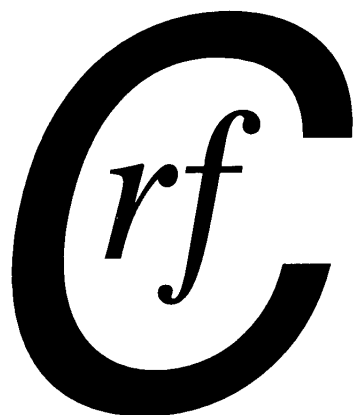


No. 33

January 2002

# NEWSLETTER

*of the*



*Coal Research Forum*

Edited by: Dr Svenja Hanson



#### EDITOR'S COMMENTS:

First of all, Happy New Year to all members and friends of the CRF! 2002 could become quite an exciting year for people interested in energy – hopefully there will be a lot of news and comments on the Energy Review in the May edition. Meanwhile, the current issue features the 50<sup>th</sup> BCURA Coal Science Lecture jointly held with CEA's first David Gunn Memorial Lecture. Also included is an edited version of the very enlightening dinner speech of the event. B Ricketts has been sounding out opinion on CCT in the House of Lords, and heard many a speech in favour of coal. And last, but not least, the Coal Forum held its Autumn Meeting at the University of Sheffield. Sadly the mood was a little subdued, as we presented the papers which would have gone to San Francisco, if the terrible events of September 11<sup>th</sup> had not led to the cancellation of last years ICCS.

'hope you enjoy the 33<sup>rd</sup> edition, and, as ever, many thanks to all the contributors and words of encouragement to anybody who might like to share information or opinions in the 34<sup>th</sup> edition.

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## First Call for BCURA Funding

The Industrial Panel has been established within the BCURA framework to arrange and promote the funding of coal research at UK universities at a pre-competitive level, that is between "blue sky" research and the commercial application stage. Accordingly, the Panel will attach considerable significance to the potential strategic, technical and economic value of the results of a project.

In this first call for proposals, highest priority will be given to proposals in the following four subject areas environment, combustion, characterisation and handling.

Other coal research subject areas will also be considered but will need to be fully justified. The guideline for the level of funding applied for through the Industrial Panel should be no greater than £50-60k. Exceptions to this limit will be considered but these will need to be fully justified.

**CLOSING DATE IS THE 28th FEBRUARY 2002**

For more details, especially on the format the proposal should take, visit the BCURA website at <http://www.bcura.org/1stcall.html>

## The 50<sup>th</sup> Robens Coal Science and 1<sup>st</sup> David Gunn Memorial Lectures 15<sup>th</sup> October 2001, Painters' Hall, London

Last year BCURA joined forces with the Combustion Engineering Association treating guests to two lectures on the 15<sup>th</sup> of October, the 50<sup>th</sup> BCURA Robens Coal Science Lecture and the 1<sup>st</sup> David Gunn Combustion Engineering Memorial Lecture. The setting was the beautiful Painters' Hall in the City of London, courtesy of the worshipful company of Fuellers. It really was quite impressive; for those who could not attend, imagine stepping into a cross between the V&A and the National Gallery. With over 100 guests having found their way there from industry, institutions and academe the attendance was very good indeed. As I do not get down to London much myself, I was feeling almost like a tourist before I arrived, having spotted the Tate Modern, the Globe Theatre and the (apparently still dysfunctional) millennium bridge on the way there from Blackfriars station. But the real attraction was, of course, the topic of the lectures: The fossil fuel industry and global warming.

Prof J Harrison set the scene in his introduction by reminding us that we are currently in the middle of a government review on energy policy. Whereas the long-term aim is for renewable sources to take over our energy supply, it is more than likely that the fossil fuel industries will stay with us for quite some time yet. Their challenge is therefore to improve efficiency and reduce emissions as much as possible.

The Robens Coal Science Lecture was given by K Fergusson, who looks back on a very distinguished career in engineering and until earlier last year was Chief Executive of the Coal Authority.



*K Fergusson (l) with Dr J Gibson, President of BCURA (r)*

He began by refuting the view that coal automatically equates to global warming. The main application of coal in the UK is power generation, 73% of its use in 1999. But the percentage of power generated from coal has already fallen dramatically from 70% in 1990 to 32% in 2000 and is expected to continue to fall to 6-13% by 2020. This forecast is, to some extent, based on the assumption of the environmental unacceptability of coal, but, especially the lowest case scenario, is hardly compatible with a diverse, secure energy supply. K Fergusson proceeded to take us through an historic journey of pollution problems, starting with particulates, then moving on to SO<sub>2</sub> and NO<sub>x</sub>, before arriving at CO<sub>2</sub>. With the former three problems deemed mostly as overcome, CO<sub>2</sub> is the real challenge now following the commitments made in Rio and Kyoto. Currently a review is under the

way into the possibility of government support for a clean coal demonstration plant. Four configurations are being considered: Firstly, retro-fitting CCT components to existing plant, secondly, retro-fitting a gasification component to an existing combined cycle gas turbine (CCGT) station, building a new, supercritical station, either with or without CO<sub>2</sub> capture or, finally, building a new integrated gasification combined cycle (IGCC) plant, again either with or without CO<sub>2</sub> capture. We were invited to consider the actual, projected and theoretical thermal efficiencies of different plant options. The best of the conventional coal-fired power plants achieve 36-40% thermal efficiency, supercritical ones 40-45%. The next generation of supercritical plants is expected to push these to 45-50%, which brings them to the same level of thermal efficiency as existing CCGT. But the next CCGT generation is predicted to achieve 50-55%, and IGCC is expected to reach 45-50+%. This does not solve the question of whether the future for power generation from coal lies in improving the steam cycle or opting for combined cycle plants, and both might conceivably be employed, as there need not be a mutually exclusive choice. Supercritical steam cycle plants are well established, which is in their favour, but they are thought to present considerable difficulty for CO<sub>2</sub> capture on account of the low CO<sub>2</sub> concentration in the flue gases. Combined cycles, able to use extremely high temperatures in the gas turbine part, have a distinct theoretical thermal advantage, which is so far barely reflected in actual efficiencies. But they also open up all sorts of possibilities for CO<sub>2</sub> removal or avoidance, which might give them the edge if CO<sub>2</sub> remains the determining future issue in clean coal technology.

Finally K Fergusson invited us to consider underground coal gasification (UCG), which is not a new idea, the first tests having been performed in Co Durham in 1912. But it could be seen in a new light on account of the CO<sub>2</sub> issue. In recent tests in Spain (El Tremedal, 1998), the gas resulting from UCG contained in the order of 45% CO<sub>2</sub> and was received at pressures up to 40 bar, conditions much favouring the separation of CO<sub>2</sub> from the gas stream. One of the uses of CO<sub>2</sub> is enhanced oil recovery, so putting together the presence of considerable marine coal resources and the presence of depleting oil fields in, say the North Sea, could be an attractive option.

The thought about oil, not necessarily its depletion, also provided a good link to the speaker for the first David Gunn Combustion Engineering Memorial Lecture, J. Mumford, Director of BP Oil UK. Oil, as well, is here to stay. Reserves are expected to last at

least another 50 years and world-wide production is predicted to peak around 2020/25. In the UK production is expected to peak earlier, from current levels of 4.1 mbarrels/day to 4.7, and to be in decline by 2010. Similarly, natural gas production in the UK is not far off its peak and by 2020 80% of the gas may have to be imported. But with huge reserves elsewhere, this is not necessarily a problem.



*Mr J Mumford (l) with Prof W G Kaye (r)*

If I devote less space to the second lecture it is not because it was less interesting or informative, but because, strictly speaking, its theme falls outside the scope of the Coal Research Forum. Coal did not get a mention until the very end, when J Mumford assured the members of the coal community present that he did not see the oil and gas industry as a threat to the coal industry. On the contrary, he saw the industries converging under the shared challenge of CO<sub>2</sub> emissions reduction. Nevertheless, I would like to pick up on a few points I personally found interesting. The efficiency of cars lies around 30% at present. Hybrid cars running at constant load could push this up to 40%, fuel cell driven ones to maybe 50%. Such an efficiency improvement alone would represent a considerable CO<sub>2</sub> emission reduction. Furthermore J Mumford does not appear to share the doubts about CO<sub>2</sub> storage prevailing in some quarters. He believes that there is plenty of storage capacity in old oil wells and in aquifers and that the real challenge is to develop the technology to capture the CO<sub>2</sub>. This would be easier to achieve if the gas stream is not diluted by N<sub>2</sub>. One such scenario is to produce H<sub>2</sub> by steam reforming at petrol stations, thus avoiding CO<sub>2</sub> at the point of combustion. Similarly, hydrogen fuel cells could achieve this for domestic power systems. The use of hydrogen for clean, distributed fuel and power is not a utopic vision. BP has opened its first H<sub>2</sub> 'petrol station' last year, and trials of H<sub>2</sub> powered buses are on the way.

I think it would be a fair summary of the evenings lectures to say that the consensus is that fossil fuel can be clean fuel and will be deemed environmentally acceptable if the CO<sub>2</sub> issue is tackled seriously.

After a brief, amiable and strictly non-controversial discussion after the lectures, the guests separated into those staying for the dinner and those who had to take their leave. As I was one of the latter, I have to apologize to the dinner speaker, Dr D Vincent,

Director of Strategy of the Carbon Trust, for not being able to report on his contribution to the evening. I very much enjoyed the two main lectures though and hope I have been able to give a taste of the many interesting thoughts put forward, and I am certainly looking forward to the 51<sup>st</sup> Robens Coal Science and 2<sup>nd</sup> David Gunn Combustion Engineering Memorial Lectures. *s.h.16/10/01*  
*photographs courtesy of CEA*

## **Climate Change, Energy Policy and the Carbon Trust by Dr D Vincent**

Dr D Vincent, Technical Director of the Carbon Trust, gave the after-dinner speech at the CEA/BCURA annual dinner that followed the lectures featured in the previous article. Although I was unable to stay for the dinner, I was fortunate enough to be supplied with the full script of the speech by CEA, for which I am truly grateful. The full speech did seem a little lengthy to be reproduced here, so I have edited it down to the main points: What is the Carbon Trust and how does it fit in in the grand scheme of energy policy:

“.....The Royal Commission on Environmental Pollution’s report “The Changing Climate”, published in June 2000, recommended that CO<sub>2</sub> emissions needed to be reduced by 60% by 2050 to stabilise emissions at twice pre-industrial levels, which, on the basis of our current knowledge, is considered necessary to avoid the worst impacts of climate change. Achieving reductions on anything like this scale will be a challenge requiring a step change in our thinking.

....The link between economic growth and carbon intensity has to be broken. This is where the climate change programme and the Carbon Trust come in. The UK climate change programme was announced in November last year. The Carbon Trust, a key component in this programme, came into being as an independent, private sector, non-profit making company at the end of March 2001 with support from the top levels in Government and business. Its remit from the Prime Minister is “to take the lead on low-carbon technology and innovation in this country, and put Britain in the lead internationally”. We are building a strong team to deliver not only energy and carbon savings from existing energy efficiency technologies and measures, but also to design a new

approach to low carbon innovation in the UK. An approach which will harness the range of funding bodies and programmes towards a shared goal. We propose to bring together the various and sometimes bewildering array of schemes, grants, funds, programmes and initiatives and mould them into a coherent fighting force to bring low carbon technologies and capabilities to market.

.....We had three main priorities this year: First, in focusing on the future and our longer term remit, we have not forgotten that we have a responsibility to help non-domestic energy users reduce their energy waste today. We are in the process of taking over the Government’s Energy Efficiency Best Practice programme, restructuring it and expanding its outreach services. A better Helpline service. More information and advice through site visits. Delivered more effectively to those who need it. And we intend to expand those services still further next year. Secondly, we have been developing our low carbon strategy. Our starting assumption has been that UK CO<sub>2</sub> emission reductions on the scale and timeframe recommended by the Royal Commission will be needed to avoid the worst impacts of climate change. The fact is, of course, we do not yet know if reductions on this scale will be sufficient. There is already a lot of climate change “momentum” in the system. Against that kind of emission reduction, we considered what the size of the “carbon gap” might be. The range we came up with, 55-90 MtC pa, is not a million miles away from estimates from other groups working in this area. Our preliminary view is that we can get a long way towards filling that gap with a vigorous programme of energy efficiency deployment and low carbon technology innovation, provided there is a policy framework which wholeheartedly enables innovation. Whether we can

fill the whole gap in this way is not clear. And whether a 60% reduction in carbon emissions will be sufficient to avoid the worst climatic impacts is by no means clear either. In the famous words of the academic community “further research is required”. And in this case they are right. We will therefore be keeping our strategy under review. Our aim is to post our strategy on our website ([www.thecarbontrust.co.uk](http://www.thecarbontrust.co.uk)) in the next few weeks. We will be encouraging informed comment. Our third priority is to design our low carbon innovation programme. This programme aims to provide a “funding continuum” through support partnerships with other funding and programme bodies. We will be investing our funds where necessary in the innovation process. And where our money will make a difference. From research, through demonstration and pilot scale operations to early market take up. The Carbon Trust will not be picking winners, but neither will it be spreading its limited resources too thinly in a vain attempt to cover all the options.

We will consider any kind of project proposal in the energy efficiency, low carbon technology and abatement areas. Not only for applications to deliver energy and carbon savings at home but also abroad. In addition to our objectives to meet ongoing climate change targets at home and helping to improve energy efficiency in the non-domestic sectors, we have a third objective. To develop a UK industry sector supplying low-carbon technologies nationally and internationally.

Coal has consistently been seen as an important part of a balanced mix to provide the UK’s energy demands. It currently supplies around a third of the electricity generation in the UK from about 30 GW of coal burn capacity. And it is assumed in the DTI’s energy projections that coal will supply around 10-22% of electricity needs in 2010. So there is a future for coal in the UK. But even its staunchest supporters would surely not argue with the statement that it is not exactly the least polluting power generation source. And, significantly, whereas we are reducing coal burn and improving coal burn

efficiency, the emerging countries in particular, are collectively increasing coal burn. The International Energy Agency forecasts have indicated that some 38% of the world’s electricity will still be generated from coal by 2020. There is a very large and growing world market for cleaner coal technologies. There is an urgent need, therefore, to limit the environmental disadvantages associated with coal utilisation. More efficient combustion, abatement technologies and carbon sequestration are all options which deserve consideration. Cleaner coal technology is an essential part of the global future for coal. The Government’s review of the case for supporting the development of Cleaner Coal Technology Demonstration plant is therefore both timely and relevant. Such technology could play an important role at home and abroad. There have already been a number of trade missions to China and India to promote UK cleaner coal expertise as well as a number of collaborative R&D and technology transfer projects initiated by the DTI. Such activities are important since just a 1% increase in the efficiency of all Chinese Coal Fired Power Stations is equivalent to roughly all the wind turbines in western Europe – of the order of 2.5GW. Such a modest increase could probably be achieved by specifying existing best practice undertaken in conventional coal fired UK power stations. The challenge, of course, is raising the efficiency of coal use, particularly in those countries which are likely to be dependent on coal for the foreseeable future. It is good to see the DTI taking the initiative via its Cleaner Coal Technology Programme. And, depending on the way in which the international carbon trading market evolves, there could be carbon credits for investors and substantial contributions to Kyoto and post-Kyoto greenhouse gas targets. That is why the Government’s decisions on the cleaner coal demonstration project – and indeed on the energy policy review more widely – are eagerly awaited. ....”

DR DAVID VINCENT, Technical Director, **The Carbon Trust**

*ed s.h*

## House of Lords Debate on Cleaner Coal – A Visitors Account by B. Ricketts

Over the years there have been many debates and inquiries in the Houses of Parliament on coal, always serious and often emotive. A number have considered clean coal, the subject of an adjournment debate in the Lords on 20th November which I watched from the Strangers' Gallery.

Lord Lofthouse of Pontefract secured this timely debate just as the Department of Trade and Industry (DTI) was reaching the end of its review on the need for Government support for a cleaner coal demonstration plant. The title of Geoffrey Lofthouse's autobiography, *A Very Miner MP*, modestly summarises his background. He opened with a nicely crafted speech presenting all the arguments in favour of clean coal technologies (CCTs) with which we are now familiar, especially the folly of allowing an over-dependence on imported gas from Russia, North Africa and the Middle East. Lofthouse briefly referred to the conclusions emerging from the DTI review and praised the Department for looking seriously at how clean coal power stations might be linked to enhanced oil recovery projects in the North Sea. However, he felt that the energy security value of coal should not be ignored and called for a clean coal obligation to stimulate short to medium term activity that would help meet the UK's environmental objectives at an affordable cost.

Lord Hardy of Wath spoke next, casting doubt on the value of energy forecasts and noting that many published forecasts from the past now look ridiculous. Peter Hardy, an MP from 1970 to 1997, trained as a teacher and is a keen naturalist. His contribution on energy matters has been recognised by the All-Party Group for Energy Studies where he holds the position of Honorary Secretary. He continued with a fairly well informed brief on CCTs, recalling Ian McGregor's myopic vision when chairman of the British Coal Corporation at the time when work on pressurised fluidised bed combustion (PFBC) at Grimethorpe and gasification at Westfield could have led to success stories for British industry. Above all, Hardy saw in coal a fuel that offers future stability against the terrorist threat that has already marred the 21st century. As a naturalist, Hardy could not resist taking a swipe at the destructive power of windmills to kill migrating birds. In any case, he had been advised by the Coal Authority that CCTs offer a cheaper way than renewables to reduce carbon emissions. Somewhat out of context, Hardy

concluded with a request to promote coal mine methane projects, quoting a potential of 1 GW.

Lord Mason of Barnsley reflected on his past involvement with CCTs, particularly the development of fluidised beds by BCURA at Leatherhead, a technology which in its pressurised form was taken up not by a British company but by ABB Carbon. Roy Mason, a miner at 14, rose to become a senior government minister in the 1960s and 1970s, including a short stint as Minister for Power under Harold Wilson. He contrasted the 1991 Select Committee report on clean coal with Energy Paper 67 and found the latter sadly lacking in substance.

Lord Ezra of Horsham gave an impassioned speech, drawing on many up to date reference sources, including reports from the International Energy Agency's Greenhouse Gas Programme based at Stoke Orchard near Cheltenham. With carbon dioxide (CO<sub>2</sub>) captured and used to enhance oil recovery from the North Sea, Ezra saw coal as "*a new source of renewable energy available in unlimited quantities*". He was insistent that now is the time to take decisions, to introduce a clean coal obligation and to move ahead with new technologies, including carbon capture and storage. He cited Kellingley Colliery as a suitable location for demonstration. Derek Ezra had a long career in the coal industry, from its nationalisation in 1947 to become chairman of the National Coal Board throughout the 1970s and early 1980s, and still has an active involvement with the energy industry, particularly the promotion of combined heat and power (CHP). He is the Liberal Democrat spokesman on energy in the Lords.

Baroness Miller of Hendon replied from the Conservative front bench with a tirade of environmental criticism against coal. Thankfully, this Soroptimist and business lady behind many a beauty club was not about to write-off coal but instead used these criticisms as a reason why a cleaner coal demonstration plant is so important and timely. The Baroness took the opportunity to attack the Government for not having given CCTs a share of the £400 million subsidy available for renewable energy, as Labour promised back in 1996.

Lord Sainsbury, Under-Secretary of State at the DTI, responded for the Government. With the DTI and the Cabinet Office's Performance and Innovation Unit

yet to complete their reviews, David Sainsbury stated that he could not give definitive answers, but would indicate the key issues and questions. After largely dismissing the need for supporting further demonstration of existing CCTs, he went on in more positive terms. The life of existing coal-fired power stations could be extended, to all intents and purposes, indefinitely and he stated that there may be a case for Government support of projects to retrofit new technologies to old plant through a relatively modest increase to the existing CCT R&D programme. However, on new clean coal power stations he was less enthusiastic. They are too expensive at current price differentials. He believed that control of pollutant emissions, such as SO<sub>2</sub> and NO<sub>x</sub>, was largely manageable using well proven equipment and that the difficulty now lay with CO<sub>2</sub>. Sainsbury recognised the potential of carbon capture and storage, though he stated that a great deal of work still needs to be done in this area. His summary of the development status of supercritical pf plant and integrated gasification combined cycle (IGCC) was fair and accurate. In response to the calls from other Lords for a clean coal obligation, he said that the Government needed to think carefully about the right mechanisms to create incentives for industry to make carbon savings from coal use. Sainsbury closed by assuring that matters would be much clearer early next year after the two review teams had reported.

Lord Sainsbury of Turville, a member of the powerful supermarket family, was Chairman and Chief Executive at Sainsburys from 1992 to 1998. He was appointed a Government minister following his peerage in October 1997 and has responsibility for the Office of Science and Technology as well as the Research Councils. This debate will certainly have raised the profile of clean coal with this influential minister. His response was the most positive heard in Westminster since 1996 when the Labour Party suggested that developers of clean coal power stations should have the same benefits as renewable developers by extending the scope of the then *non-fossil fuel obligation* (NFFO) to include clean coal.

Apart from a handful of tourists who drifted in and out of the Strangers' Gallery, the debate was watched by Rob Wright and Brian Morris from the DTI, respectively head of coal and manager of the CCT review. Lurking in the shadows, two gentlemen from Mitsui Babcock could also be made out. Not the turnout one sees for Question Time, just a few souls hoping to turn the tide of attitude against coal.

Brian Ricketts, 30 December 2001  
 (bricketts@ukcoal.com)  
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## CRF Internal News

### Treasurer Resigns

At the last Executive Meeting on the 21<sup>st</sup> November in Sheffield, following the Autumn Meeting, it was brought to our attention that M Thomas wishes to resign his position as Treasurer. He has kept our accounts in good shape for many years and deserves our sincere gratitude for his efforts. The matter of his succession will be dealt with at the next AGM in spring 2002. In the meantime M Cloke has volunteered (or has been volunteered) to look after the accounts.

### New Division Chairman

The Chair for the Coal Preparation Division has recently become vacant on account of S Hall, the previous occupant, taking up a position on the other side of the globe (literally). He has chaired the lively, productive division for many years and, again, a big thanks is due. C Shah has agreed to take over. After many years with the NCB and British Coal at the Mining Research and Development Establishment, where he was heavily involved in coal preparation, he has been working in SchEME at the University of Nottingham since 1994.

# **Power Production in the 21<sup>st</sup> Century: Impacts of Fuel Quality and Operations**

## **28<sup>th</sup> October – 2<sup>nd</sup> November 2001, Snowbird, Utah, USA**

The United Engineering Foundation conference on “Power production in the 21<sup>st</sup> century: Impacts of fuel quality and operations” took place at the beginning of November in Snowbird, Utah.

About 40 scientists and engineers attended. Many more cancelled or did not complete their registration after the tragic events of 11 September. Will Gibb, Jon Wells and Fraser Wigley attended the conference from the UK. Most other attendees were from the States, Scandinavia and Australia. Oral presentations filled four days of the conference, in addition to a poster session and technical visits. Most of the

papers focused on ash formation and deposition during coal or biomass combustion, from plant trials through detailed characterisation to modeling. Many presentations were followed by lively debate, which carried on at mealtimes.

Bright sunshine and the mountainous setting of the Snowbird resort made ‘off-duty’ activities enjoyable, especially after a heavy snowfall. The conference series will continue in Denmark early in 2003. For more information contact Fraser Wigley ([f.wigley@ic.ac.uk](mailto:f.wigley@ic.ac.uk)).

*Fraser Wigley  
Imperial College*

## **Autumn Meeting 2001**

### **A Selection of the UK Papers from the ICCS 2001**

#### **21 November 2001, Tupton Hall, University of Sheffield**

It has become a CRF tradition that every International Conference on Coal Science is followed by a second chance to hear some of the UK papers presented at it. But this year it was not so much a second chance as the one and only chance. Following the tragic events of September 11<sup>th</sup> the American organisers of the conference, planned to take place in San Francisco from September 30<sup>th</sup> to the 5<sup>th</sup> of October, decided to cancel, or possibly re-schedule, it. Maybe the uncertainty and down-beat mood following the cancellation deterred some people from attending the autumn meeting. The attendance of the meeting was down from previous years with just over 30 members present. Then again, it is a busy time of the year, both in industry and academe, so many people probably simply did not have the time to spare.

For those of us who managed to make it to Sheffield, it was a pleasant meeting with 11 talks on a wide variety of subjects chosen to represent the 31 papers from the UK that would have been given at San Francisco. Many thanks to the local organiser, N. Russell, who assured that the meeting proceeded smoothly in most agreeable surroundings.

After a brief welcome by V.Sharifi, the meeting, chaired by our secretary D.McCaffrey, kicked off with a local contribution by N.Russell. The subject caused some surprise amongst the members, as it dealt with enhancing the slagging propensity of ash. Low NO<sub>x</sub> burners and the resulting lower flame

temperatures lead to less slagging and consequently a larger fly-ash load than some ESP systems are designed to deal with. The addition of calcium carbonate and dolomite was shown to enhance slagging by providing CaO. The work continues to optimise addition levels. The second presentation was by J.Lakatos from Nottingham University and was concerned with the possibility of coal helping to clean chromium-contaminated waste water. It was shown to have the potential to reduce and remove CrVI, which is harmful. The effectiveness depends on coal rank (lower ranks work better) and the pH of the solution, amongst other things. It is planned to investigate whether the performance could be further enhanced by altering the coal structure. G.P.Reed from Imperial College followed on considering trace elements in the co-combustion of coal and bio-mass. Two types of biomass were used, straw and wood bark, and with neither of them was any considerable synergy regarding trace elements observed. The order of volatility, i.e. the partition between gaseous and solid products, was much the same as observed for coal alone. He also introduced a novel suspension-fired reactor developed at Imperial College, which featured again in N. Paterson’s talk at the end of the morning session. Before then J. Jones from Leeds presented her work on the co-combustion of coal and bio-mass. It also featured at the June meeting at Drakelow (see Newsletter No.32), but, just to re-cap, considerable synergism between coal and

sawdust was observed leading to much reduced PAH emissions. Next, I talked about the modified and newly re-commissioned electrostatic precipitator rig at Nottingham University and the behaviour of carbon in fly-ash during electrostatic precipitation. In a second presentation from Leeds University R.Backreedy elaborated on the difficulties that blending of coal presents to combustion modelling, especially when the exact composition of the blend is unknown. The behaviour of blends was also the topic of the final talk of the morning session by N.Paterson. At Imperial College also some synergy in two-coal blends was observed, which was consistent with preferential combustion of the more reactive component.

After having been fortified by traditional Yorkshire fayre, the afternoon commenced with another presentation by G.P.Reed. Again trace element partitioning was the subject, this time during co-gasification with sewage sludge, which tends to have high lead and zinc contents. Although some trace element concentrations in the flue gases were higher than for coal on its own, the emissions remained within the regulatory guide-lines. D.Large from Nottingham University departed from the theme of burning or gasifying coal, considering its use in climate study. Our current knowledge of climate is mainly based on marine samples, but coal could change that. The authors were able to identify a

catastrophic climate event known as the Late Palaeocene Thermal Maximum from cores of coal deposited at the time. In view of the current concern about global warming, the scale of the climate event made a big impression on the audiences imagination, especially as it is thought to have started with a gradual increase of CO<sub>2</sub> in the atmosphere. The penultimate presentation was also from Nottingham University, given by M.Cloke. He outlined recent advances in image analysis techniques with the view to improving carbon burn-out predictions. The main achievement is that information can now be obtained from individual particles and the system is capable of separating touching particles. The final presentation was by K.R.Cliffe from the Waste Incineration Centre at Sheffield University. It concerned the co-firing of olive oil waste in a FBC, but also featured work on other types of waste. For olive oil waste in particular it was found that up to 20% could be added to coal with an efficiency loss of 5%. In general the potential of FBC of coal to deal with, and derive energy from, wastes that could not easily be incinerated on their own, and most likely would become landfill, was demonstrated. I think everybody who attended would agree that we had an interesting, enjoyable, well organised day and that, judging by the wide variety of topics presented, coal research at UK Universities is going strong.

*s.h. 3/12/01*

## CALENDAR OF COAL RESEARCH MEETINGS AND EVENTS

Date	Title	Location	Contact
12 March 2002	<b>Joint Meeting of Combustion Division and Advanced Power Generation Division</b>	Mitsui Babcock, Renfrew	Dr A W Thompson SChEME University of Nottingham Nottingham NG7 2RD Tel: 0115 9514198 Fax: 01159514115 e-mail: <a href="mailto:alan.thompson@nottingham.ac.uk">alan.thompson@nottingham.ac.uk</a>
April 17 <sup>th</sup> 2002	Combustion Institute (British Section) Spring Meeting 2002  to be held in association with The Institute of Physics Combustion Physics Group, the British Flame Research Committee and the Coal Research Forum	Queen Mary, London	Prof Chris Lawn Department of Engineering Queen Mary, University of London, Mile End Rd, London E1 4NS Tel: 0207-882-5279 Fax: 0208-983-1007 e-mail: <a href="mailto:c.j.lawn@qmul.ac.uk">c.j.lawn@qmul.ac.uk</a>
<b>24 April 2002</b>	<b>AGM</b>  <b>Proposed topics are co-ordination of UK ECSC activities and the outcome of UK government Energy Review</b>	IMEchE Headquarters London	<b>David McCaffrey</b> The Coal Research Forum P.O. Box 154 Cheltenham GL52 5YL Tel: 01242 236973 Fax: 01242 516672 E-mail: <a href="mailto:coalresearch@coalresearchforum.org">coalresearch@coalresearchforum.org</a>
2-5 April 2002	6 <sup>th</sup> European Conference on Industrial Furnaces and Boilers	Lisbon, Portugal	Prof Albino Reis Rua Gago Coutinho 185-187 4435-034 Rio Tinto , Portugal Tel: +351 2297 34624 Fax: +351 2297 30746 e-mail: <a href="mailto:conference@infub.pt">conference@infub.pt</a> web: <a href="http://www.infub.pt">http://www.infub.pt</a>
24 <sup>th</sup> - 25 <sup>th</sup> June 2002	Final Symposium on the ECSC Coal Research Programme	Luxemburg, details to be announced	Mr J K Wilkinson, Commission of the European Communities, Rue de la Loi 200, Brussels, Belgium, B-1049 Tel : 00322-295-5576 Fax : 00322 -296-6016 E-mail: <a href="mailto:keith.wilkinson@cec.eu.int">keith.wilkinson@cec.eu.int</a>
7-10 July	4 <sup>th</sup> International Symposium on Coal Structure 2002 – Structure and Reactivity of Carbonaceous Materials	Gliwice, Poland	Dr Janusz Pajak Polish Academy of Sciences Institute of Coal Chemistry Gliwice, Poland Tel: 48 2380 770 Fax: +48 32 2312 831 E-mail: <a href="mailto:cs2002@karboch.gliwice.pl">cs2002@karboch.gliwice.pl</a> Web: <a href="http://www.karboch.gliwice.pl/cs2002">http://www.karboch.gliwice.pl/cs2002</a>
21-26 July 2002	29 <sup>th</sup> International Symposium on Combustion	Sapporo, Japan	Prof Ken-ichi Ito Hokkaido University Kita 8 Nishi 5, Kita-ku Sapporo, Japan e-mail: <a href="mailto:ito@york-me.eng.hokudai.ac.jp">ito@york-me.eng.hokudai.ac.jp</a>
16-18 <sup>th</sup> September 2002	4 <sup>th</sup> UK Meeting on Coal Research and its Applications	Imperial College, London	Dr A W Thompson SChEME University of Nottingham Nottingham NG7 2RD Tel: 0115 9514198 Fax: 01159514115 e-mail: <a href="mailto:alan.thompson@nottingham.ac.uk">alan.thompson@nottingham.ac.uk</a>