



# ECCOAL

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## CLIMATE CHANGE

# THE ROAD TO COPENHAGEN

»International climate change negotiations are reaching a critical stage, with a new global agreement due to be reached at the end of 2009 in Copenhagen. Negotiations are being held over the course of 2009 as nations attempt to reach agreement on new commitments beyond the Kyoto Protocol's first commitment period which ends in 2012.»

The World Coal Institute recently published a series of six 'Climate Policy Papers' outlining the steps WCI believes are needed if climate change is to be successfully addressed. The Papers also highlight the importance of coal in meeting future energy demand and the technologies that are available to reduce emissions from coal. Below are summaries of the key messages from each paper.

### Paper 1 - Coal Meeting Global Challenges

Coal is an essential energy resource and raw material for industrial production and electricity generation, has a vital role in long-term sustainable development and can be used in a manner consistent with climate change goals. WCI calls on countries to work with industry and support this vision for coal as a key resource able to meet the challenges of the coming decades.

### Paper 2 – Reducing Emissions, a Central Role for Efficiency

A successful response to climate change requires reducing CO<sub>2</sub> emissions from coal use. While CCS is a key technology to reduce CO<sub>2</sub> emissions from coal, other technologies - such as improving the efficiency of coal-fired power plants – provide opportunities for significant and cost effective emissions reductions.

WCI has made a number of recommendations on how emissions from coal-fired power plants can be reduced:

- Replace the oldest and most inefficient coal-fired plants with larger, more efficient units
- Construct the most efficient new coal-fired plants possible
- Implement capacity building and knowledge sharing programmes to ensure that the operation and maintenance of plants follows international best practice

- Ensure that the Clean Development Mechanism (CDM) and any future market based mechanisms incentivise the deployment of the most efficient coal-fired plant
- Identify opportunities to develop methodologies or other innovative enabling mechanisms to encourage coal washing in order to improve power plant efficiency

### Paper 3 – CCS & the CDM

The inclusion of CCS as Clean Development Mechanism Project Activities would strengthen the CDM and represent an important step towards accelerating the wide scale deployment of CCS and achieving the ultimate objective of the climate change treaties – the UNFCCC and the Kyoto Protocol – the reduction of global CO<sub>2</sub> emissions. WCI supports the inclusion of CCS in the CDM and in any successor mechanism after the Kyoto Protocol's first commitment period ends in 2012.

Continued from cover



Excluding CCS from the CDM denies developing countries the opportunity to deploy this critical technology, limits their capacity to contribute to emissions reductions, and

undermines the global effort to reduce emissions. Any outstanding technological, methodological, legal, policy and financial issues raised should be addressed during the project validation phase as is standard with other CDM projects.

### Paper 4 – CCS & the Post-2012 Agreement

CCS is the only currently available technology that allows deep cuts to be made in CO<sub>2</sub> emissions from fossil fuels and must be deployed at huge scale if climate change is to be successfully addressed. Substantial effort is being made now to accelerate the development and deployment of CCS in developed countries. These efforts include an agreement by the G8 countries to commit by 2010 to construct 20 CCS plants; the EU CCS programme to build 10-12 fossil fuel power plants fitted with CCS by 2015; the allocation of US\$3.4 billion to CCS in the US economic recovery package; the UK announcement to build four CCS coal-fired plants; and the funding of 2-4 coal-fired CCS plants by the Australian government. WCI believes that any revised or new international climate change agreement must build upon and enhance these efforts to accelerate the commercialisation of CCS.

### Paper 5 – Investing in CCS

Successfully addressing climate change requires the deployment of low-carbon

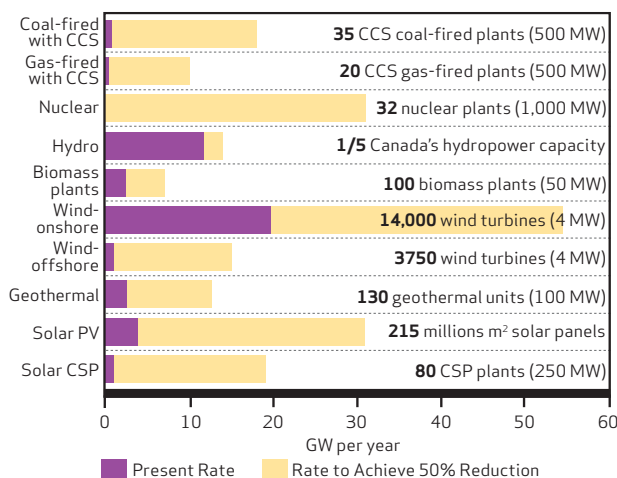
technologies at a scale and rate not previously witnessed. CCS will make an essential contribution to global emissions reduction efforts; attempting to address climate change without CCS is estimated to increase costs by over 70% – an additional annual cost of US\$1.28 trillion by 2050. The WCI believes that the new international climate change agreement must play a central role in increasing worldwide investment in CCS and has made a number of recommendations.

- Enhance the deployment of the full portfolio of low-carbon technologies, including energy efficiency, renewables, CCS, nuclear and biomass technologies
- Promote and catalyse greater international investment in CCS to reflect the importance of this technology to international efforts to lower GHG emissions
- Provide CCS support mechanisms equivalent to those used to support other low-carbon technologies, enabling CCS projects to be developed now
- Contribute to cost reductions in CCS technologies which will enable medium-term climate goals to be reached cost effectively
- Facilitate and enable the dissemination of this clean energy technology to countries which consider CCS to meet their national sustainable development criteria

### Paper 6 – Electrification of the Transport Sector

Stabilising CO<sub>2</sub> requires deep cuts to be made in emissions from all sectors. The transport sector emits almost 20% of the

### Average Annual Power Plant Investment Needed between 2010-2050 to Reduce Emissions by 50% from Current Levels



Source: IEA "Energy Technology Perspective" (2008)

world's CO<sub>2</sub> emissions and presents a challenge for emission reduction efforts as the sector is predicted to still rely heavily on oil-based fuels in the coming decades. Decarbonisation of the electricity sector can generate significant emission cuts in transport through substituting fossil fuels with low-carbon electricity. Capturing and storing CO<sub>2</sub> from a single, large point source, such as a coal-fired power station, is much simpler than reducing CO<sub>2</sub> emissions from many 1000s of vehicles, enabling these emission reductions to be delivered more cost effectively.

All the 'Climate Policy Papers' can be downloaded on the WCI website.

## COAL INFORMATION

# NEW WCI WEBSITE GOES LIVE

>>The World Coal Institute has gone live with its new website – [www.worldcoal.org](http://www.worldcoal.org)>>

The website features both a new design and new and updated content. This includes a 'CO<sub>2</sub> Stored' counter on the homepage, showing the amount of CO<sub>2</sub> from human activities which is already being stored underground. The new site also features an interactive map of CCS projects worldwide, showing projects at industrial/commercial scale that are operational or in planning and operational research projects. You can access information about each project and links to further information.

As well as these new features, the site builds on WCI's previous website and continues to provide a wide range of information on all aspects of the coal

industry – from basic information about the mining and use of coal, to issues around the environmental impacts associated with coal, coal and society and detailed information on carbon capture and storage. The site features case studies from WCI members covering water management projects, community engagement and methane recovery and use, amongst others. You can also access video footage covering various aspects of the coal industry, which can be found in the 'News' section of the site.

All WCI publications can be downloaded from the website, including accessing the online version of Ecoal. If you would prefer to receive Ecoal

electronically, please sign up via the publications order form on the website.

World Coal Institute website – [www.worldcoal.org](http://www.worldcoal.org)



IEA

# CLEANER COAL IN CHINA

>>The International Energy Agency (IEA) recently released the report “Cleaner Coal in China”. The report provides policy advice in a number of key areas of China’s coal sector in order to help improve resource recovery, mine safety, environmental performance and economic efficiency.>>

Coal currently accounts for 70% of China’s primary energy production and consumption. It is expected to remain the country’s main energy source for the foreseeable future. With vast indigenous coal reserves of 189 billion tonnes, China’s rapid development of coal-fired power over the past quarter of a century has allowed it to achieve high levels of energy security and unprecedented economic growth, lifting millions out of poverty. However, the report comes at a time when China and the rest of the world are faced with important decisions to make about anthropogenic CO<sub>2</sub> emissions, particularly with a successor to the Kyoto Protocol due to be agreed in Copenhagen this December.

In his foreword, IEA Executive Director Nobuo Tanaka noted that China’s coal currently provides the world’s economy with more energy than Middle Eastern oil. He emphasised that the report should serve as a timely reminder that it is in everyone’s interests to deal with the environmental impacts of coal use on this kind of scale through the development and deployment of clean coal technologies. Carbon capture and storage (CCS) is highlighted throughout the report as a key component of the IEA’s recommended strategy for the future development of the Chinese coal industry. The report goes on to focus on ten key areas in which changes can be implemented.

## 1. Managing the exploitation of China’s coal reserves

China has experienced problems with maintaining environmental and safety standards at unregulated small scale coal mines (not operated by the major coal producing companies). The IEA suggests that fairer and more transparent resource allocation, possibly through auctioning, would help to prevent these unregulated mines being developed and allow higher safety and environmental standards to be set. This could potentially open the door to further international participation in the coal market, thus allowing easier transfer of technologies and practices into and out of China.

## 2. Industry restructuring

In order to help combat the problem of small scale unregulated mines, the IEA recommends that the Chinese coal-mining industry should be restructured in

order to allow entry by firms of varying sizes operating economically efficient mines. The report uses the examples of Europe, Australia and the United States to demonstrate historically successful coal industry restructuring.

## 3. Coal mine safety

The report suggests that providing greater levels of training and empowerment to mine workers - coupled with the work of the existing national inspectorate - would allow them to take more responsibility for their own safety. Levels of safety would be further increased by preventing the development of unregulated small scale mines, where a high percentage of mining accidents are estimated to occur.

## 4. Competitive markets

The IEA suggests that a properly functioning coal market, with effective supply and demand responses, would be an important step towards achieving improvements in China’s coal sector. In recent years, China has struggled with issues such as supply shortages, volatile prices and transport bottle necks, and these have prevented the market from operating efficiently. This has also hindered efforts to focus on the environmental and safety issues associated with coal recovery and use.

## 5. Promoting cleaner coal technologies

China currently hosts facilities that feature some of the largest-scale and most advanced equipment in the world, and the IEA recommends that the government should seek to further encourage joint ventures and international partnerships in order to advance the development of technologies. The report suggests that this would help to promote and enhance cleaner coal technology transfer both into and out of China.

## 6. Developing new cleaner coal technologies

As well as promoting the use of existing cleaner coal technologies, the report highlights the excellent opportunities that exist for China to increase R&D efforts into new technologies. The IEA points towards China’s pioneering development in the area of direct coal liquefaction as evidence that the country has the ability to lead the world in the development of CCS. The report

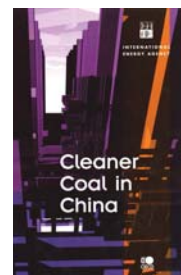
suggests that participation by the government, industry and academia would allow international partnerships to flourish and stimulate development of new technology prior to commercialisation.

## 7. Deploying well-proven technologies and practices

The IEA recommends that China should deploy techniques and equipment already widely available across the entire coal chain. These measures include deploying more advanced and rational mining techniques in order to improve recovery rates of coal and matching fuel quality to users’ specifications. The report suggests that the implementation of simple housekeeping measures during the transport phase and in power generation and other end uses could significantly reduce emissions, particularly dust.

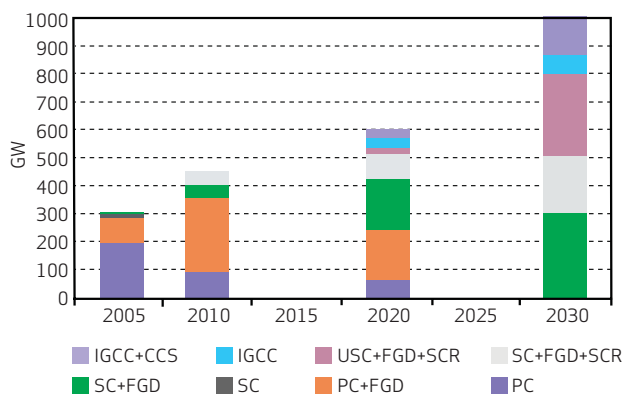
## 8. Importance of effective regulations

The report suggests that greater accountability and transparency at all levels of governance will help with the implementation of effective environmental and safety regulations. The IEA is confident that the implementation of effective regulations will be an important stimulus for the widespread deployment of CCS technologies.



Continued on p4 ►

## Installed Capacity Forecast for Coal-fired Units & Pollution Control Technologies in China (GW)



IGCC - integrated gasification combined cycle  
 USC - ultra-supercritical  
 FGD - flue gas desulphurisation  
 SCR - selective catalytic reduction  
 SC - supercritical  
 PC - pulverised coal (combustion)

## CCS

## GLOBAL CCS INSTITUTE

>>Australia hosted the inaugural meeting of the Foundation Members of the Global Carbon Capture and Storage Institute (GCCSI) in April 2009.>>

Chief Executive Milton Catelin participated in the Canberra event on behalf of the World Coal Institute along with more than 160 representatives of various government, industry and research bodies.

"Alongside the May 2009 announcement of the UK Government's expanded support for up to four commercial scale CCS projects, the last few months have seen a very welcome acceleration of the demonstration phase of CCS. 2009 will be seen as a turning point not merely for the coal industry's attempts to substantially minimise its emissions, but also in the world's battle to combat global warming", Mr Catelin said.

Australian Prime Minister Kevin Rudd officially launched the GCCSI on the first day of the meeting, and delivered encouraging words on the opportunities and challenges in the near future. The Minister for Resources and Tourism, Martin Ferguson, and Minister for Climate Change and Water, Penny Wong also participated in the meeting, indicating the very high importance the Australian Government is attaching to the GCCSI and the future role of CCS.

At the time of the launch of the GCCSI, there were 85 Founding Members and Collaborating Partners. Membership now stands at 134, with a number of applicants in the later stages of signing up.

The two days of the meeting proper were spent in useful discussion of the intended governance, structure, and the international role of the GCCSI, as well as group and panel dialogue around securing projects, creating partnerships and alliances, knowledge sharing, and harnessing community support.

The GCCSI was announced in

September 2008, with annual funding of up to A\$100 million to accelerate the global deployment of commercial scale CCS projects. The Australian government appointed Nick Otter as interim CEO and recently appointed James D. Wolfensohn

to the position of Chair of the International Advisory Panel of the GCCSI. The GCCSI became a separate legal entity on 1 July 2009.

For further information:  
[www.globalccsinstitute.com](http://www.globalccsinstitute.com)

#### Foundations Members of GCCSI as at June 2009:

The Governments of Australia, Abu Dhabi, Canada, European Commission, China, France, Germany, Indonesia, Italy, Japan, Republic of Korea, Mexico, Netherlands, New Zealand, Norway, Papua New Guinea, South Africa, UK, USA and the Australian State Governments of New South Wales, Queensland, South Australia, Victoria and Western Australia

Asian Development Bank, Japan Bank for International Cooperation

Alstom Power Ltd, AMEC, Anglo American Services, ARUP, BHP Billiton, BP Australia, Chevron Australia, China Huaneng Group, Chiyoda Corporation, Doosan Babcock Energy, The Dow Chemical Company, ENEL, Exxon Mobil Australia, General Electric International, Golder Associates, Greenhouse Gas Storage Solutions (GGSS), Hatch Associates, Hitachi Limited, HTC Purenergy, Hydrogen Energy International, INPEX Corporation, IHI Corporation, JGC Corporation, Nippon Steel Engineering, Macquarie Capital Advisers, Mitsubishi Corporation, Mitsui & Co, Parsons Brinckerhoff Australia, Peabody Pacific, PricewaterhouseCoopers, Rio Tinto, RWE Power AG, Samsung Techwin, Santos, Senergy Alternate Energy, Services Petroliers Schlumberger, Shell International, Southern States Energy Board, StatoilHydro ASA, Taisei Corporation, Toshiba Corporation, Total S.A., TRUenergy Development, Woodside Energy, Worley Parsons Services, Xstrata Coal, ZEEP Australia

Australian Coal Association, British Geological Survey, Carbon Capture and Storage Association, Cooperative Research Centre for Greenhouse Gas Technologies (CO2CRC), Commonwealth Scientific and Industrial Research Organisation (CSIRO), demosEUROPA, Electric Power Research Institute (EPRI), The Clinton Foundation, Główny Instytut Górnictwa (Poland), IEA Greenhouse Gas R&D Programme, Japan Coal Energy Center (JCOAL), National Low Emissions Coal Research, Petroleum Technology Research Centre, Research Institute of Innovative Technology for the Earth (RITE), South African National Energy Research Institute (SANERI), The Climate Group, Underground Coal Gasification Association, United States Energy Association, University College of London, World Coal Institute

Collaborating Participants - International Energy Agency, International Energy Forum, The World Bank

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#### 9. Creating an international price for pollution

In order to help deploy cleaner coal technologies in an economically efficient manner, the report suggests that China's pollution abatement strategy should incorporate market mechanisms, such as sulphur and carbon trading. This would help with efforts to ultimately create an international price for carbon and create financial incentives for CCS deployment.

#### 10. China's role in a cleaner future

The IEA recommends that China takes a

determined approach towards developing domestic policy that is compatible with global measures, such as international carbon trading, in order to push forward CCS deployment. The report suggests that further cooperation with international partners will help to establish common international technical standards for coal plants, including better defining the "capture-ready" concept so that the large number of new coal plants being constructed in China does not lock the country into high levels of CO<sub>2</sub> emissions for years to come.

The publication of the report marks an important step in the developing relationship between the IEA and China. Cooperation on CCS research, development and deployment between China and OECD countries will be vital in pushing the technology forward and allowing the coal industry in both China and elsewhere to make a positive contribution to global CO<sub>2</sub> abatement.

Full details on the report can be found at:  
[www.iea.org/w/bookshop/b.aspx](http://www.iea.org/w/bookshop/b.aspx)

## CANADA

# SASKATCHEWAN-BASED CCS PROJECTS LAUNCHED

»Two CCS projects have recently been launched in Canada, highlighting progress that is being made on CCS worldwide. In this article, the International Performance Assessment Centre for Geologic Storage of CO<sub>2</sub> (IPAC-CO<sub>2</sub>) outlines the work undertaken by this organisation and provides an overview of the recent CCS partnership between Saskatchewan and Montana. »

The IPAC-CO<sub>2</sub> is a new, independent organisation established to help fill the gap in the CCS chain. With an administrative centre at the University of Regina, discussions are under way to establish IPAC-CO<sub>2</sub> regional network centres over the next few months in Canada, Brazil, China, Europe, India, South Africa and the USA. IPAC-CO<sub>2</sub> builds on almost 20 years of experience in CCS at the University of Regina. It received C\$10 million in seed money from the Government of Saskatchewan and Royal Dutch Shell. However, IPAC-CO<sub>2</sub> will operate as an independent, non-aligned organisation.

IPAC-CO<sub>2</sub> is a facilitating organisation and will bring together various national and international stakeholders with interests in the risk assessment of geological storage of CO<sub>2</sub>. The aim is to create an organisation that will provide objective advice on geological storage and thus provide the confidence required by regulators and industry that risk and liability are adequately evaluated. IPAC-CO<sub>2</sub> will not compete with organisations undertaking commercial risk assessment; instead it is hoped that IPAC-CO<sub>2</sub> will provide complementary services.

IPAC-CO<sub>2</sub> is being led by Dr Malcolm Wilson, a member of the expert Working Group III of the Intergovernmental Panel on Climate Change (IPCC) that produced the Special Report on CO<sub>2</sub> Capture and Storage (2005). Working Group III was part of the IPCC group of scientists awarded the 2007 Nobel Peace Prize. The core team of IPAC-CO<sub>2</sub> scientists - from multiple Canadian universities - were instrumental in conducting the research for the IEA's Weyburn-Midale CO<sub>2</sub> Monitoring & Storage Project. Weyburn-Midale is a significant CCS research project in North America and is endorsed by the IEA Greenhouse Gas R&D Programme. President Barack Obama made specific reference to the Weyburn-Midale project during his first visit with Canadian Prime Minister Stephen Harper in Ottawa.

More funding is being sought to move the Centre beyond its five-year start-up phase. Scientists gathered at the IEA offices in Paris a few months ago to collaborate and refine the IPAC-CO<sub>2</sub>

work plan. Representatives from Dalhousie University, the University of Alberta and the University of Regina from Canada, Royal Dutch Shell from The Netherlands, Imperial College from the UK, the South African National Energy Research Institute, the IEA and IEA GHG participated in the two-day strategic session.

## CCS in Saskatchewan & Montana

A few months after IPAC-CO<sub>2</sub> was launched, the Province of Saskatchewan partnered with the State of Montana on what is hoped will be a C\$270-million CCS demonstration project. An MOU has been signed for the States to work together on the development of one of the largest international CCS demonstration projects in the world. Both the US and Canadian federal governments have recognised CCS as one of the key technologies in future international efforts to address climate change.

Under the agreement, the Saskatchewan - Montana partnership will work to achieve four goals:

- Construction of a technology-neutral CO<sub>2</sub> capture plant (reference plant) at an existing coal-fired electrical generating station in Saskatchewan that would have the flexibility to test a range of post-combustion carbon capture technologies;
- Construction of a North American CO<sub>2</sub> storage facility in eastern Montana including injection infrastructure with the option of using CO<sub>2</sub> for enhanced oil recovery;
- Construction of pipeline infrastructure for the transportation of CO<sub>2</sub> from the reference plant in Saskatchewan to the storage facility in Montana; and
- Development of a North American training facility to meet the needs of a growing CCS industry and regulators, based primarily at the University of Regina and Montana State University.

The project will help Saskatchewan to meet the federal government's target to reduce GHG emissions by 20% below 2006 levels by 2020. It will also allow Montana to reduce CO<sub>2</sub> emissions while being able to utilise its vast coal reserves - Montana has 30% of the coal in America.



On the Canadian side, it will cost approximately C\$150 million to design and build the CO<sub>2</sub> reference plant, related CO<sub>2</sub> pipeline infrastructure and a North American training facility for CCS technicians. The Government of Saskatchewan will provide up to C\$50 million through Crown Investments Corporation and has requested C\$100 million from the federal government through its Clean Energy Fund.

The State of Montana has requested US\$100 million from the Government through the US Department of Energy to support construction of a CO<sub>2</sub> pipeline on the US side of the border and the development of the underground CO<sub>2</sub> storage and research in the infrastructure in Montana.

A steering committee has been formed to oversee the Canadian component of the project. The committee will complete work on the development phase by 31 August 2009, including a full project plan, engineering design, business plan, detailed budget and construction timeline. With the financial support of the Governments of Canada and the USA, construction of the plant could begin as early as September 2009 and the plant could be operational as early as the summer of 2011. The goal for the reference plant is to test a range of technologies in the capture of up to one million tonnes of CO<sub>2</sub> over a four-year period.

For further information visit the IPAC-CO<sub>2</sub> website: [www.ipac-co2.com](http://www.ipac-co2.com)

Premier Brad Wall (right) and Governor Brian Schweitzer signed a Memorandum of Understanding (MOU) in the Saskatchewan Legislature on 7 May 2009 between the Government of Saskatchewan and the State of Montana.

Photo courtesy of University of Regina Photography Department

## CCS

# CCS IN THE UK

>>In April the UK government announced measures to move towards a low carbon economy and promote CCS deployment in Britain as part of its 2009 Budget.>>

The budget included a section entirely dedicated to 'building a low-carbon recovery' and outlined moves by the government to upscale its commitments towards tackling climate change, with an ambitious new greenhouse gas emissions reduction target of 34% by 2020.

The government acknowledged that deployment of CCS will be a key step towards achieving this new emissions target. In his budget speech, Chancellor Alistair Darling indicated that a "new mechanism" would be used to help fund up to four CCS demonstration projects. The Chancellor confirmed that these will include both pre- and post-combustion coal projects.

The announcement represented a major up-scaling of the government's commitment to CCS, with public funding measures having previously been restricted to the competition to build a single CCS demonstration plant by 2014. This competition will remain in place however, with an additional £90 million being allocated to companies to fund preparatory studies for CCS.

Following the Chancellor's budget speech, further details of the government's CCS strategy were revealed by Ed Miliband, the Secretary of

State for Energy and Climate Change. Mr Miliband announced that no new coal plants will be permitted in the UK "from day one" without demonstration of CCS, abandoning a previous proposal of allowing plants to be "capture-ready". Initially,

demonstration plants will be required to capture CO<sub>2</sub> emissions from the equivalent of 300MW of output.

Mr Miliband also outlined a requirement for all coal plants to be fully retrofitted with CCS within five years of the technology being judged technically and commercially viable. The Department of Energy and Climate Change indicated that the government will undertake a consultation to determine whether this rule can be implemented in the form of an emissions performance standard. Mr Miliband also confirmed that funding for the initial batch of CCS demonstration projects will be raised in the form of a levy on consumers' electricity bills.

The government announced it intends to create a number of CCS

**"There is no alternative to CCS if we are serious about fighting climate change and retaining a diverse mix of energy sources for our economy," Ed Miliband, Secretary of State for Energy and Climate Change.**

clusters around the country in regions where CO<sub>2</sub> reductions can be made most economically, such as Humberside, Teesside and Merseyside. Plans were outlined to rejuvenate industry in the North Sea through the potential for carbon storage in depleted oil and gas fields. Overall, the

government believes that its plans to develop CCS and other carbon abatement technologies could create and sustain around 50,000 jobs by 2030.

With coal currently accounting for 37% of the UK's electricity generation capacity and a number of coal-fired plants set to come to the end of their operational lives in the next few years, CCS will prove vital in allowing Britain to continue to take advantage of such an abundant fuel whilst significantly reducing CO<sub>2</sub> emissions.

The government is set to announce the results of its CCS consultation over the summer after which specific details on the UK's future CCS policy should become clearer.

*Further details of UK government CCS policy can be found at [www.decc.gov.uk](http://www.decc.gov.uk)*

## CCS

# AUSTRALIA CLEAN ENERGY INITIATIVE

>>The Australian Government's May 2009 budget included details of a new Clean Energy Initiative (CEI). The CEI has been developed to support the Carbon Pollution Reduction Scheme (CPRS), which will seek to implement a cap-and-trade system in Australia.>>

The CEI is made up of three components; a CCS Flagships Programme, Solar Flagships Programme, and plans for a new "Renewables Australia" body. The CCS Flagships Programme will see the government provide A\$2.425 billion worth of funding over nine years, with a target of creating 1000MW of low emission fossil fuel generation from 2-4 projects demonstrating the full range of capture and storage technologies.

The Australian CCS flagship projects

will contribute to the global portfolio of projects supported by the Global Carbon Capture and Storage Institute (GCCSI). It is hoped that the development of these flagship projects will aid the transition to a low-carbon economy not only in Australia but worldwide, through the sharing of economic and technical learning.

The projects deemed eligible for funding will be determined in early 2010 and it is hoped that construction will begin in 2012 with commissioning from

2015. Projects are expected to be on an industrial scale and to make a significant contribution to the 1000MW target. Coal gasification, post-combustion capture and oxyfuel will all be considered as suitable capture technologies. Further details of the legislation connected to the CCS Flagships Programme are expected to be released in the coming months.

*Full details of the CEI can be found at: [www.ret.gov.au](http://www.ret.gov.au)*

## METHANE

# CREATING VALUE FROM COAL MINE VENTILATION AIR

>>The presence of coal mine methane (CMM) in working mines represents a safety concern and has traditionally been carefully controlled by mine operators. More recently a number of mines now recover and utilise the drained CMM resource to produce either electricity or pipeline quality gas. However, to date the methane released by the ventilation systems of underground coal mines has remained virtually unexploited.>>

In this article, Biothermica Technologies provides an overview of the first Ventilation Air Methane (VAM) abatement system at an active mine in America, which was recently commissioned at a Jim Walter Resources mine in the US.

## Ventilation Air Methane (VAM)

The concentration of methane in mine ventilation air is extremely dilute; typically below 1%. This has proven to be a barrier to its utilisation, but technological advancements and the growth of the carbon offset market have recently made it possible to operate profitable VAM emission abatement projects.

Globally, these VAM emissions amount to about 300 million tonnes of carbon dioxide equivalent (tCO<sub>2</sub>e) each year, which represents about 60% of all CMM emissions and makes up 5% of man-induced methane emissions. China is the world's largest VAM emitter with approximately 40% of this total, followed by the US, Ukraine, Australia and Russia.

## US VAM Project

The first VAM abatement system in America has recently been commissioned at Jim Walter Resources' (JWR) active mine no. 4 near Brookwood, Alabama. Biothermica developed and implemented this project which features its VAMOX™ system.

The operating principle behind the VAMOX™ is the following: mine exhaust air is heated so that the methane it contains spontaneously transforms into carbon dioxide (CO<sub>2</sub>) and water vapour. This flameless reaction of oxidation releases heat which the VAMOX™ recovers, allowing it to operate without any supplemental fuel with as little as 0.2% methane in the VAM. Since methane is a much more potent than CO<sub>2</sub> as a greenhouse gas (GHG) and because of the nature of the reaction, oxidising one tonne of methane reduces GHG emissions by approximately 18tCO<sub>2</sub>e and generates as many carbon offset credits.

This project was the first North American VAM installation and therefore a 51,000m<sup>3</sup>/hr capacity unit, which captures only 10% of the mine fan total output, was selected. For

future projects, Biothermica plans to scale-up the unit capacity to 170,000m<sup>3</sup>/hr and use multiple units in parallel to increase total capacity. With the methane concentration averaging 0.8% in the captured mine exhaust air, this project will achieve annual emission reductions of some 40,000 tCO<sub>2</sub>e, the same as removing 8000 cars from the road.

This project is also the first of its kind to have been approved by the US Mine Safety and Health Administration (MSHA). To achieve this and to facilitate the VAMOX™'s integration in the operational environment of the mine, several key features were developed and integrated into its design. Among the most important characteristics is the total independence from the mine's ventilation system; all of the ancillary equipment are physically and electrically segregated from the mine fan and all other mine equipment. Mine exhaust air is, for instance, captured via an inlet duct positioned in front of the diffuser but physically separate from it. This ensures that there is no impact on the performance of the mine ventilation system regardless of the operational conditions.

Other equipment, instruments and remote communication systems ensure that the VAMOX™ operates safely under all circumstances and that its availability is as high as possible. After a few months of operation, initial observations already demonstrate the success of the project; the system has achieved or surpassed all of the key performance characteristics and its availability rate is already at 95%.

## Carbon Offsets

The common practice is to release VAM into the atmosphere. Therefore, capturing and destroying it reduces GHG emissions and can generate bankable carbon offset credits. The market for these credits is relatively new but solidly implanted around the world and growing at a rapid pace. In 2008 alone, the value of this global carbon market was estimated at US\$1.26 billion.

"Cap-and-trade" schemes have been adopted by countries that ratified the



Kyoto Protocol as well as by other governments. In parallel, voluntary initiatives by corporations and other non-regulated entities have led to a vigorous international voluntary market.

As different carbon standards have emerged and great efforts have been devoted to validate, monitor and verify project activities, the carbon industry has established its credibility. Biothermica's VAM oxidation project, for example, has been validated by a third-party in accordance with the Voluntary Carbon Standard (VCS) and publicly registered on the new APX VCS Registry.

Both the technology to oxidise VAM and the context in which it can be used profitably are now a reality. Moreover, projects using the VAMOX™ do not necessarily require capital investment from the mines and are relatively simple to implement without affecting mining operations. VAM utilisation is therefore poised to play a significant role in helping the coal mining industry minimise its environmental impact while generating a new source of revenues.

For further information visit: [www.biothermica.com](http://www.biothermica.com)

VAMOX™ system at JWR's mine no. 4 in Alabama, USA

VAMOX™ inlet duct fully independent of the mine's ventilation system's exhaust fan diffuser



CO<sub>2</sub> EMISSIONS

# RETROFITTING OF COAL-FIRED POWER PLANTS

>>The Massachusetts Institute of Technology (MIT) recently released a report summarising the outcomes of a symposium it sponsored in late March on the 'Retrofitting of Coal-Fired Power Plants for CO<sub>2</sub> Emissions Reductions'>>

Participants in the original symposium represented a wide range of stakeholders from utilities, academia, government, public interest groups and industry. The symposium was formed in order to provide policy advice for the development and demonstration of commercial-scale retrofitted mitigation technologies in the absence of a strong carbon price signal. It paid special attention to the contribution emissions reductions from existing coal plants can make to overall global efforts to tackle climate change and the steps governments, particularly in the US and China, must take to ensure all CO<sub>2</sub> reduction technologies for coal plants are deployed at the required rate. A number of key points were raised during the discussions:

- CO<sub>2</sub> emissions from existing coal power plants currently account for 20% of global CO<sub>2</sub> emissions and therefore their reduction must form part of credible pathway towards stringent GHG stabilisation targets. These reductions will be particularly important in China and the US, the world's two largest emitters of CO<sub>2</sub> from coal plants.
- Bilateral R&D programmes between the US and China should be implemented. These will be particularly important in establishing the "China Test" to examine whether China and other developing countries can implement CO<sub>2</sub> emissions reduction technologies and practices affordably.
- Multiple pathways to CO<sub>2</sub> emissions reductions from the current fleet of coal plants exist, including post-combustion capture installation (highlighted as the most direct pathway), efficiency retrofits, biomass co-firing retrofits and major

rebuilt of existing plants (highlighted as expensive but an opportunity to make huge efficiency gains with or without CCS).

- A new, large focused federal research programme is required in the US to support carbon mitigation at existing coal-fired power plants.

Symposium participants recommended relatively large (300MWe or greater), high efficiency coal plants as being the most suitable for CCS retrofit. Although these plants currently make up less than half of the US fleet, their numbers are increasing rapidly in China due to the high rates of deployment of coal power plants witnessed in recent years.

In addition to the need to retrofit CCS technologies to existing coal power plants, the symposium called on the US government to move quickly towards large-scale, sustainable CO<sub>2</sub> sequestration demonstration with a view to developing a stable regulatory framework suitable for commercial operations.

The symposium found that the US alone will need to invest around US\$1 billion per year over the next decade in research and development in order to help stimulate long-term deployment of post-combustion capture, oxy-combustion and ultra-supercritical technologies. Costs to support commercial scale demonstration of the technologies would be additional to this and are estimated to be around US\$12-15 billion over the next 10 years. The symposium agreed that these costs should be borne jointly by government and industry.

The full report can be found at: <http://web.mit.edu/newsoffice/coal-paper.pdf>

The World Coal Institute is a non-profit, non-governmental association. Membership is open to coal enterprises and stakeholders from anywhere in the world. Member companies are represented at Chief Executive level. The WCI is the only international body working on behalf of the coal industry worldwide.

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## CONFERENCES

### CoalGen Europe 2009

Katowice, Poland, 1-4 September  
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[attendingcge@pennwell.com](mailto:attendingcge@pennwell.com)  
[www.coal-gen-europe.com](http://www.coal-gen-europe.com)

### 8th Coaltrans South Africa

Johannesburg, South Africa  
7-9 September  
Details: Coaltrans Conferences  
[registrations@coaltrans.com](mailto:registrations@coaltrans.com)  
[www.coaltrans.com](http://www.coaltrans.com)

### 1st IEA GHG International Oxyfuel Combustion Conference

Cottbus, Germany, 8-11 September  
Details: IEA Greenhouse Gas R&D Programme  
[stanley@ieaghg.org](mailto:stanley@ieaghg.org)  
[www.co2captureandstorage.info](http://www.co2captureandstorage.info)

### Coaltech 2009

Brisbane, Australia, 15-16 September  
Details: IIR Conferences  
[richard.beattie@iir.com.au](mailto:richard.beattie@iir.com.au)  
[www.iir.com.au](http://www.iir.com.au)

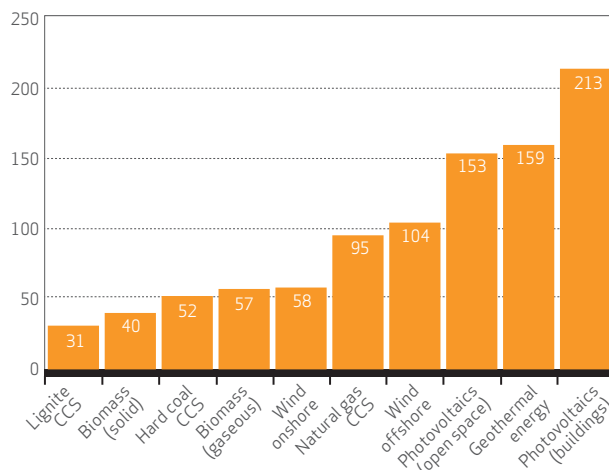
### Carbon Capture & Storage World Summit

Arlington, USA, 22-24 September  
Details: IntertechPira  
[john.buss@pira-international.com](mailto:john.buss@pira-international.com)  
[www.carboncaptureandstorage-conference.com](http://www.carboncaptureandstorage-conference.com)

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### 2020 CO<sub>2</sub> Avoidance Costs for Power Generation Technologies (EUR/t of CO<sub>2</sub>)

Investing in CCS now will lower the cost of the technology – as installed capacity is increased and operational experience gained – enabling medium-term emission reduction objectives to be reached at lower cost. Failure to widely deploy CCS will mean that alternative – and frequently more costly – low carbon technologies will need to be deployed.



Source: McKinsey & Company "Costs and Potentials of Greenhouse Gas Abatement in Germany," Energy Sector Perspective, Berlin (2007)