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NEWSLETTER

of the

Coal Research Forum

Edited by: Dr Alan Thompson

EDITOR'S COMMENTS:

Welcome to the 40th edition of the CRF Newsletter. The Spring 2004 issue has a summary of the papers given at the re-launched Coal Preparation Division meeting which took place at the end of March at UK Coal Mining Ltd. Headquarters offices at Harworth. Our Annual General Meeting is scheduled for May 19th at Cottam Power Station and there has been considerable interest in our 5th European Conference planned for early September in Edinburgh. We have a number of articles including one on underground coal gasification and also a summary of the last RCFS funded project appraisal results. I hope you will find something of interest in our latest offering.

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Re-launch meeting of the Coal Preparation Division

Held at UK Coal plc. Headquarters, Harworth, March 31st 2004.

The re-launch meeting of the Coal Preparation Division took place at the Headquarters of UK Coal plc, Harworth. Its aim was to bring attendees up to date with regard to the present status of coal preparation in the UK; to describe what is currently being developed both commercially and from UK universities and to identify the R&D needs for the future. The division had not held a meeting since June 2002 time as the previous chairman was no longer employed in this field. The re-launch got off to a uncertain start when the chairman failed to materialise. However, David McCaffrey stepped into the breach as emergency chairman for the day where he was ably assisted by Brian Ricketts.

Brian Ricketts welcomed the attendees to UK Coal and explained that the DTI Clean Coal Programme had been replaced by the Carbon Abatement Technology Programme. Although coal was seen as a key element it was stated by Lord Whitty that details regarding the programme would not be available until next year.

The first presentation in Session 1 was by Jonathan Brough of UK Coal Mining Ltd and was entitled "Setting the scene in the UK". The presentation comprised a review of existing coal preparation plants in the UK with reference to the processes employed. At present there are 9 coal preparation sites operating on 5 different coal seams of various qualities.

Ellington is currently working the Brass Thill seam which is a low volatile coal which is being won some 8km from the pit bottom. Coal preparation involves the use of 2 x 500mm diameter dense medium cyclones and a Wemco drum for large minerals. A Mozely desliming unit produces –63micron material which currently is discharged into the sea. The question posed was how long could this continue? The coarse discard is set down on the beach and this is a useful sea defence material.

Kellingley is cleaning Silkstone coal which is won about 6.5km from the pit bottom. Plant available includes a 500t/h Baum jig and a Wemco drum for domestic fuel upgrading. Conventional froth flotation involving 2x horizontal belt vacuum filters also takes place. The tailings from this process are dewatered using a multiplate tailing press.

Maltby preparation plant currently handles Park Gate from around 5.5km from the pit bottom. This is the only coking coal being produced in the UK and goes to Monckton Coke works. The coal passes initially through 2 Bradford Breakers for primary screening and cleaning, followed by natural medium deshaling barrels and natural medium cyclones. Conventional froth flotation is practised and the coal concentrate is collected and dewatered on a rotary vacuum filter. Tailings are treated by thickening and transfer to lagoons.

Harworth plant treats coal from the Deep Soft seam which is 7.5km distant from the pit bottom. The plant uses dense medium technology, conventional froth flotation and rotary vacuum filtration.

Welbeck plant cleans Park Gate and Deep Soft coal seams which are 6.5km from the pit bottom. The plant includes a single 500t/h Baum jig and a conventional Baum tower. There is a Wemco drum for domestic fuel upgrading, conventional froth flotation, rotary vacuum filtration to dewater coal concentrate and conventional thickeners and lagoons for tailings.

Thoresby plant treats the Deep Soft seam from 6.5km beyond the pit bottom. Plant is very similar to Welbeck except there are 2 x 250t/h Baum jigs.

Daw Mill plant cleans the Warwickshire Thick Seam which is 6.5km from the pit bottom. It is a very clean coal and power station fuel is produced by crushing and dry screening. The coal face is 7m thick. A Wemco drum is used for domestic fuel production. Very little waste and tailings are produced from this plant.

Rossington plant handles coal from Park Gate seam which is 8km from the pit bottom. Equipment available includes Bradford Breakers, natural deshaling barrels, natural medium cyclones, Mozely desliming cyclones and thickeners for lagooning of tailings.

Gascoigne Wood is a reception plant for coal from multiple faces of the Barnsley and Stanley Main seams. Its equipment includes natural medium deshaling, dense medium plant and column froth filtration with multi roll presses for filtration of coal and tailings.

A breakdown of the processes employed showed dense medium cyclones (3), Baum plant (3), Wemco drums (7), froth flotation (6) and thickeners (7).

Issues of concern for UK coal preparation plants were said to be:

- Greater distances from pit bottom to coal face.
- Majority of "ideal" coal faces are already worked out.
- Lower combustible yield.
- Mean ROM particle size always decreasing.
- Tipping activities are more costly / more difficult.
- Lagoons as large amounts of tipping space.
- Legislative environmental constraints regarding production and combustion and site activities.

Session 2 entitled "Coal preparation – what is being developed at present" began with another late substitute speaker. At very short notice, Mr David Baillie of JMC Mining Services Ltd. agreed to give his paper entitled "Review of coal preparation in China".

China is a very large country comprising 6 regions, North West, South West, Mid South, East, North and North East and 26 provinces. There are 17 different categories of coal with bituminous at 75% being the largest major type. Lignite accounts for 13% and anthracite for 12%. Its coal reserves are 1,000 billion tonnes and it is producing coal at the rate of 1.1 billion tonnes of raw coal per year. Only 7% of the reserves are surface mined. Approximately 50% of the coal is found in the North region with ~30% in the North West region. Shanxi province in the North West region is a particularly important area with 25% of China reserves being found here of which 60% is coking coal. Anthracite is mainly found in the North East region.

Coal from China shows moderate sulphur contents from 0.25% to 2.5% with an average value of 1.1%. Its ash content is less than 20% but the coal is regarded as being moderately difficult to wash. Washing is normally done for coking coals. China is the highest producer of SO_2 and CO_2 and the consequences of burning such quantities of coal have produced a serious environmental situation.

Coal consumption was stated as being 38% industrial, 31.5% power (low but increasing), 17.5% household, 7.7% metallurgical, 2.2% railways and 3.3%

other. China's energy demand for 2000 was 1.5 billion toe (tonnes oil equivalent) of which 66% was coal. Coal demand is expected to double by 2020.

It was stated that there were about 1,600 coal preparation plants in China where the average wash rate of 38.66% was low and the utilisation was 73.6%.

A description of the An Jialing 16Mtpa Coal Preparation Plant was given. A low sulphur circuit produces ~2,400 t/h and a high sulphur circuit, ~1,400t/h. There are primary and secondary dense medium baths which treat the –150+13mm material at RD's of 1.6 and 1.8. A similar set-up for the –13+0.15mm has RD's of 1.5 and 1.6. The –0.15mm thickener underflow is dewatered using Spanish filter presses.

Of the coal preparation plant operating in 2000, 56% were jig washers, 26% heavy medium, 14% were froth flotation and 4% were others.

China appears to have done more coal preparation development than in the UK, particularly in the fields of froth flotation and dense medium cyclones (DMC). A 3-product DMC was seen in China similar to the UK-developed Larcodems.

Dry beneficiation of coal has also been the subject of investigation. This has included the use of a compound dry cleaner for –18 to 0 coal, a fluidised bed based air dense medium approach and a triboelectric separation process for –38micron coal for PF use.

The coal preparation development targets for the 10th 5 year plan from 2001 to 2005 included; improvements to productivity, increasing the proportion of DM processed coal to >30%, increasing the wash rate of raw coal to >50% and increasing the wash rate of steam coal to >60%. Also included were the development of a coal blending capacity, a high sulphur cleaning process and a dry cleaning process. The establishment of a National Engineering Centre of Coal Preparation Technology was proposed and finally the export of coal was to be increased to 80Mtpa by 2005. By 2001 the figure had already reached 81Mtpa!!

Investments for the 5 year plan amounted to £463M of which £446M was for 33 coal preparation plants and £17M for 2 blending plants. These investments only covered the large state owned entities.

373 Technological Innovation projects were also mooted of which preparation plant activities comprised 297 projects and £714M. The remainder involved screening, blending, coal-water mixtures, briquettes and coal quality monitoring.

In conclusion David Baillie presented a list of business opportunities for the coal preparation industry. Firstly, it was important to recognise that China only wants the highest quality technology and investment. It wants to be involved in shared business or joint venture opportunities. Area of interest to China include coal preparation equipment supply, process design and plant construction, coal processing, R&D collaboration and Clean Coal Technology, education and training.

Countries currently operating in these fields in China are the USA, Germany with some Australian involvement. There did not appear to be much UK involvement at this stage.

The second paper in this session was entitled "New coal preparation plant for Russia" and was presented by Mr David Woodruff of EIMCO Ltd. The major coal reserves of Russia are found in the east of the country. The Kuzbass region in western Siberia is Russia's main coal mining region in terms of production and

quality accounting for 45% of national production. The coals are high quality steam and coking coals and anthracite characterised by their high calorific value and low sulphur contents. Further east in the Yakutia basin is the very large coal deposits of Neryungri. The location of these coal deposits is convenient for their export from the east coast port of Vladivostok.

Prior to 1990 the scope for export of coal cleaning plant was limited and only Wemco flotation cells found a market in Russia. However, since ~1992 the coal mining companies have been allowed to buy whatever they needed, for example, Wemco drum heavy media separators. From that time, other more varied plant has been supplied such as belt presses, thickeners and flotation cells. Climatic conditions in these regions are severe and the coal cleaning plant has to be enclosed within a heated building to prevent the water circuits from freezing. The region is also a high-risk earthquake zone.

Details were then provided for a number of contracts undertaken by David Woodruff's firm to supply coal preparation plant. These included Tomasinski Siberginski (1992, barter trade deal), Belovskaya (1993, thickener, belt presses) and Sokolovskaya (handled by Skeeda Mining Ltd. in Chorley, Lancashire).

A recent contract for Mezdurechenskaya Mining (Sibcoal) for a 630t/h state-of-the-art plant for a low ash 25x6mm power station fuel was also described. The contract, valued at $17M, involved Intertech Mining and required the treatment of multi-seam coals that were difficult to wash. Temperatures down to –46°C and an earthquake zone rating of 8 placed special requirements for the contract. The cleaning process produced coking coal, (8.5% ash, 7% moisture) and power station fuel (middlings).

A new product also described was the Wemco Smart Cell. Unlike other flotation cells this device has the rotor at the top. Available in sizes from 10m^3 to 70m^3 for coal a vessel of 250m^3 is currently being commissioned in Chile to process copper ore. The major players in Russia are from the USA, South Africa and Germany. Specific firms to note were Andritz for hyperbaric filters and Krebs.

The third paper in this session was given by Dr Neil Rowson from the University of Birmingham and was entitled "Coal preparation research at Birmingham University". Dr Rowson works in the Formulation Engineering Research Centre, which is part of the Chemical Engineering Department in the School of Engineering. Within the centre is the Minerals Processing section whose main activities include the utilisation of mineral resources more efficiently and the reduction of environmental pollution. The work of the group ranges over minerals separation processes, metals recycling and coal treatment. Major research areas are: biohydrometallurgy leaching and modification, the efficient separation of minerals from low-grade ores, thermally assisted liberation of minerals, the effect of microwave radiation on minerals, the recycling of metal and the desulphurisation of coal prior to combustion.

A number of topics were mentioned from completed projects which included subjecting coal to microwave radiation in order to lower the energy requirements for grinding, the investigation of segregation mechanisms using positron emission particle tracking (PEPT), microwave treatment of pyrite in coal to assist in its removal and microwave-enhanced solution techniques. It was disclosed by Dr Rowson, however, that currently little coal research is being carried out.

Coal handling research being carried out at the University of Nottingham and also some aspects of world-wide activities in this field were discussed by Dr Doug

Brown. He began by posing the questions 'What is coal handling? What are the problems? How do we measure coal handleability? and What can we do about it? The problems cited were blockages at transfer points, spillages and failures to discharge from railway wagons and silos. A further problem is that there are few means of quickly predicting or anticipating troublesome coals. Much work has been done to solve the problem but so far no universal coal handleability tester has been agreed and accepted despite Nottingham's recent work on its Handleability Monitor and Edinburgh's on its Cohesive Tester.

Accepting that handleability testing is still not fully developed, the discussion turned to means by which its adverse effects could be lessened. These included improving the quality, size and moisture levels of coals, reducing their handling and crushing, reducing coal washing and improving cleaned coal dewatering processes. Several of these factors can be achieved if the plant is operated within rather than above its design limits.

Two other areas of particular interest to the University of Nottingham are concerned with improving the quality of washed coal and dry cleaning of coal. The first involves the imaging of froth flotation concentrates. This work is aimed at the production of cleaner, more easily filtered coal, high ash tailings, (for which saleable products may be possible), and optimisation of chemical dosing. Dry cleaning is aimed at reducing the amount of ROM coal which is washed. The further removal of high ash fines results in a better quality dry product.

Dr Brown concluded by indicating that handleability problems could be reduced if a minimum of fines were produced and that minimal water washing of ROM coal should take place. However, customers and market forces will dictate what the nature and quality of the final product.

Dr Jan Cilliers then presented a paper entitled "Froth flotation research at UMIST". Dr Cilliers manages the Froth and Foam Research Group at UMIST which is using advanced image processing and analysis techniques for the characterisation of flotation froths, and to study the mechanisms of bubble particle interactions. Using real-time image analysis of the froth structure and dynamics, a kinetic model of the flotation process has been developed. By understanding the effect of the operating conditions on the froth, process control can be effected. Image analysis has recently been enhanced with tomography.

The image of the surface of the froth only yields limited information of the froth kinematics. A flow model of a cross-section through a foam has been developed that yields a visual representation of a flowing foam, incorporating coalescence and bursting. This model is being used to optimise equipment design and understand the stability and breakdown of industrial foams, such as are found on oil-gas platforms and in bio-transformation plants. This model has been extended to include the liquid and solid motion, particularly for mineral flotation. Other research interests are in the areas of processing, modelling and the separation of particulates and particulate systems. Of particular interest is the use of hydrocyclones for the dewatering and recovery of sub-micron particles.

Dr Cilliers described two case studies using the froth model developed at UMIST. In the first the addition of wash water was simulated. Two methods are possible, adding water uniformly or adding it at a single point. The model predicted that the latter would give improved performance and that the former would result in a lower coal recovery. The second case study involved froth handling. Three types of launder design were considered. These were the double cone, dough-nut (internal) and single cone types. The data produced showed that the single cone

gave the best performance followed by the double cone and finally the dough-nut launder.

Dr Cilliers summarised his presentation by indicating that they have developed a complete froth floatation model capable of modelling gas, liquid and particles. It can also handle arbitrary shaped vessels under wide operating conditions and it has been industrially verified.

Other research activities in this filed at UMIST include froth image analysis for control purposes. On-line froth stability measurement and tomography.

Research at the University of Edinburgh entitled "Coal blends: Measurement and prediction of handleability" was described by Dr Zhijun Zhong. A general introduction to coal types and the requirements of power stations was followed by mention of the types of handleability monitors hitherto available and their deficiencies.

The objectives of the work described were to establish the scientific basis for cohesion prediction for a coal blend from the cohesive strength characteristics of its constituent coal. In addition, to develop effective solutions for achieving handleable coals which minimise the wastage of combustible material and which satisfy all other contractual requirements. Finally, to implement the multi-parameter optimisation in a computer programme.

Working with the Edinburgh Cohesion Tester a number of different combinations of coals and moisture contents were examined. In summary, it was found that when two sticky coal were blended at sub-critical moisture contents, the cohesion of the blend was found to vary linearly with the blend composition. By contrast, however, it was found that when a coarse coal and a sticky coal were blended, there was no linearity found regardless of the moisture contents. These results formed the basis for a model which was developed. The results from the model showed excellent agreement with actual measurements. A further development to the model ensured that contractual requirements for power generators such as calorific value, ash, cost and cohesiveness of the blend were all met when using three different coal blend components.

Research is continuing at Edinburgh to semi automate the large-scale cohesion tester and the development of on-line handleabilty monitoring is "on the way".

The final session of the day was entitled Coal Preparation : What needs to be done? The first paper was by Steve Pringle of UK Coal Mining Ltd and was entitled "Future expectations for coal preparation research and development". Mr Pringle began his presentation by explaining the important areas of responsibility within coal preparation at UK Coal Mining Ltd. These included Policy, Operations, Performance and Efficiency.

Coal cleaning plants were listed as 3 DM plants, 2 shale DM plants, 2 Baum jigs, 1 Baum jig/DM plant and 1 shale medium plant. Starting with an average ROM ash content of 35%, 24 million t/y are washed with and average saleable yield of 65%.

Performance Monitoring uses five targets, as follows: plant performance vs potential, delays as a % of availability, number of quality complaints, coal losses in discard at SG 1.62 and ash content of fine solids in plant effluents.

Efficiency is classified as the cost of operation and is expressed as £/tonne of ROM processed or £/GJ of saleable products. The cost of operation was broken

down into four categories, i.e. process equipment/ materials (40%), mobile plant, (25%), labour (25%) and power heat and light (10%).

In terms of where R&D should be focussed Mr Pringle said that increased performance meant an increase in efficiency which resulted in a lower cost/tonne. R&D must influence the cost/tonne of the saleable coal. Areas of possible benefit include improvements in the reliability of equipment/systems, equipment design should be fit for purpose and not complex, innovative materials should be considered which could offer improvements in impact/wear and corrosion resistance, limited downtime should be sought via maintenance management systems and proactive (on-line) monitoring systems should be considered.

Issues in R&D relating to coal quality include more work on spontaneous combustion, on-line monitoring, (i.e. sampling, analysis, handleability, moisture ash, sulphur and chlorine contents), desulphurisation processes, (i.e. gravity and froth flotation), demineralisation of coal, (i.e. chemical treatment with hydrofluoric acids).

R&D opportunities in coal processing include pneumatic dry cleaning of coal, pneumatic / hydraulic conveying of coal, continuous dewatering of coal at fine sizes, dry screening of minerals at fine sizes and magnetite recovery, (recent 50% increase in the cost of magnetite).

A comment on coarse discard / fine effluent (slurry) was made regarding possible new uses. At present 100 million tonnes of accessible coarse discard is available for immediate disposal. It has been used as fill, landfill overcapping, raising riverbanks and in cement manufacture. In addition, 10 million tonnes of lagooned/ stockpiled material is available for recovery and / or upgrading. It is used as a fertiliser and when sintered after pelletisation produces a lightweight engineering material. New, innovative uses for these materials would be welcomed.

In conclusion, R&D needed to be innovative, radical and effective. Quality, performance and efficiency improvements adding value to the processes were what was needed and the suppliers / researchers were urged to think laterally and take more risks.

Steve finally left us with the most memorable (mis)quote of the day!! – "As John F. Kennedy, that famous coal plant engineer, once said, 'And so my fellow coal preparation engineers, ask not what coal cleaning can do for you, but what you can do for coal cleaning!!' ".

Philip Deakin, who has been Director General of ABMEC – Association of British Mining Equipment Companies since 1996 gave the next paper which was entitled "The export of UK mining technology and governmental sector support". ABMEC is the trade association representing the major mining equipment manufacturers in the UK. Business development initiatives to assist the member companies to transfer the bulk of their business from the home to the export market commenced in the mid 1990's and have been pursued vigorously ever since. It was recognised that the home market would not be large enough to sustain the underground coal mining equipment manufacturing sector for which ABMEC represents the bulk. Rather than close companies, mergers and take-overs have taken place to provide an all embracing group of underground mining equipment companies that is harmonious and able to supply all underground equipment and services to the globalised mining world.

A business plan was prepared some years ago which outlined the need for ABMEC to expand its horizons and membership. Two of the these initiatives, government involvement and the mineral preparation equipment sector were then discussed by Mr Deakin.

ABMEC has become the sole representative trade association to the government for the mining sector through UKT&I, which is the export development leg of the Department of Trade and Industry.

Up to 2 years ago government supported industrial sectors via a market approach and for companies wishing to conduct visitations to exhibitions or receive delegations from such markets or conduct seminars funding was made available. However, if the politically correct market to visit was not a mining country then funding was not available to ABMEC or at the very best was not as great as that for those visiting the market.

Government realised that the market approach was not the best way forward for companies wishing to export and that it was preferable for industry to determine where its promotional drive should be. To this end the sector driven approach evolved. Thirty-four sectors were selected as being of primary importance to the UK's need for trade development. In selecting the sectors, industries such as aerospace, oil and gas, education and training were immediately apparent and were included on the list at an early stage.

Mr Deakin said that ABMEC had been lobbying on behalf of the equipment manufacturers for a number of years and immediately the policy change was recognised they beat a path to the government's door to stake a claim for the industry. He was particularly pleased to advise today's meeting that mining is listed as one of the 34 selected key sectors chosen for governmental support. He also stressed that the name heading for the sector is mining and not just equipment manufacture.

The next phase of this presentation concerned the Mining Sector Partnership. This sector represents the whole of the mining sector and not just underground equipment supply therefore the government needs a link to the industry as a whole. Individual companies generally cannot make representations to the government unless they are large and have strategic importance. Although dialogue can be entered into full representation has to be from a legitimate and recognised body.

Following sector recognition a trade advisory group was set up using contacts both existing and recognised by ABMEC. ABMEC has become in its own right the secretariat and focal point of the advisory group. The group is now established and is beginning to feed into government its ideas and debate meeting quarterly throughout the year. Representative companies and bodies on the Advisory Group are as follows:- ABMEC, British Chilean Chamber of Commerce, Camborne School of Mines, Dargo Associates, ECGD, Future Energy Solutions, International Mining Consultants, Mining Association of the UK, South Yorkshire International Trade Centre and the UKT&I.

Arising from sector recognition and the trade advisory group came the UKT&I business plan for the mining sector as a whole, the result of which is a £450k budget for 2004/05 50% of which will be directed through and managed by ABMEC for export activities. This amount of money has been granted from government by way of the business plan prepared by UKT&I in conjunction with ABMEC and its planned activities. It also embraces initiatives and activities as prepared by overseas posts covering some 23 countries involved in mining over

the whole sector sphere of equipment and services offered by the companies as well as planned missions and exhibitions in the promotion of the mining equipment industry of the UK. Further to this, ABMEC is currently applying for the secretariat of the Mining Sector Partnership.

Mining does not mean ABMEC and it does not mean coal. Mining embraces all aspects of mining under one governmental umbrella and the sector partnership is the visible vehicle to embrace any and all companies, contractors or consultants that have an affiliation under whatever guise to the mining industry.

Under the sector partnership, a programme of marketing and promotional tools to include literature, CDs and information documents will be developed into which individual companies can involve themselves. The promotion is will be global and will embrace as much as is feasible and targeted for and on behalf of the UK mining industry sector.

Mr Deakin said that his last and the main point of his presentation was to attract the mineral preparation companies of the UK into forming a combined force to approach the international market to better their chances for the sale of equipment and services.

A recent survey conducted by IMC as commissioned by ABMEC and UKT&I had highlighted 500 companies that purport to have mineral preparation involvement. Furthermore the conclusion of the report was that the majority of such companies were exporting and wish to do better or wish to commence an export drive.

Quoting from the report's conclusions:

"The study into the strength, depth and capability of the UK mineral preparation industry has concluded that over 500 companies service the industry and that the financial contribution to country is in excess of £4.5 billion per annum with an employment in the region of 31,000 staff.

40% of the identified companies service the industry in three areas of expertise, these companies represent large companies and small one staff operations. However, the study has identified that the companies that operate within the industry are generally small in staff and have an annual turnover of between one and five million pounds per annum.

Contribution from international markets represent £1.5 billion per annum of turnover, however, it has been identified that half of the companies operating in the United Kingdom have not made a significant impact on the international market, but are willing to improve their market share if advice and promotion were available.

The study has identified that the UK has great capability both in depth of expertise and financial resources to establish themselves internationally and that ABMEC would find sufficient support to establish a dedicated association that would promote the UK's strength and capability within the mineral preparation industry.

- if only 10% of these companies choose this path then 50 combined driven companies could make a serious impact in the marketplace."

ABMEC, through its own business plan, has highlighted as priorities for coal Russia, China and India and a second stream of countries including Australia, South Africa, Mexico and the USA for UK targeted promotion on behalf of the

member companies. Russia is committed to building 10 new coal preparation plants over the next 6 years. A far greater amount will be required by China, and India has just passed a law that demands ash removal to a maximum 34% for their indigenous coal industry. All countries listed are also developing their mineral assets which should encourage the mineral preparation sector. Your only choice as see it is which country to target first?

It is with these statistics in mind and the regular visits to market, both inward and outward missions and developing industry to industry committees with government involvement that the prospect to export within this industry continues to develop.

Mr Deakin concluded by reiterating that the market is available, government support and funding is available and the organisation exists within ABMEC to implement these philosophies.

The final paper of the day "Coal preparation: modern market requirements was presented by Phil Cairns of UK Coal Mining Ltd. Mr Cairns position was Contractor Manager – Generator Sales. He began by describing the situation with regard to coal supply/demand in the UK at 16.8mt/yr for the electricity supply industry (ESI), 1.7mt/yr for industrial users and 0.4mt/yr. Currently, less than 50% of the coal burnt in the UK is produced in the UK.

Some of the differences between UK and imported coal qualities were also highlighted with lower sulphur and chlorine and higher calorific values in imported coal being important factors.

Several benefits were, however, noted for UK produced coal such as 'just-in-time' deliveries, which assisted stock management and cash flow; a local supplier who was easily contactable and could respond quickly to problems should they arise and a coal supply which has always been by tried and tested lines of communication. In addition, no new port or rail infrastructure would be required; the boilers currently in use in the UK were originally designed to burn UK coal and lower NOx emissions and unburnt carbon in ash are expected from most UK coals.

An idealised coal preparation plant was then described which would produce an ideal coal but unfortunately such an entity is only in the imagination. This Utopian plant would wash out 95% of all of the sulphur and all of the chlorine in the coal. It would produce clean and consistent fuel containing no tramp material. The coal would be free handling, well-sized and low in ash. The slurry from the coal cleaning plant would then be pelletised as a saleable by-product. Back in the realms of reality Mr Cairns spelled out what were essential requirements in the modern coal markets of today. Firstly, and most importantly for the ESI, the coal should be consistent in quality and free from tramp material. It seemed that this was regularly achieved with imported supplies but less so in some UK produced coals. In the case of the domestic market, coals should be consistent to the standards to which they are being supplied, free of tramp material, clean and free of fines and well-sized.

Andrew Howells, National Secretary of the Mineral Engineering Society and a business consultant for Norec Ltd summarised the days presentations. After thanking UK Coal Mining Ltd. for hosting the meeting, the presenters for their papers, the attendees for their interest in being there and the stand-in chairman, David McCaffrey, the meeting was drawn to a close with the predominant feeling that it had been a day well spent.

5th European Conference of Coal Research and its Applications. University of Edinburgh September 6-8 2004.

The organising committee of the Coal Research Forum's fifth biennial conference would like to ensure that all of our readers are aware of the forthcoming meeting. This event was first held at Loughborough University in 1996 and was followed two years later at the University of Nottingham. 2000 saw the event held in Aston University and in 2002 the event was hosted by Imperial College in London.

Many of you may already be aware of the conference which this year is being held in Edinburgh. The organisers have had a good response from researchers in many areas of coal science from a number of overseas countries who wish to present aspects of their work. This is an event which allows networking with similar-minded researchers. Can you afford to miss it with all those potential project partners being there! Further details can be found on the Forum's website, www.coalresearchforum.org or by contacting the Newsletter Editor, who, with his different hat on, is also Conference Secretary!!

NOTE: The Institution of Chemical Engineers – Coal Utilisation Subject Group has offered to provide some financial assistance with travel and accommodation expenses (at £100 each), to enable a up to 10 PhD students at UK universities to attend this conference. Applicants wishing to take advantage of this offer should apply in writing giving their full contact details to the Conference Chairman, Professor John Patrick of the University of Nottingham by E-mail to john.patrick@nottingham.ac.uk.

Underground Coal Gasification:

UCG may offer a new way of exploiting vast coal reserves in several parts of Canada

by Ken Waldie - September 2003
Combustion-News Business Editor
www.combustion-net.com/
Canada's clean combustion network

Two Canadian companies are developing and commercialising technologies for the gasification of coal through underground combustion. Ergo Exergy Technologies Inc. of Montreal recently completed a demonstration project at Chinchilla in Queensland, Australia and is presently working with partners to develop a commercial power plant there. Laurus Energy of Toronto is developing Canadian applications for this technology. Executives of both companies told Combustion-News that Underground Coal Gasification (UCG) can play an important role in helping Canada meet its commitments under the Kyoto Protocol. Simon Maev, Vice President of Business Development for Laurus Energy, says that suitable coal is known to exist in British Columbia, Alberta, Nova Scotia, and New Brunswick, and the company is evaluating resources in Saskatchewan, Manitoba, and Ontario. "Just to give you an idea," he says, "20 million tonnes of average coal in situ — which is a relatively small volume — can support a combined-cycle UCG power plant of 110 MW for about 50 years." Maev goes on to point out that Alberta's ultimate potential has been estimated at more than 2 trillion tonnes, much of it in proximity to industrial users and related infrastructure.

In simple terms, UCG involves injecting air or oxygen and steam into underground coal seams through a borehole and igniting the coal in situ. The coal

seam is gasified and hot product gas is removed via a second borehole. The speed of combustion is controlled by the rate at which oxidants are injected. The hot gas is conditioned for use in a gas turbine power plant or as a chemical feedstock. The product gases are similar to those obtained from conventional surface coal gasification systems, but production is achieved at a much lower cost.

Ergo Exergy was founded in Montreal in 1994 by several UCG experts from the former Soviet republics, where commercial-scale UCG operations have been conducted for more than 40 years. The company has been working on commercialising UCG in the western world ever since and claims to have developed major improvements in the UCG process, including optimal drilling techniques, fast and inexpensive well linking, efficient underground gasifier design, and gas clean-up systems. Ergo has named this proprietary technology Exergy Underground Coal Gasification or eUCG. Ergo officials say that compared to generic UCG technologies, eUCG offers better efficiency and reliability, provides superior environmental management, and is applicable to a wider range of coal conditions.

- **An old technology waiting to be rediscovered?**

Basic UCG processes have been understood for more than a century, and trial burns have been conducted in the former Soviet Union, the UK, Belgium, Spain, and the US, among other countries. Research began in the UK in the 1910s, and a small UCG operation was demonstrated in Derbyshire in the 1950s. The American program expended several hundred million dollars on UCG trials over 20 years beginning in the mid-1970s. A small, shallow test in Alberta in 1976 investigated the feasibility of linking boreholes. Only in the Soviet Union, however, did UCG developments reach commercial scale.

Some coal experts believe that the key technology developed by the Soviets is a method for heating the coal to a temperature where volatile gases are released and then igniting those gases to start the UCG reaction. The Soviets have also reportedly developed methods of adapting drilling techniques for different types of coal under varying conditions.

In a report published in 1976, experts at the University of California estimated that by the early 1970s the Soviet investment in UCG development had already reached ten billion 1976 US dollars. UCG production in the Soviet Union began in 1932 and peaked in 1964 at several sites with lignite or bituminous coal seams ranging from 0.4 to 20 metres thick. Two of these plants continue in operation today, one in Uzbekistan and the other in Siberia. According to another published report, after 40 years of operation the Uzbekistan plant was producing roughly half of its 1963 peak of 860 million cubic metres, although some observers say output is probably now much less than that.

- **Commercialisation in the west**

A number of obstacles have stood in the way of UCG development in the west. The main concerns are that while they reached "commercial" scale the Soviet plants never met any free-market economic test and were developed in an era where environmental concerns received little attention within the Soviet bloc. Dr. Michael Blinderman, Ergo Exergy's Director of Technology, strongly disagrees with this perception. "Economic and environmental inadequacies of Soviet technology have been a perception rather than a fact, as the Chinchilla project proved," he says. "The perpetuation of this perception was to the advantage of the R&D lobby in the west that has tried to reinvent the wheel for the last 30 years and has managed to waste enormous public and private funds." Nonetheless, the fact that the Soviets developed UCG technology under conditions where there was little discipline from either free markets or public

environmental concerns is certainly behind the scepticism of some coal experts. Another obstacle has been that UCG requires an unusually complex combination of specialised disciplines ranging from chemistry to geology to geotechnical engineering. Ergo Exergy, however, appears to have developed practical solutions.

Recent developments have combined to mitigate this traditional scepticism. The need to reduce greenhouse gas (GHG) emissions under the Kyoto Protocol will mean that new coal-fired power plants are unlikely to be built in developed countries. Natural gas is the principal alternative since it can be used efficiently in gas turbine generators, but it is expensive, and declining reserves are likely to push prices up further. UCG offers the opportunity to combine the low fuel cost of coal with the efficiencies of combined-cycle gas turbine generation. Gas produced by UCG processes costs roughly one-fifth as much as natural gas at current prices. Production of electricity from UCG through combined-cycle turbines produces more CO_2 than natural gas but much less than conventional coal. Moreover, very low capital and operating costs could potentially enable cost-effective CO_2 removal and sequestration by re-injection into the UCG cavity left by the removal of coal.

Knowledge gained by the Soviets has now been made available in the west through Ergo Exergy and its joint venture partners. Michael Blinderman told Combustion News that while this technology will remain proprietary it has been licensed to Linc Energy for use in Australia and to Laurus Energy for use in Canada. He added that he and Simon Maev, Executive Vice President of Laurus Energy, will present a paper explaining some of the details, along with a Canadian perspective, to the Combustion Canada '03 Conference in Vancouver, September 21-24, 2003.

The possibility of exploiting otherwise untapped coal reserves is another force driving interest in UCG technology. Many countries have sufficient coal reserves for hundreds of years without even considering the increase in reserves that would result from the addition of otherwise unrecoverable resources using UCG. The privatisation or deregulation of the electric power sector in some countries has also fuelled interest. These factors have combined to motivate a spate of UCG conferences and feasibility studies over the past several years. The European Working Group on UCG conducted a trial supported by the European Commission in El Tremedal, Spain between 1992 and 1999. This trial demonstrated the feasibility of UCG at depths of 500 metres or more. The UK Coal Authority followed up with a pre-feasibility study of its own. The UK is now working with China to transfer UCG technology, and a project is planned for Shanxi Province starting in 2003. Other studies have been conducted in New Zealand, India, and Pakistan, among other countries. The Chinchilla project in Queensland, Australia, however, is the largest demonstration UCG project ever to be completed in the west.

- **The Chinchilla project**

Chinchilla project is a joint development between Montreal-based Ergo Exergy Technology, Australia's Linc Energy, and CS Energy, a power generation company located in Queensland. A prefeasibility study was completed by November 1997 and the project obtained initial funding soon after the privatisation of Australia's electricity sector in June 1999. Linc Energy, which holds coal leases in Queensland for more than 5 billion tonnes, has been the primary developer of the project. CS Energy provided initial funding, and Ergo Exergy designed the UCG plant and supervised its construction and commissioning. Ergo Exergy has been operating the gas production facility in Chinchilla for the last four years and has

senior technical staff on site, including Dr. Blinderman, Director of Technical Operations for the project.
http://www.lincenergy.com.au/
http://www.lincenergy.com.au/
http://www.csenergy.com.au/http://www.csenergy.com.au/

- **UCG feasibility**

The initial task of the project was to demonstrate the feasibility of UCG in exploiting the coal deposit in Chinchilla. A pilot plant was constructed and the first gas was produced on December 26, 1999. Nine production wells have been completed, raising capacity to 80,000 Nm3/h, sufficient for continuous operation of a 67 MWe combined-cycle gas turbine. Gas calorific values are about 5 MJ/Nm3. The coal is situated in a 10-metre-thick seam 140 metres below the surface, and the UCG reaction is supported by air injection. After 30 months of continuous operation, more than 80 million cubic metres of gas were produced from approximately 32,000 tonnes of coal. This makes it by far the largest and the longest operating UCG facility in the west.

Dr. Blinderman points out that satisfying obvious environmental concerns was a critical element of the Chinchilla project. "We had to prove that the process is safe, controllable, and containable, and in particular that the reaction could be shut down in an environmentally friendly manner," he said, "and we did that under the supervision of the Queensland Environmental Protection Agency in April 2003." He went on to explain that when air injection is stopped the reaction quickly slows down but does not stop because small quantities of "water gas" are produced through the reaction of groundwater with the hot coal. "We are still producing some gas at the moment (August 2003), as the cavity continues to be filled with water." He explained that while in principle the reaction could be stopped almost immediately by the injection of about 30,000 tonnes of water, it would be difficult in this arid area of Australia. Independent audits have confirmed compliance with the Environmental Management Plan which is part of the Mining Development Lease granted by the Queensland government. Under the strata conditions found in Chinchilla, groundwater influx into the gasifier contains the reactor in a "steam jacket" and water flows into the cavity, confining the chemical process and preventing environmental contamination. No adverse environmental effects from the project have been reported.

- **Electric power generation**

The next step of the project was to demonstrate the commercial feasibility of using the Chinchilla gas to generate electricity. A pilot cleanup plant was constructed and it was shown that the gas could be cost-effectively conditioned to meet the exacting requirements of gas turbines. According to a joint paper by Ergo Exergy and GE Power Systems presented to the Gasification Technologies Conference in San Francisco in 2002, General Electric has established that its existing syngas combustors and control systems are suitable for the gas produced at Chinchilla. It was determined that turbines as small as 40 MW could be commercially profitable using this gas and that extremely low operating costs and very high internal rates of return could be achieved with larger plants, up to an optimum of around 400 MWe.

International investors are presently in the due diligence process with Linc Energy for the next phase, which involves the construction of a commercial power plant. Construction is expected to begin by the end of this year, and the first phase generation system is expected to go online in mid-to-late 2004. One of the options being considered is the use of a GE Frame 6B gas turbine. To minimise business risks, the initial open-cycle generation system will produce 47 MWe, rising to 67 MWe when it is equipped with a Heat Recovery Steam Generator

(HRSG) several months after launch. Compressed air will also be obtained from the turbine to provide part of the requirements for the UCG reactor. Operations will be monitored for about six months and if they are successful the plant will be expanded by an additional 177 MWe with the installation of a GE Frame 9E gas turbine. Linc Energy's coal lease in Chinchilla has potential reserves of more than 300 million tonnes. This is sufficient to supply a 400 MWe combined-cycle power plant for approximately 170 years.

The cost of power generation from the initial 67 MW plant has been estimated at about US 1.4 cents per KWh. Gas production accounts for 10% of this cost and the rest is cleanup and electricity generation. Costs will be significantly lower after the installation of a larger generation system. The project sponsors also intend to install an oxygen-blown UCG plant in Chinchilla to demonstrate gas production as a feedstock for chemical applications.

- **Environmental considerations**

Emissions of GHGs during electricity generation are another important consideration. UCG-fuelled combined-cycle power generation is much cleaner than coal but not as clean as natural gas. A life-cycle analysis study conducted by the BHB Billiton Newcastle Technology Centre in Australia concluded that for plants of comparable size, a combined cycle plant using UCG synfuel would produce 708 kg/MWh of specific greenhouse gas emissions, compared with about 920 kg/MWh from a coal-fired plant with supercritical boiler and 430 kg/MWh from a natural-gas combined-cycle plant. Since capital costs for UCG are less than half of those for coal-fired generation and the cost of syngas is a fraction of the cost of natural gas, there is considerable scope for cost-effective containment operations. By one estimate, the use of a commercial CO_2 removal method such as Rectisol® would reduce emissions from a UCG-combined-cycle plant to around 350 kg CO_2/MWh, much lower than emissions from a natural gas plant. While the cost-effectiveness of sequestering CO_2 in the UCG cavity has yet to be demonstrated, even without this innovation reductions of roughly 25% in GHG emissions could be achieved just from substitution of UCG for conventional coal.

- **Canadian applications**

Ergo Exergy executives say that the company will remain focused on licensing its proprietary technology and providing related expertise around the world. Laurus Energy Inc. of Toronto is currently doing groundwork and acquiring leases in Canada. Laurus is also seeking strategic alliances for the development of the first UCG plant in Canada.

Ergo Exergy's UCG technology is suitable for a wide range of coal ranks, although it is not appropriate for anthracite. Coal seams from 30 to 750 metres deep, 0.5 to 30 metres thick, horizontal to steeply dipping, and with coal calorific values as low as 8.0 MJ/kg can be successfully extracted using eUCG technology, according to company officials. Essentially all the coal resources found in Canada, with exception of those suitable for open cast mining, can be exploited with UCG.

Simon Maev of Laurus Energy says that suitable coal is known to exist in British Columbia, Alberta, Nova Scotia, and New Brunswick, and the company is evaluating resources in Saskatchewan, Manitoba, and Ontario. With conventional coal-fired power stations unlikely to proceed in today's carbon-constrained environment, Maev adds, "there is a huge gap growing between available capacity and future demand for power generation in Canada. There is no clear solution using conventional technologies to prevent an energy shortage without violating Canada's Kyoto commitments. We are sure that UCG-based power generation will play a very important role in Canada in the coming years because it can deliver clean and inexpensive power from otherwise unusable resources."

http://www.ergoexergy.com/http://www.ergoexergy.com/
http://www.lincenergy.com.au/http://www.lincenergy.com.au/
http://www.csenergy.com.au/http://www.csenergy.com.au/

The lights go out for last French mine

Extracted from Adam Sage's article – The Times April 24 2004.

France marked the closure of its last coal mine yesterday as 300 years of labour, grime and struggle ended with petit fours and a son et lumiere. As the final lump of coal was extracted from La Houve mine in Creutzwald in Lorraine, eastern France, the authorities laid on 72 hours of festivities as a "homage" to the profession being extinguished. Nationalised in 1946, the French mining industry employed 358,000 at its height, with 58,897 million tonnes of coal extracted in 1957, the record year. But from the 1960's, the French authorities focused on nuclear power, which now supplies 80% of France's energy. Coal mines, like others across Europe, began a long, difficult decline. The proportion of electricity generated by coal slipped from 30% in 1960 to 4% in 2000. In recent years it has cost Euro 200 (£134) a tonne to extract coal that has a market value of £43 a tonne. The cost to the state of maintaining the mining industry has run to an annual Euro 325 million. In 1994, with les Charbonnages de France, the state-controlled group that owns the mines, burdened by debts of Euro 3.7 billion, the French Government announced a 10-year closure plan. It said that the final mine would shut by 2005, but gave a guarantee to miners that they would be able to continue working after that date if they had not reached the age of retirement. Under the deal, they can claim a full pension at the age of 45. The 4,265 people employed by les Charbonnages de France will be employed to dismantle and survey the mines.

Coal pit under review

BBC News -Wednesday, 14 January, 2004, 07:16 GMT

The future of one of Nottinghamshire's three surviving coal pits is being reviewed because of geological problems. Owner UK Coal had announced before Christmas 2003 it planned to spend £18m on Welbeck Colliery, near Ollerton, to access new reserves. But the discovery of a geological fault means the company has had to go back to the government to submit a new mining plan. The colliery employs 450 people and a spokesman for UK Coal said the company was confident it would overcome the problem. The company has put two other pits under review - Rossington near Doncaster and Ellington in Northumberland.

Fight for Survival

January 13, 2004 2:17am - Financial Times

The coal industry is dwindling in size and is now a shadow of its former self, but there are still those that argue that the government should ensure it survives. The business case for mining coal is constantly under threat from cheap coal imports from countries such as South Africa where production cost is lower. Proposed legislation to curb sulphur dioxide emissions could also provide reasons why power stations do not want to buy expensive, sulphur-rich UK-mined coal. One argument for giving state aid to the industry is to safeguard thousands of jobs in the Midlands, Yorkshire and the North-East. Another is less social and more strategic. UK Coal, the company that operates most of the remaining pits,

says mines should be kept open even if they are uneconomic to give the country an alternative fuel source if supplies of gas and oil are cut off.

Largest waste coal plant in world sprouts from Pennsylvania coal region

The Associated Press, January 26, 2004.

When it was built in 1921 at the height of Pennsylvania's fabled coal production, the coal-fired power plant at the mouth of the Conemaugh No. 1 Mine was state of the art, a symbol of the area's industrial might. At night, its lights looked like a steam ship on the Conemaugh River. By day, its smokestacks dwarfed the yellow-brick row homes where workers lived in Robindale. Over the years, plant workers and miners dumped so much ash and low-grade coal - a persistent smell of rotten eggs hung in the air from smouldering piles of waste coal - that the heaps held off the waters of a devastating 1977 flood long enough for Robindale to evacuate.

"It was like a dike around the town," said Albert Fatula Sr., a retired coal miner who lived there at the time. "It slowed the water down pretty good." The flood waters left the houses in Robindale uninhabitable and the coal mine shut down soon afterward, a casualty of an industry that withered as cleaner-burning fuels increasingly displaced coal. Now, in place of the old power plant is another state-of-the-art power plant. It's the biggest in the world to burn "boneys," the heaps of discarded low-grade coal and rock that are some of the most identifiable signs of the once-powerful coal industry here.

With its 755-foot covered conveyor belt - the length of 2 1/2 football fields - connecting a huge, indoor coal-crusher and a towering steel-sided boilerhouse, the new plant is wrapped around the old one, which was shut down last month after 82 years. The plant's owner, Houston-based Reliant Energy, says it is a sign of a new era in electricity.

"To us, it is consistent with where the industry needs to go," said Reliant's chief executive officer, Joel Staff. "It is an efficient use of resources and environmentally friendly." And for an electricity industry being squeezed by the high cost of cleaner-burning natural gas - which fuels more than 90 percent of the generating capacity built between 1991 and 2002, according to federal figures - waste coal is an intriguing possibility. It is a cheap source of fuel whose supply seems guaranteed for the foreseeable future. Reliant estimates there are 250 million tons of waste coal within 50 miles of the site, while the state Department of Environmental Protection offered a more conservative, "extremely rough" estimate of 240 million tons state-wide. The plant employs a relatively new technology that creates a kind of wind tunnel to recirculate the waste coal with a limestone additive. The boilers can actually generate electricity by burning everything from high-grade coal to tires to organic matter.

Reliant has committed to the state that it would burn at least 65 percent waste coal, but says it is shooting for 100 percent. Annually, the plant is expected to burn 3.5 million tons of waste coal. At 521 megawatts, it is about five times the size of the largest of the 17 or so other commercial waste-coal plants in the United States and it is 2 1/2 times as powerful as the plant it is replacing.

"In the business we're in, we had to be very comfortable that it was a smart investment," said Richard D. Imler, the plant's general manager. "Because of the fuel we're burning, it really makes it worth it." While the new plant will create about 3 million tons more ash than the old plant, it will emit significantly lower

levels of nitrogen oxides, sulfur dioxide and soot - which contribute to acid rain, smog, and breathing problems, among other things - and use less river water for the cooling towers. The plant has earned the support of state officials for the removal of boneys, which blight the landscape and leak acidic runoff into groundwater and waterways. Kathleen McGinty, Pennsylvania's secretary for environmental protection, called waste coal "an important new source of electricity" during an industry conference earlier this month, and her department acknowledges the state does not have the resources to remove the boneys itself.

Electric utilities view waste-coal as an important development in ensuring a steady supply of electricity because it provides an option to coal, natural gas and nuclear power. "In a world in which we're looking for a diversity of supply, this is a step forward," said J. Michael Love, president of the Energy Association of Pennsylvania, which represents utilities that buy electricity from producers such as Reliant. Some environmental advocates say they recognise the problems created by the existing piles of waste coal. They contend, though, that burning it would not bring any more jobs and investment than, say, a wind energy farm or a plant that burns organic matter, and would only increase environmental damage.

"It does allow the legacy of pollution to continue," said David Masur, the executive director of the non-profit group, PennEnvironment. "The idea of (burning waste coal) as a fix is erroneous." New technology to burn waste coal emerged from the fuel shortages in the 1970s and was developed in Europe, those in the industry say. The first waste-coal plant in the United States was built in Pennsylvania in 1988, prompting GPU Inc., which owned the Seward plant, to explore using the technology to replace the ageing coal-fired boilers. The plan was put on hold in the mid-1990s when GPU decided to sell its power plants, said Vince Brisini, an environmental manager for Reliant, which inherited the plans when it bought Seward in 2000 as part of a larger deal that included 21 Pennsylvania power plants. The $800 million cost of building the plant was prohibitive _ about twice the cost of a similarly sized natural-gas plant. But Reliant got help from the state, which issued $400 million in tax-exempt bonds through an independent state agency. Less than four years later, the project is nearly complete. Both boilers have undergone test firing, and Reliant hopes to have the plant online by May 1, company officials said.

There are additional environmental benefits that the company likes to tout. For one, Reliant cleared 2 million tons of waste coal from Conemaugh No. 1 Mine before it built the new facility. And once the waste coal is burned, some of the calcium-rich, alkaline ash that is created by injecting limestone into the combustion process can be used to neutralise acidic drainage from Pennsylvania's 5,100 abandoned mines. The rest is to be dumped into a lined landfill nearby. For a depressed area still reeling from the loss of coal and steel jobs over the last five decades, many see economic benefits of building and supplying the plant as being more important than environmental concerns or the noise and dust created by the plant and associated heavy truck traffic. "You have your pros and cons," said Gary Stiles, a 63-year-old hardware store owner in Seward who can see the plant from his back porch and described the sound as an approaching freight train. But "it's something we can live with because we need the jobs."

UK Coal quits Australia

By PA News

Mining group UK Coal today moved to focus on its British operations after agreeing to sell its mining interests in Australia. The Doncaster-based firm plans

to dispose of its 97 per cent stake in New South Wales-based Gloucester Coal to investment bank ABN Amro Rothschild for £21.5 million.

UK Coal said it would use the cash for general purposes and to pay for new coalface equipment at two of its collieries at Daw Mill, Warwickshire and Kellingley, North Yorkshire. The group, formerly known as RJB Mining, has been trying to sell Gloucester Coal for around two years.

It paid £12 million for a 12 per cent stake in the Australian group - then known as CIM Resources - in May 1996 and increased its interest to more than 80 per cent in October 1999. UK Coal made the acquisition to get a feel for pricing patterns in the international market, which was then fiercely competitive.

However, the market has since become more predictable and more price information has become available. "At that time, it was helpful to have an inside track on the market," a spokesman said. The sale will enable the group to concentrate on further improving performance in its UK business. It said in September that pre-tax profits before one-off charges in the six months to June 30 rose to £1.3 million from £500,000 in the same period last year. The group has an annual turnover of £550 million and employs more than 6,000 people at 12 deep pits and a similar number of open cast mines, which together produce about 18 million tonnes of coal a year.

UK Coal unsettled by production glitches

Thu 04 Mar 2004

LONDON (SHARECAST) - High coal prices helped coal miner and property group UK Coal cut its losses sharply in 2003, but problems at its Rossington and Welbeck deep mines could hinder further progress this year.

Pre-tax losses in 2003 tumbled from £83.1m to £1.3m though adding back one-off gains and provisions released, the underlying improvement was from a loss of £27.3m to £100,000 in the red.

Gordon McPhie, chief executive, said, "The sharp rise in world coal prices in September has been maintained, though with forward contracted sales of 90% of production in 2004 and 50% of planned output in 2005 there will be limited benefit over the next two years."

He added that plans to cut production costs this year have been affected by geological problems at Rossington and Welbeck, which are expected to add around 3% to unit costs.

Property sales generated a profit of £5.8m up from £2m. The final dividend is maintained at 5p giving a ‘same-again’ total of 10p.

Power cuts 'could hit UK by 2006'

'If... The Lights Go Out' was broadcast on BBC Two on Wednesday, 10 March 2004.

The UK could be hit by electricity supply problems within two years, an expert who advises the government on energy policy has said. Dieter Helm told BBC Two's 'If... The Lights Go Out' the UK had a "clapped out" power generation system and was too dependent on imported gas. A committee of MPs has also

warned of possible problems with the network. But the Department of Trade & Industry said new capacity was being created by reopening mothballed power stations.

Government policy was focused on the safe, secure and affordable supply of electricity, the DTI said. Mr Helm's concerns have been echoed the cross-party Trade and Industry Committee, which said much of Britain's power network was nearing the end of its 40-year lifespan. "There is a danger that there is currently insufficient investment in the network to replace in a planned and orderly way equipment which is reaching the end of its life," the report said. "Simply to maintain present performance levels, capital expenditure by the network owners would have to double," it said. London and Birmingham both suffered power blackouts within the space of a week last summer, raising questions about the UK system's reliability. The BBC's 'If... The Lights Go Out' programme asks if the UK is becoming too reliant on imported gas supplies and examines what could happen should terrorists attack a vital pipeline.

Gas consumption in the UK has soared by 66% since 1992 to 113bn cubic metres a year, according to figures from industry regulator Ofgem. Meanwhile, electricity generation using gas has jumped from just 1.7% of total consumption in 1990 to 29.7% in 2002. Mr Helm accuses the government of having no insurance against power cuts. He highlights the decline of North Sea gas and the condition of the UK's power stations as causes for concern. The UK's coal power stations are due for replacement and most nuclear generators are set to close in the next decade. Mr Helm says that without new policy initiatives the UK's luck will run out and there could be supply problems by 2006. Defending its strategy, the DTI pointed out that the government had a "statutory responsibility to ensure security of energy supplies". And it said the market-driven approach to deliver energy supplies was working. Since privatisation, it said, there had never been an occasion when supply had not been sufficient to meet demand.

Construction of a $1.3 billion coal-fired power plant

REUTERS NEWS SERVICE
http://www.reuters.com/http://www.reuters.com/

TEL AVIV - A ministerial committee led by Israeli Prime Minister Ariel Sharon gave final approval yesterday to construction of a $1.3 billion coal-fired power plant in the southern coastal town of Ashkelon.

The decision came despite fierce opposition to the plant from environmentalists, who sought a cleaner alternative. "This coal plant apparently will be the last in the series of coal plants," National Infrastructure Minister Ephraim Eitam told Israel Radio. The new plant, expected to begin operation in 2008, will have capacity to produce 1,100 megawatts of electricity. The plant will join two other sites that already produce coal in Israel, including another site in Ashkelon. The decision sparked protests from Israeli environmental group Green Course, which demonstrated at the Prime Minister's office in Jerusalem. This followed a demonstration on Sunday outside Eitam's home in the occupied Golan Heights. Green Course campaigner Zecharya Tagar said the group advocated the use of "cleaner" natural gas energy over coal. "Coal pollutes the air, is poisonous to the public and contributes to global warming," he said. "Moreover, the ashes produced from burning coal are likely to drain into ground water and pollute the water with carcinogenic heavy metals."

An Israel Electric spokeswoman noted the company also had plans to build nine natural gas plants as well as convert three fuel oil plants to natural gas. The natural gas will be brought in by pipeline from the Mediterranean. Eitam said the country could not afford to rely on one source of energy. "Israel's electricity sector cannot be based on a single source of energy that is as vulnerable as a gas pipeline and that is why this coal plant is so vital," he said.

News from ECGD

From Business Credit Management UK, 28 January 2004

An environmentally friendly power plant in Malaysia which received support from the Export Credits Guarantee Department (ECGD) is now successfully supplying up to and, at times, more than 20% of the country's power requirements. ALSTOM Power Turbo Systems, working in consortium with a local Malaysian partner, has handed over the third and final 700MW unit of the power plant to the owner, Tenaga Nasional Berhad Janamanjung (TNBJ). This handover was achieved some four years after the ECGD underwrote a loan for the project, that was managed from ALSTOM Power Turbo System's office in Knutsford, Cheshire.

Trade Minister Mike O'Brien said: "I welcome business which delivers sustainable development while minimising the effects on the environment. This state of the art plant is delivering power in a more environmentally friendly manner, through the use of low-sulphur coal.

"I am glad to see ECGD supporting projects won by UK exporters in difficult times through to successful conclusions." ECGD provided an export credit guarantee for the £442million (GBP) loan, arranged by HSBC, for TNBJ to purchase the main equipment, which includes boilers, steam turbines and generators. The plant, on the West coast of peninsular Malaysia some 200km North of Kuala Lumpur, benefits from modern and environmentally friendly technology, using mainly low sulphur grade coal.

The project forms part of the Malaysian Government's Vision 2020 initiative to sustain economic growth and reduce the country's heavy dependence on gas for energy. The transaction also marked the first time that three export credit agencies (ECAs) have worked together on a single case under ECGD's One Stop Shop initiative. As part of this arrangement ECGD guaranteed a loan to finance UK, French and Norwegian exports and in turn obtained reinsurance from its French and Norwegian counterparts, Coface and GIEK.

John Tyler, Director of Financing at ALSTOM, said: "In the difficult economic climate that existed in Southeast Asia in 1999, it was quite a challenge for ECGD to lead the triple-ECA support package for the triple-currency financing for this important project. "That they succeeded is testament to the efforts of the ECGD and to everyone else who worked so hard behind the scenes," he added.

Article by Clive Hadfield & Associates Ltd.

This item is something of a departure for the Newsletter as it is basically an article promoting a particular service, which is something that the Forum have not previously done. However, in view of the authors' steadfast submission of revised drafts for this article, the Forum acceded to its publication in the Newsletter. As Editor I would welcome feedback as to whether the readership feel this type of article is appropriate for inclusion in the Newsletter.

Mass Transfer Essentials for CO_2 Capture and Gas Scrubbing

Carbon dioxide (CO_2) is a "greenhouse" gas. Such gases in our atmosphere readily allow sunlight to enter. However, they absorb reflected heat from the Earth's surface and retain some of it. Thus, increasing levels of carbon dioxide in air lead to heat gain and result in global warming.

Atmospheric concentrations of greenhouse gases have increased by about 25% since world-wide industrialisation began in the mid 1800's. A major source of the gaseous increase is industrial combustion of fossil fuels (coal, oil and gas). Combustion turns the "fixed" carbon of fossil fuel into gaseous carbon dioxide. This is happening at a faster rate than natural processes can capture the carbon dioxide and return the carbon to the earth.

In 1997, thirty eight nations, meeting at Kyoto in Japan, reached an agreement to reduce overall carbon dioxide emissions by 5.2% by 2010. The European Union accepted a more stringent target of 8% and has continued to devote effort and resources towards meeting this target.

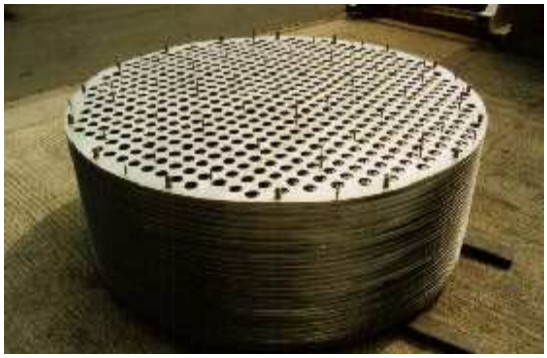
The International Energy Agency (I.E.A.), which was established in 1974, began a Greenhouse Gas research and development programme in 1991 to gather information on technologies with potential to reduce greenhouse gas emissions. In May 2002 the I.E.A. issued a technology status report summarising "where we are now" and "next steps" for fourteen CO_2 capture approaches and seven CO_2 storage approaches.

In the U.K., the Carbon Trust was set up in March 2001 to help to reduce CO_2 emissions and to help to create a low carbon technology knowledge base in the U.K. The Carbon Trust has reviewed forty nine technologies and ranked them both by their potential to reduce carbon dioxide emissions and by the likely benefits to flow from financial investment (see table below). The gas scrubbing techniques described later in this paper contribute to one of the listed technologies – carbon dioxide sequestration. Sequestration is assessed as having a high carbon saving potential but a low need for investment.

Overview of Technologies Reviewed				
Demand – side buildings: Building	Supply – side: fuels & "Conventional" energy production	Supply – side: renewables	Transport:	Enabling technologies
• Building fabric • Controls and building energy management systems • Cooling • Heating • Integrated building design • Lighting • Ventilation Demand – side industry: • Alternative equipment • Combustion	• Carbon dioxide sequestration • CHP advanced macro • CHP domestic micro • Cleaner coal combustion • Coal bed methane • Fuel cells – baseload power • Fuel cells – domestic CHP • Fuel cells – Industrial & commercial • Nuclear fission	• Biomass – local electricity generation • Biomass – local heat generation • Geothermal • Low head hydro • Photoconversion • Solar photovoltaic • Solar thermal electric (high – temperature	• Biomass – transport • Fuel cells – transport • High efficiency automotive	• Electricity storage technologies • High voltage direct current (HVDC) transmission to shore • Hydrogen infrastructure (including transport) • Hydrogen production • Hydrogen storage & distribution • Intermediate energy

technologies • Materials Process control	• Nuclear fusion • Ultra high efficiency combined cycle gas turbines (CCGT) • Waste to energy	generation) • Solar water – heating collectors • Tidal energy – lagoons & barrages • Tidal stream • Wave energy – offshore/ near shore devices • Wave energy – shoreline devices • Wind power – onshore & offshore		vectors • Smart metering

The IEA technology status report of May 2002 "Solutions for the 21st Century" states "High efficiency gas liquid contactors are in development that would eliminate the need for physically large scrubbers, thereby reducing absorbent throughputs and regeneration costs". As long ago as 1967, such a device was developed and patented. It was known as the film tray and over two hundred large absorption or distillation columns were packed with film trays, world-wide. The device was improved and further patented in 1987. A third new geometry is currently being developed with the assistance of a DTI micro project grant. Film trays – and their later developments – work by using some of the kinetic energy of an up flowing gas stream to evenly form and distribute a series of thin scrubbed horizontal films of a descending absorbent liquid. The trays are assembled into multiplate cartridges for insertion into their column (see photograph below), and they offer a superior column packing in five critical aspects.



For effective gas/liquid contacting in the circumstances of CO_2 capture, there are five essentials:

- The avoidance of by passing and channelling.
- High tolerance of fouling.
- Low pack heights (Height Equivalent to Theoretical Plate).
- Wide operating range (Turndown).
- Low-pressure drop.

Also, it is desirable to have a low liquid loading and a low liquid hold up.

Film trays meet all five essentials and have the desirable attribute of one millimetre depth of liquid on the horizontal plates and a typical hold up rate of 30 seconds worth of the liquid flow rate per entire column.

All five essentials are met as:

- Some of the gas kinetic energy is used to self distribute the absorbent. Thus, even with a disturbed flow pattern the mechanism is self-correcting and channelling is avoided. Columns will self distribute even at five metres diameter.
- Because the transfer mechanism is aerodynamically driven and because of the simple open structure of the packing, substantial fouling may be tolerated. The accompanying photo is of one of six 2.7 metre diameter 30 plate cartridges. The cartridges were made in 1996 to replace previous film trays that had been damaged by fire. Prior to the fire, the previous trays had operated fully continuously for 22 years processing sticky polymer at 270°C. When the old trays were removed, they were hard coated to a depth of 3mm.
- The height equivalent to a theoretical plate is typically 300mm for film trays.
- The turndown ratio is typically 6:1 for film trays, with high transfer efficiency being maintained over the entire range.
- Pressure drop is typically one inch water gauge per theoretical tray.

The IEA technology status report of May 2002 points to the need to "reduce the size of absorption towers and capital and operating costs". The technology outlined above has been meeting such requirements for over thirty years:

- Self-distribution of liquid provides the benefit of avoiding much of the expense of mechanical liquid re-distributors.
- Tolerance of fouling has the benefit of very substantially extending intervals between maintenance shutdowns, giving associated savings in standby capacity capital cost and in maintenance costs.
- Low absorption stage height brings the benefit of substantially reduced column height with its associated capital cost reduction.
- High mass transfer efficiency increases the operating capacity a column, allowing greater throughput per capital cost.
- Wider turndown ratios allow for the provision of a smaller number of columns for a given range of duty, without sacrificing controllability. Thus, both space and capital are saved.
- Low pressure drop eases the load on fans, thus saving energy costs.
- A low liquid inventory, in both the scrubbing and stripping columns, offers the prospect of both capital and operational savings in liquid re-processing.

Two small companies (Caswell and Company Ltd. of Corby and D.C. Developments Ltd. of Norwich) have combined with micro business Clive Hadfield and Associates Ltd. to apply and develop the technology.

Research has already demonstrated the very efficient removal of industrial solvents from air using a low cost oil based absorbent over film trays. A recent DTI grant will allow the proving of a low cost water absorbent based system for cleaning up air borne emissions from print works. A two foot diameter pilot column in Norfolk is available to trial other concepts, as required.

The technology is obviously very relevant to the need for an efficient CO_2 scrubbing system. The history, the design "know how", the tooling, the manufacturing capability and the pilot column are all available now.

The designers and manufacturers would like the opportunity to prepare costed proposals to meet specific needs by the application of this technology.
For further details contact:

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National Coal Newsletters

Two overseas coal newsletters have recently been brought to my notice. These are from China and New Zealand. The most readily accessible is the China Coal Newsletter which is published by AAA Minerals International, a service and consulting company specialising in Chinese coals and minerals. Its web site, through which access to the newsletter can be gained, is **www.aaaminerals.com** The other is simply titled Coal Newsletter and is published by CRL Energy Ltd. for the Coal Association of New Zealand Inc. It is not a new journal as the March 2004 issue is number 53, however it does not appear to be available on the web. The editor may be contacted by fax on 0064 4570 3701.

Please note that the web page for Canada's clean combustion network www.combustion-net.com has been taken off line indefinitely. For information in this region, please log onto the CANMET Energy Technology Centre web page on www.nrcan.gc.ca/es/etb/cetc/

Tailings

- EHN of Spain is planning to invest £352m in renewable energy projects across the UK over the next five years, and is setting up a headquarters in Newport, South Wales. 30-Dec-03

- Innogy is to abandon its Regenesys electricity storage project after its German parent RWE decided against providing sufficient capital expenditure to commercialise the technology. 17-Dec-03

- UK Coal is to introduce seven-day working at Kellingley colliery in Yorkshire with the creation of 240 jobs, but 70 jobs are being lost at its Ellington colliery and its Selby complex will close in June. 11-Dec-03

- International Power has won planning permission to build a multi-million pound flue gas desulphurisation plant at its Rugeley power station in Staffordshire. 22-Jan-04

Student Bursaries for the 2004

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

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

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

Update on new Research Fund for Coal & Steel (RFCS) Projects, (successors to the ECSC Coal Research programme)

The projects listed which were above the 'Threshhold' in the recent appraisal exercise in ranking order are as follows:

1. Commercial scale testing of a fluidized-bed drying plant for highly efficient lignite-fired power plants.
   Budget 6.29M Euro, Funding requested 2.52M Euro
   Co-ordinator =RWE Rheinbraun AG

2. Improved environmental control and battery life through integrated monitoring systems.
   Budget 1.59M Euro, Funding requested 0.96M Euro
   Co-ordinator = Corus UK Ltd.

3. Advanced gas purification technology for co-gasification of coal, refinery by-products, biomass and waste, targeted to clean power produced from gas and steam turbine generator set fuel cells.
   Budget 3.68M Euro, Funding requested 2.21M Euro
   Co-ordinator = Institut Scientifique de Service Public

4. Zero "dioxin" releases in coal combustion and coal/organic waste co-combustion processes.
   Budget 3.33M Euro, Funding requested 2.00M Euro
   Co-ordinator = Institut Scientifique de Service Public

5. Component test facility for a 700°C power plant.
   Budget 15.30M Euro, Funding requested 6.12M Euro
   Co-ordinator = VGB Power Tech e.V.

6. Understanding and mastering coal fired ashes geopolymerization process in order to turn potential into profit.
   Budget 1.56M Euro, Funding requested 0.94M Euro
   Co-ordinator = Institut Scientifique de Service Public

7. Increasing the efficiency of roadway driveages through the application of advanced information, automation and maintenance technologies.
   Budget 3.06M Euro, Funding requested 1.83M Euro

Co-ordinator = Asociation Investigacion y Desarrollo Ind. Recursos Naturale.

8. Hydrogen production from advanced gasification processes.
   Budget 3.10M Euro, Funding requested 1.86M Euro
   Co-ordinator = University of Nottingham

9. Use of coal to reduce dioxin emissions from co-combustion in fluidised bed boilers.
   Budget 1.88M Euro, Funding requested 1.13M Euro
   Co-ordinator = Chalmers Tekniska Hogskola AB

10. Development of a pilot-scale flameless oxidation burner for ultra low NOx combustion of pulverised coal.
    Budget 2.86M Euro, Funding requested 1.71M Euro
    Co-ordinator = Universitat Stuttgart

11. Safe, economic and environmentally friendly control of gas reservoir of closing and closed mines.
    Budget 3.26M Euro, Funding requested 1.96M Euro
    Co-ordinator = Institut National de L'Environnement Industrial et des Risques

12. Utility scale CFB for competitive coal power.
    Budget 3.13M Euro, Funding requested 1.88M Euro
    Co-ordinator = VTT Processes

13. Prevention of PCDD/F and other toxic emissions during coal solid waste co-combustion.
    Budget 1.59M Euro, Funding requested 0.95M Euro
    Co-ordinator = Aristotle University of Thessaloniki

CALENDAR OF COAL RESEARCH MEETINGS AND EVENTS

Date	Title	Location	Contact
24 June 2004	Meeting of Combustion Division/ Presentation of the work of Industry to Academe	Scottish Power, Longannet Power Station, Scotland	Dr A W Thompson, SChEME, The University of Nottingham, Nottingham, NG7 2RD Tel: 0115-951-4198 Fax: 0115-951-4115 E-mail: alan.thompson@nottingham.ac.uk
6-8 September 2004	5th European Conference on Coal Research & Its Applications	University of Edinburgh	Organised by the Coal Research Forum Contact Dr A.W.Thompson Tel: +44 115 951 4198 Fax: +44 115 951 4115 Email: alan.thompson@nottingham.ac.uk
13-17 September 2004	21st Annual International Pittsburgh Coal Conference	Osaka International Convention Centre, Osaka, Japan	University of Pittsburgh School of Engineering Dominion Centre for Environment and Energy 1249 Benedum Hall Pittsburgh, PA 15261, USA Tel : +1-412-624-7440 Fax : +1-412-624-1480 E-mail: pcc@engr.pitt.edu Website: www.engr.pitt.edu/pcc
18 October 2004	53rd BCURA Robens Coal Science Lecture; to be given by Dr Kelly Thambimuthu, CANMET Energy Technology Centre, Ottawa, Canada	The Royal Institution, Albermarle Street, London	Mr J D Gardner, BCURA Company Secretary, Gardner Brown Ltd., Calderwood House, 7 Montpellier Parade, Cheltenham, GLOS, GL50 1UA Tel : 01242-224886 Fax : 01242-577116 E-mail : john@gardnerbrown.co.uk
Autumn 2004 (provisionally 3 November 2004)	Joint Meeting of the Advanced Power Generation and Combustion Divisions, topic to be announced	Venue to be announced	Mr P W Sage Tel: 01235-432098 Fax: 01235-452753 E-mail: peter.sage@aeat.co.uk Dr A W Thompson (see above)

16 March 2005	Meeting of the Coal Preparation Division, "Coal Preparation and Handling, Where We are at Present, What is Being Developed and What Needs to be Done"	The Coal Authority, Mansfield, Nottinghamshire NG18 4RG	Mr AW Howells Tel: 01226 730440 Fax: 01226 730688 E-mail:andrew.howells@norec.ltd.uk