final site selection this year among four places that are located in Texas and Illinois. It will soon after make its technology choices. In addition to lending money and its scientific brainpower, NETL will also try to ensure the selection process is done fairly through a series of audits.

"The project and the timeline are very realistic, but challenging," says Mike Mudd, CEO of the FutureGen Alliance in Columbus, Ohio. "It is critical we meet our deadlines. We always try to identify and resolve situations that might cause delays. If we can maintain that perspective, we will be on line in 2012."

FutureGen's partners are all determined. If the project works, it would be the ultimate energy-driven public-private partnership -- and one that would also lead to the subsequent development of other ultra-clean coal projects.

[http://www.energycentral.com/centers/energybiz/ebi\\_detail.cfm?id=371](http://www.energycentral.com/centers/energybiz/ebi_detail.cfm?id=371)

## **New technology to reduce large-scale emissions**

18 September 2007

A novel technology to trap large-scale greenhouse gas emissions caused by coal mining and power generation is being developed by a University of Queensland researcher. Dr John Zhu, Senior Lecturer in the School of Engineering, aims to develop a carbon nanotube (CNT) membrane for gas separation that will work like a sieve to separate high volumes of methane or carbon dioxide from other gases.

Dr Zhu said that the CNT technology was exciting because it would trap moving gases up to 100 times faster than other gas separation techniques and could therefore be used by large-scale plants such as power stations. "Conventional membranes such as polymeric and metal membranes, porous silica and carbon molecular sieves all show a trade-off between how well they separate gases and how much gas they can process," he said.

"The CNT membranes can both separate effectively and process large volumes of gas, making them superior to conventional membranes at the large scale required for coal-fired power plants or natural gas processing. "If the technology is successful, it may be able to significantly reduce the amount of greenhouse gases produced through power generation. This is especially important in Queensland where we are dependent on power generated from coal." The carbon nanotube technology works by "sieving"

gas as it passes through the membrane, and can be applied to various aspects of the power-generation process including during the mining process and after the fuel is burnt.

During underground coal mining, methane (an explosive gas which is present in the coal) must be removed before the coal can be extracted. In current practice, the methane is so diluted with air that it cannot be used and is therefore released into the atmosphere. The CNT membrane will enable the methane to be separated and harnessed for use as valuable pipeline quality gas.

In power stations, after coal or gas is burnt, a CNT membrane may be used to separate carbon dioxide from waste gas. The carbon dioxide can then be permanently and safely disposed of through methods such as sequestration.

If successful, the CNT membrane is likely to be commercialised and available for use in the next 10 to 15 years. Dr Zhu said he was both pleased and grateful that his research was being recognised by the University with the award, and for the opportunity to advance research in an area so critical to the future health of the planet.

"I have been concerned about humankind's impact on the environment for many years. It is imperative that we reduce greenhouse emissions. I hope the CNT membrane will help to achieve that," Dr Zhu said.

<http://www.uq.edu.au/news/?article=12979>

## **Coal by-product makes fertiliser less explosive**

6 July 2007

When Darrell Taulbee first learned the 1995 terrorist bombing of the Oklahoma City federal building was carried out with a common fertilizer as an explosive, he got to work. Toiling away at his coal research lab at the University of Kentucky, Taulbee has spent the intervening years trying to dilute ammonium nitrate to make it a less desirable tool for terrorists. Now, he believes he has found a way to coat the product with coal combustion by-products to minimize its explosive power.

"We found that not only does it appear to be as effective in agriculture as a fertilizer, but it would have a longer shelf life" than pure ammonium nitrate, said Taulbee, a research scientist and industrial support coordinator at the school's Center for Applied Energy Research.

The potential fix for the use of ammonium nitrate as an explosive device comes amid continuing debate in Washington over how to control the substance. Lawmakers are considering a measure to regulate the purchase and sale of the fertilizer via registration with the Department of Homeland Security.

Taulbee received a \$125,000 grant from a DHS contractor, the National Institute for Hometown Security in Somerset, Kentucky, to research

coating ammonium nitrate. He experimented with different concentrations, crafting makeshift bombs and gauging how much of the explosive power was suppressed.

He determined that a 20 percent ratio of coal ash to 80 percent ammonium nitrate prevented large blasts, even when the samples were crushed. Between 1 million to 2 million tons of agricultural grade ammonium nitrate is produced each year, to provide crops with nitrogen, but sales have slowed in recent years amid liability concerns. Taulbee said at least one executive from an ammonium nitrate producer consulted on the project.

Farmers would have to use more fertilizer if it was coated, but he believes many would. "I think most farmers are willing to make a small sacrifice, if it will mean their ammonium nitrate is safer," he said. Congress has been looking at ways to regulate ammonium nitrate, out of fear it could be used in a terrorist attack. The House Homeland Security Committee approved a bill (HR 1680) in April that would require those who produce, sell and distribute the fertilizer to register with DHS or state-run registration programs. Potential users would also be checked against federal terrorism watch lists.

A similar bill (S 1463) was introduced in the Senate last month, and lawmakers said the ammonium nitrate provisions could be added to the bill that would implement the recommendations of the Sept. 11 commission (HR 1), which is awaiting conference with the Senate version (S 4).

Kathy Mathers, vice president of public affairs for the Fertilizer Institute, the industry's trade association, said several member companies are looking at similar ways to dilute or change ammonium nitrate to make it safer. "We don't discourage them from doing it, but it's purely commercial in nature," she said. "There's a lot of things in research stages, but there's nothing that we've pushed as an alternative to legislation."

Taulbee said he thinks the government should focus on innovative solutions like his, instead of a registration program. "I think the government should mandate [coating ammonium nitrate] because it gives maximum security," he said. "If you sell it to someone with a license, it will be like illicit drugs. Someone is going to get their hands on it on the black market." He estimates that it would cost about \$20 million a year for the government to subsidize the coating of ammonium nitrate with the ash, which is cheap and often winds up in landfills.

The government has also considered requiring that ammonium nitrate be diluted to a maximum of 80 percent, but Taulbee said diluted ammonium nitrate can still be enhanced by experts to be used as an explosive. Once the product is coated, it cannot be enhanced, as other scientists testing Taulbee's work have found. The University of Kentucky is exploring a patent on the product, but financial gain doesn't seem likely. "If it can be used for the public good, we'd be fine with that," he said.

## **Sasol in talks with China on coal-to-fuel plans**

17 September 2007

Sasol, the biggest coal-to-motor-fuel producer in the world, is in talks with Sinopec on coal liquefaction projects, the Chinese commerce minister, Bo Xilai, said. Bo, speaking at a conference in northern China on Monday, did not specify whether Sasol's talks are with China Petroleum & Chemical, known as Sinopec, or its state-controlled parent China Petrochemical, known as Sinopec Group.

Sasol, based in Johannesburg, is in talks with "large" Chinese oil companies to distribute fuels in the nation's northwest, Chen Liming, executive vice president of Sasol's China unit, said Friday. Sinopec and PetroChina, both based in Beijing, are China's biggest fuel suppliers. Sasol is building coal-to-fuel plants in the United States, China and India, where interest in the technology has increased as oil prices have risen. Oil closed above \$80 a barrel in New York for the first time last week. Sasol's plants in China need an oil price of \$40 a barrel or more to be profitable, Pat Davies, the chief executive officer, said last year.

Sasol and Sinopec were discussing using "indirect technology," Bo told the China International Energy and New Industry Expo in Taiyuan, capital of Shanxi Province, the country's biggest coal-producing area. He gave no further details.

China, the biggest producer and consumer of coal in the world, has the potential to build 12 coal-to-fuel plants, André de Ruyter, president of Sasol's China unit, said in June last year. Sasol and its partner Shenhua Group, the biggest coal producer in China, are conducting the second phase of a feasibility study to build two coal-to-liquids projects in Shaanxi and Ningxia provinces. Sasol, which produces more than 40 percent of the motor fuel for South Africa, plans capital expenditure of \$20 billion between this year and 2009. Shenhua Group is the parent company of China Shenhua Energy.

China, the largest gasoline exporter in Asia, cut overseas sales of the fuel to a 10-month low in August and increased imports to meet rising summer demand. The country exported 260,000 metric tons of the fuel in August, compared with 330,000 metric tons in July, customs data released in Beijing on Monday showed.

The August shipment is the lowest since September last year, when China exported 182,000 metric tons. Imports surged to 44,858 metric tons last month from 14 metric tons in July.

The government earlier this month ordered state oil refiners to ensure domestic supply to the nation. Fuel demand typically peaks in the summer because of increased travel and air-conditioning use.

"Domestic refineries have to cut gasoline exports and increase imports to address the tight supply situation in the domestic market," Daming Yao, an oil analyst with Guangdong Oil & Gas Association, said Monday. Gasoline imports between January and August almost doubled to 71,275 metric tons from a year earlier, the customs data showed. China Petrochemical, the nation's biggest refiner, is increasing output to meet shortages in the southern provinces of Fujian and Guangdong, the nation's biggest manufacturing hubs, the refiner said.

Sinopec Group, as China Petrochemical is known, will increase crude processing volume by 6.7 percent to 14.23 million metric tons in August as it runs its refining units at maximum capacity, it said.

China controls prices of diesel and gasoline to curb their impact on inflation, which climbed to 6.5 percent last month, a 10-year high.

<http://www.iht.com/articles/2007/09/17/business/sxsinopec.php>

## **German utility to build "more efficient" coal plant**

14 September 2007

German utility E.ON will build the prototype of a new cleaner and more efficient coal-fired power station at Wilhelmshaven on Germany's North Sea coast, it said on Friday. The one billion euro (\$1.39 billion) project, with 500 megawatts capacity, is seen coming on stream in 2014 and will offer an efficiency rate of 50 percent compared with the average rate of 36 percent at coal-to-power plants in Europe. Efficiency rates describe energy output as a proportion of raw materials input.

The plant would emit 30% less climate-harming carbon dioxide (CO<sub>2</sub>) than conventional ones, E.ON said, calling this a quantum leap in power plant technology. "Coal will remain indispensable for future power generation," said the technical director of E.ON Energie, the group's central European marketing arm, Bernhard Fischer. "Our Wilhelmshaven project will create the basis for the future usage of coal."

The plant was included in E.ON's rolling investment plan up to 2009, issued last December. E.ON said construction of the hard-coal fired plant would begin in 2010. Innovative materials for the project have been tested at E.ON's coal-to-power Scholven plants at Gelsenkirchen, where the company commands more than 2,000 MW of capacity. The coastal location at Wilhelmshaven would help supply cooling water for the new plant and provide easy access for coal freighters bringing imported feedstock, E.ON said.

E.ON is focusing on avoiding carbon emissions due to legal requirements to scale back fossil fuel burning, while coal is the most heavily polluting raw material for power generation. It is developing so-called sequestration processes and carbon dioxide storage underground at sites in Germany and abroad, while also heavily diversifying into renewable energy.

<http://uk.reuters.com/article/oilRpt/idUKL147779920070914>

## **Siberia will increase coal production by a record 9% this year**

18 September 2007

Russia`s largest coal producer OAO Siberian Coal Energy Co (SUEK) will increase output by about 9% to a record 100 Mt this year, according to comments by chief executive officer Vladimir Rashevsky. Exports will rise about 15% to 27 Mt, Mr Rashevsky told reporters in the Siberian mining city of Khabarovsk today. He said SUEK planned to boost annual output to 160 Mt within five years.

[http://www.mining-journal.com/Breaking\\_News.aspx?breaking\\_news\\_article\\_id=3816](http://www.mining-journal.com/Breaking_News.aspx?breaking_news_article_id=3816)

## **Student Bursaries for 2007**

Up to 6 travel and subsistence bursaries for up to £300 are on offer to bona-fide full-time students wishing to attend appropriate National and International coal-related conferences, such as the "7<sup>th</sup> European Conference on Coal Research and its Applications" to be held at Cardiff University in September 2008, (please see the Calendar of Coal Research Events for details of both this and other events at the end of this Newsletter). To apply, please send the abstract submitted to the conference with a brief supporting letter from your supervisor to:

Prof. J.W. Patrick  
School of Chemical & Environmental Engineering  
The University of Nottingham  
University Park  
Nottingham NG7 2RD

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

## **Update on current BCURA Projects**

B66 THE UNIVERSITY OF GREENWICH, "Direct On-Line Measurement of Wall Friction of Coal as an Indicator of Handleability" Dr.M.Bradley and Dr.R.J.Farnish, (01/10/02 to 30/06/07).

B69 THE UNIVERSITY OF GREENWICH, "Handling Characteristics of Biomass/Coal Mixes for Co-Firing : Measurement Techniques and Establishing Benchmarks", Dr.M.S.A.Bradley, (01/10/03 to 30/06/07).

B72 TES BRETBY, "The Maintenance of the BCURA Coal Bank", Mr.G.Bradley, (01/04/04 to 31/03/07).

B73 IMPERIAL COLLEGE, "The Selection of Low Cost Sorbents and Process Conditions for Mercury Capture from Flue Gases", Prof.R.Kandiyoti and Prof.D.R.Dugwell, (01/10/04 to 30/09/07).

B74 CRANFIELD UNIVERSITY, "The Properties and Combustion Characteristics of Coal-Derived Fuels for Industrial Gas Turbine Applications", Prof.J.B.Moss, (01/10/04 to 30/09/07).

B78 IMPERIAL COLLEGE LONDON, (DEPT. OF MATERIALS), "Coal-biomass Ash Deposition during Deeply-staged Combustion", Dr.F.Wigley, (01/01/06 to 31/12/07).

B79 UNIVERSITY OF LEEDS, "Co-firing Coal/Biomass and the Estimation of Burnout and NO<sub>x</sub> Formation", Prof.A.Williams, Dr.J.M.Jones and Prof.M.Pourkashanian, (01/01/06 to 31/12/07).

B80 IMPERIAL COLLEGE LONDON, (DEPT. OF MECHANICAL ENGINEERING), "Characterising Biomass Particle Behaviour under Co-combustion Conditions", Dr.J.R.Gibbins, (01/10/06 to 30/09/09).

B81 IMPERIAL COLLEGE LONDON, (DEPT. OF MATERIALS), "Coal Mineral Transformations under Oxy-fuel Combustion Conditions", Mr.F.Wigley, (01/01/07 to 31/12/08).

B82 IMPERIAL COLLEGE LONDON, (DEPT. OF CHEMICAL ENGINEERING), "Improvements in Amine Flue Gas Scrubbing Systems for Coal Fired Power Plants", Dr.C.S.Adjiman, Dr.A.Galindo, Prof.G.Jackson and Dr.J.R.Gibbins, (01/10/06 to 30/09/09).

B83 UNIVERSITY OF NOTTINGHAM, "Mercury Oxidation by Fly Ash Constituents and Flue Gases and its Optimisation for the Development of Mercury Control Technologies", Dr.M.Maroto-Valer and Prof.C.E.Snape, (01/10/06 to 30/09/09).

B84 UNIVERSITY OF GLAMORGAN, "Optimisation of Fluidised Bed Combustion of Mixtures of Coal and High Moisture Content Biomass", Dr.D.R.Garwood, Prof.J.Ward, Dr.S.J.Wilcox and Mr.M.Fisher, (01/10/06 to 30/09/09).

B85 UNIVERSITY OF LIVERPOOL, "On-line Condition and Safety Monitoring of Pulverised Coal Mills Using a Model Based Pattern Recognition Technique", Dr.J.Wang, (01/10/06 to 30/09/08).

B86 TES BRETBY, "The Maintenance of the BCURA Coal Bank", Mr.G.Bradley, (01/04/07 to 31/03/10).

## CALENDAR OF COAL RESEARCH MEETINGS AND EVENTS

Date	Title	Location	Contact
4-5 October 2007	2nd International Symposium on Capture and Geological Storage of CO <sub>2</sub>	Paris, France,	François Kalaydjian, IFP - Communication Division, 1 & 4, avenue de Bois-Préau, 92852 Rueil-Malmaison Cedex, France Tel: +33 1 4752 6440 Fax: +33 1 4752 7049 Email: <a href="mailto:francois.kalaydjian@ifp.fr">francois.kalaydjian@ifp.fr</a> Internet: <a href="http://www.co2symposium.com">www.co2symposium.com</a>
Monday 8 <sup>th</sup> October 2007	The 2007 BCURA Coal Science Lecture, "Zero Emissions Power Generation from Coal – What is being done and What Needs to be done", by Mr. Nick Otter, Alstom Power Ltd.	The Institute of Physics, 76, Portland Place, London, W1B 1NT.	Mr. J.D.Gardner, The BCURA Company Secretary.  Tel : 01242-224886.  E-mail : <a href="mailto:bcura@gardnerbrown.co.uk">bcura@gardnerbrown.co.uk</a>
<b>Wednesday 14<sup>th</sup> November 2007</b>	<b>The Coal Research Forum Autumn Meeting, to be held jointly with the ESG, CUSG and ECTSG of the IChemE, and the Energy Institute "Understanding the Low Carbon Economy"</b>	<b>The University of Birmingham Conference Centre.</b>	<b>Event Organiser :</b> <b>Dr David J A McCaffrey</b> <b>Tel : 01242-236973</b> <b>E-mail :</b> <b><a href="mailto:mail@coalresearchforum.org">mail@coalresearchforum.org</a></b>  <b>Programme Organiser :</b> <b>Mr Clive Hadfield</b> <b>Tel : 01455-552999</b> <b>E-mail :</b> <b><a href="mailto:chadfield@tiscali.co.uk">chadfield@tiscali.co.uk</a></b>
<b>Wednesday 21 November 2007</b>	<b>Coal Preparation Divisional Meeting Joint with the Minerals Engineering Society Southern Group</b>	<b>The University of Nottingham, Nottingham</b>	<b>Mr Andrew Howells</b> <b>E-mail:</b> <b><a href="mailto:hon.sec.mes@lineone.net">hon.sec.mes@lineone.net</a></b>
Wednesday 28 November 2007	British Flame Research Committee, "The Development of Industrial Burner Technologies to handle New and Difficult Fuels"	National Metal Forming Centre, West Bromwich, West Midlands	Mr. Geoff Rhine, Tel : 0121-441-3865 E-mail : <a href="mailto:jmrbf@aol.com">jmrbf@aol.com</a>
Tuesday 2 September 2008	IEA Coal Science Workshop (topic to be advised)	University of Cardiff, Cardiff	Robert Davidson. IEA Clean Coal Centre Gemini House, 10-18, Putney Hill, London, SW15 6AA. Tel : 0208-7890-2111. <a href="mailto:robert@iea-coal.org.uk">robert@iea-coal.org.uk</a>

<b>Wednesday 3- Friday 5 September 2008</b>	<b>7th European Conference on Coal Research and its Applications</b>	<b>University of Cardiff, Cardiff</b>	<b>Dr A W Thompson</b> Tel : 02476-192-569 or 01332 514768 <b>E-mail :</b> <a href="mailto:awt_crf@btinternet.com">awt_crf@btinternet.com</a>