

WORLD COAL INSTITUTE

COAL: DELIVERING SUSTAINABLE DEVELOPMENT

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Key Messages

>> Energy demand has grown strongly and will continue to increase, particularly in developing countries where energy is needed for economic growth and poverty alleviation.

>> All energy sources will be needed to satisfy that demand by providing a diverse and balanced supply mix.

>> As the most important fuel for electricity generation and a vital input into steel production, coal will have a major role to play in meeting future energy needs.

Affordable Coal

>> In most circumstances coal is cheaper per energy unit than other fuels. As a result, it has remained the fuel of choice for electricity generation on a global basis and is likely to remain so for several decades.

>> Coal prices are consistently more stable than oil and gas prices, reflecting coal's widespread availability and diverse and competitive markets.

Secure Coal

>> Coal has a unique role to play in meeting the demand for a secure energy supply. It is abundantly available, affordable, reliable, geographically well-distributed, and easy and safe to transport.

>> Coal liquefaction allows coal to act as a substitute for crude oil; synthetic gas can also be produced from coal.

Innovative Coal

>> Environmental effects of electricity production are a concern for us all. The challenge for coal – as for all fossil fuels – is to reduce its greenhouse gas and other emissions, while continuing to make a major contribution to global development and energy security.

>> Coal is on a technology pathway that has already delivered major environmental improvements. Further technical solutions include improved combustion efficiency and reduced emissions, coal gasification, carbon capture and storage, and the production of hydrogen from coal.

>> Carbon dioxide capture and storage offers the potential for major reductions in CO₂ emissions from coal consumption, approaching zero emissions.

>> Constructive partnerships between energy producers, energy consumers and governments are essential to ensure demand for affordable and reliable energy is met, while managing sustainable development and energy security.

COAL & CSD15

>> Coal provides 40% of the world's current electricity needs. Almost 70% of global steel production relies on coal. >>

The coal industry has an important role in sustainable development, and we recognise our responsibility is to deliver affordable, clean and reliable energy.

The world cannot switch off coal overnight. We are committed to delivering results, and fast.

Energy Efficiency will drive the future. We recognise that our product can be used more efficiently to produce goods and services, and are working within the industry and with other sectors to lead achievements in this area. Technologies developed and deployed today are delivering efficiency gains – and with them CO₂ reductions; future innovation will deliver even more.

Climate Change will affect us all. Carbon capture and storage is essential to achieve the major cuts in emissions that are required.

Air Pollution adversely affects human health. Unregulated and inefficient use of traditional solid fuels, including biomass, currently leads to some 1.6 million premature deaths per year, while poor urban air quality due to industry and transport emissions causes billions of dollars in health costs. Coal plays a critical role in moving communities to electricity and providing alternative liquid and gaseous fuels which reduce air pollution.

Technology Transfer is taking place, but slowly. We must do more to provide solutions where they are needed. We – industry and governments together – must invest in research and development, in people and skills, and in new materials to deliver long-term sustainable technological solutions.

Water is fast becoming a major global concern – and the energy sector must address its usage of scarce water resources. The coal industry is working in partnership with local and national authorities, and with its consumer sectors, to minimise water usage at operations.

Business Action for Energy

The World Coal Institute is a participating organisation in Business Action for Energy (BAE) – an ad-hoc temporary business initiative bringing together a comprehensive network of global businesses. It brings together international, regional and sector organisations and major energy producers and consumers.

BAE's role is to provide a platform to coordinate the delivery of international business positions, achievements, activities and partnerships on energy issues to the 14th and 15th sessions of the UN Commission on Sustainable Development (CSD).

Business Action for Energy will be hosting a number of events here at CSD15, and we welcome your participation.

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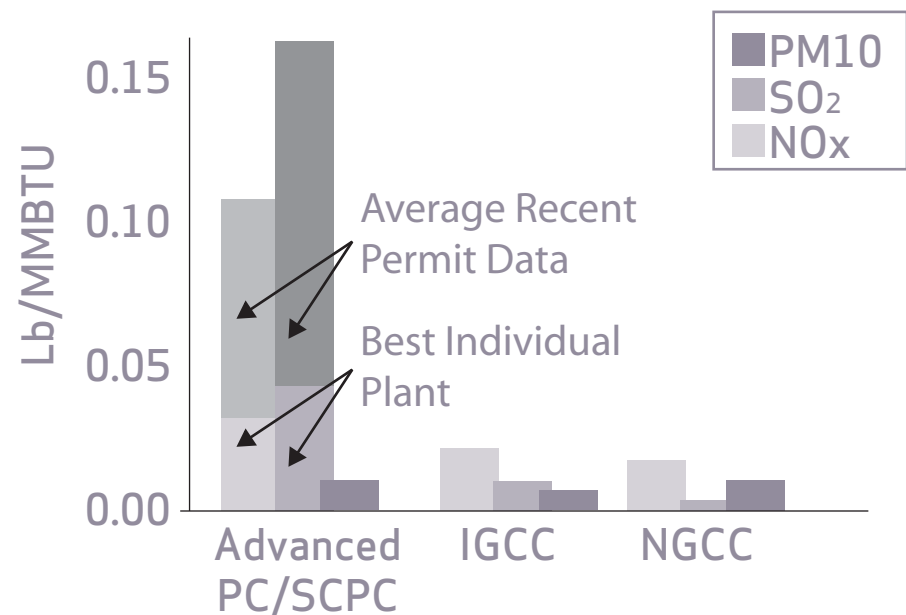
IGCC— ADVANCING EFFICIENCY

>> Converting coal to gas through Integrated Gasification Combined Cycle (IGCC) enables high efficiency electricity generation – typically around 45%, with levels over 50% expected in future. >>

An IGCC plant uses up to 40% less water and up to 90% of mercury emissions can be captured compared to conventional plants. Emissions of oxides of nitrogen (NOx) are reduced by at least a third, and sulphur oxides (SOx) by more than two-thirds. Particulate emissions are reduced to almost zero.

The IGCC process can be readily modified to produce a separate stream of CO₂ which can be captured

Comparative Emissions



Source: GE internal data, average of 28 permits granted, applications and publicly reported emissions * PC – Pulverised Coal. SCPC – Supercritical Pulverised Coal. NGCC – Natural Gas Combined Cycle.

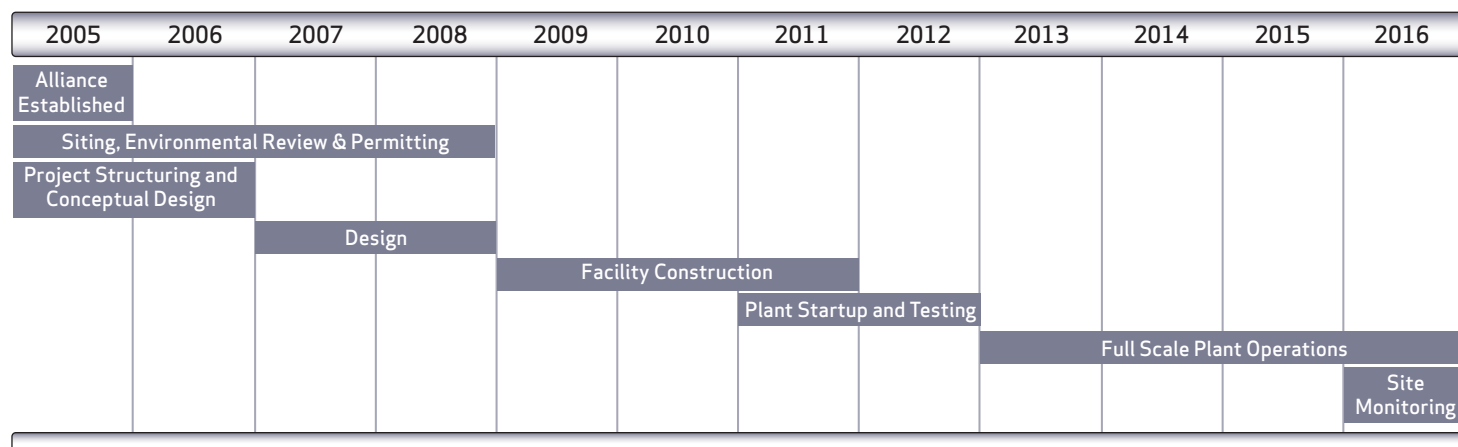
and stored, resulting in a near-zero emissions coal power plant.

The FutureGen Initiative, an international public-private partnership, aims to provide the world's first coal-fuelled near zero emissions power plant. The 250MW plant will employ coal gasification technology integrated with combined

cycle electricity generation and CO₂ storage. The plant will prove the technical and economic feasibility of producing low cost electricity and hydrogen from coal while reducing emissions to nearly zero. FutureGen will be operational by 2012.

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FutureGen Timeline



COAL MINE METHANE

>> Coal mine methane (CMM) is a valuable clean fuel source for power generation or domestic cooking and heating. >>

The capture of methane from coal mining is an essential option for improvements in environmental and economic performance, as well as enhancing mine safety.

The Appin Tower Power project in New South Wales, Australia is currently one of the largest CMM projects in operation. The 94MW power station is operated by BHP Billiton and uses coal mine methane supplied by the Appin, Tower and West Cliff collieries to generate electricity for the local utility grid, powering up to 60,000 homes.

The Appin Tower Power project has been running at full capacity since 1996, and currently achieves a reduction of nearly 3 million tonnes of CO₂ equivalent (Mt/CO₂-e) per year.

The Xstrata Oaky Creek power station in Queensland was commissioned in 2006 and is expected to save around 341,000 tonnes CO₂-e per annum, which is the equivalent of removing 78,000 medium sized petrol driven motor cars from the road each year. The gas-fired power station uses methane extracted from the mine to generate electricity for supply into the national grid.

The Jincheng Anthracite Mining Group, Inc., located in Shanxi



Oaky Creek Envirogen Plant, Photo courtesy of Xstrata Coal

Province, China, produces high-quality anthracite coal at several mines that generate substantial volumes of methane. Following early successes, a third CMM power plant (120MW) is being developed. By 2008, the project will use at least 166 million cubic meters of CMM per year to serve about 90,000 households and various commercial and industrial establishments in the

area. About 410,000 people in Jincheng will directly benefit from the cleaner CMM-based energy, reducing indoor and atmospheric pollution. Together, the new power generation capacity and the planned gas distribution will avoid emissions of about 500 million cubic meters per year, or 40 Mt/CO₂-e over 20 years.

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CARBON CAPTURE AND STORAGE – MYTH OR REALITY?

>> Carbon capture and storage (CCS) is vital for achieving large scale reductions in CO₂ emissions from energy use. >>

A number of projects are under development to apply CCS to large scale coal-fired electricity generation and will deliver their first results within the next decade (see table overleaf).

Major steps are taken towards the commercialisation of the technology reflected in the actions taken by business, governments and international bodies. Earlier this year the European Union called for all coal-fired power plants to be fitted

with CCS by 2020, and is currently determining an appropriate incentive scheme.

The technologies for geological storage are all proven and a number of large scale projects are operational today (see map).

END

CO₂ Storage Demonstration Projects

Source: IEA Greenhouse Gas R&D Programme



COAL-FIRED CCS PROJECTS

>> A number of commercial scale CCS projects have been proposed. >>

Project	Location	MW	Year	Comments
ZeroGen	Australia	100	2010	ZeroGen involves IGCC power plant technology with CCS in a saline aquifer. Announced in 2006, ZeroGen hopes to be the first commercial scale “zero-emissions” coal-fired power plant anywhere in the world.
Progressive Energy	UK	800	2011	The Progressive Energy project will use IGCC and capture 5Mt of CO ₂ per year to be used for enhanced oil recovery in the Central North Sea. The Progressive Energy project will be able to operate on coal or petroleum coke with the possibility of including biomass.
SaskPower	Canada	300	2012	The SaskPower project will use low-sulphur lignite coal with post-combustion capture or oxyfuel technology. The SaskPower project will use the captured CO ₂ for enhanced oil recovery in the region.
FutureGen	USA	275	2012	FutureGen will use coal gasification to produce electricity and hydrogen as well as provide a test bed for developing future technologies. The project is a partnership between the US Department of Energy and industry. The site of the projects has been narrowed down to four sites - two in Texas and two in Illinois.
PowerFuels	UK	900	Post-2012	The PowerFuels IGCC CCS project is to be located at the Hatfield Colliery, which is due to re-open in 2007 after being closed for more than two years. The colliery is also owned and will be operated by PowerFuels.
E.On	UK	450	Post-2012	The E.On IGCC project will be co-located with their existing gas-fired power plant in Killingholme. The first phase of the project would be the construction of the power plant with CCS being added in the second phase.
RWE	Germany	400-450	2014	The first of the RWE proposals will use IGCC technology. This project will be able to separate hydrogen after gas treatment and cleaning to use directly as an energy source or in synthetic fuel production.
RWE nPower	UK	1000	2016	The second of the RWE proposals will investigate supercritical technology combined with post-combustion CCS. This is the largest of all the proposed CCS projects to date.
Vattenfall	Germany	250	2020	Vattenfall are due to finish their 30MW CCS pilot plant in 2008. This pilot plant will provide them with a platform for the research and development that is required to build their larger commercial scale plant by 2020, at the latest.

CLEAN FUELS FROM COAL

>> **Liquid fuels derived from coal (CTL) can provide affordable ultra-clean cooking fuels, alleviating health risks from air pollution - sulphur and particulate emissions are eliminated or greatly reduced. >>**

CO₂ emissions may be up to 40% less than from the use of traditional solid fuels.

In China, the International Finance Corporation (the private sector arm of the World Bank) is financing a plant in the Inner Mongolia Autonomous Region which will provide 400 million tonnes per year of ultraclean coal-derived fuel for household cooking and heating, transportation and power generation.

The use of ultraclean liquid fuels from coal has even greater potential in the transport sector, where reduced emissions can greatly improve urban air quality and reduce associated health impacts. South Africa has been producing CTL fuels for many decades, and new plants in China and the USA are under construction.

The Monash Energy project in Australia will produce 62,000 barrels of coal-derived diesel per day, and aims to have a demonstration plant in place by 2010. The plant will also produce 220MW of electricity to power the process and supply the national electricity grid. CO₂ emissions will be captured from the process and stored in the oil and gas fields of the Bass Strait. The Monash project has been designed to allow product flexibility – with the possibility of a future hydrogen economy in mind.

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CLEAN TECHNOLOGIES – CHINA & INDIA

>> **China and India have both embarked on programmes to enhance the performance of their coal-fired plant – and that means bringing in new technologies and training operators to new skills. >>**

China is now adopting the latest technology – in 2004, half of all new power station orders were for ‘supercritical’ units, which operate at high temperatures and pressures. This technology can improve power plant net efficiency to 43-47% and

reduce total emissions output by up to 20% compared to existing power plant technology. By the end of 2005, 22 large supercritical units had been commissioned and 100 more are planned. Stepping up the temperature and pressure leads to state-of-the-art ‘ultrasupercritical’ technologies with even greater efficiency (over 50%) and environmental benefits – and China has four large projects in the pipeline, the first of which is due to commence operation in 2007.

Integrated gasification combined cycle is an emergent technology – well demonstrated in the USA and Europe, but yet to meet its commercial potential. Chinese researchers are building upon the expertise and lessons learned of demonstration projects elsewhere and defining their own technologies for local conditions – the potential for emissions reduction is vast.

India has announced a series of ‘ultra-mega’ power projects to provide some 17 gigawatts of electrical power, and based on ‘supercritical’ technology constructed locally thanks to technology and skills transfer. The Global Environment Facility has announced a major rehabilitation programme for coal-fired power in India – the first such project funded by the organisation, and one that will allow India to obtain the energy that their development demands while emitting fewer greenhouse gases.

END

MEETING THE WATER CHALLENGE

>> **A successful public-private partnership has been set up in South Africa between a local municipality and coal mining industries active in the Mpumalanga province. >>**

The project demonstrates the possible achievements through collaboration to provide sustainable resource management in a water-stressed region.

Mining companies Anglo Coal and BHP Billiton’s Ingwe Collieries, both Members of the World Coal Institute, are building a water treatment plant in partnership with the local municipality of Emalahleni. The project will assist the region in tackling water pollution related to local mine activities while meeting the increasing needs of a growing population.

With a capacity to provide 20 million litres of clean drinking water for distribution to consumers, the plant can meet around 20% of daily requirements.

The Emalahleni water-recovery treatment plant is a pioneering project using the best technology available offered by the industry research centres to serve clean water to both industry and local communities.

Further expansion and duplication of the project is already under consideration to increase capacity and help other municipalities to improve their water management – demonstrating the impact of collaboration and smart management of resources.

Such initiatives can have a significant impact on long term strategies for economic development and environmental performance.

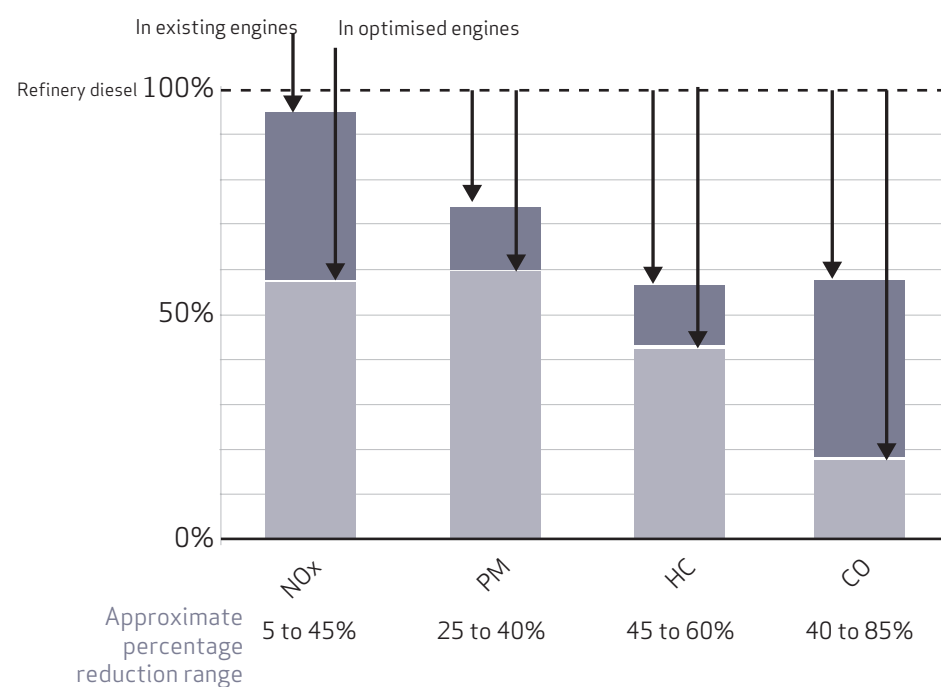


The Emalahleni Water Treatment Plant. Photo courtesy of Anglo Coal.

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Emissions Reductions from Synthetic Fuels – Europe

Source: Alliance for Synthetic Fuels in Europe, 2006



Millennium Development Goal	Importance of Energy	Coal
Eradicate extreme poverty and hunger	Energy inputs such as electricity and fuels are essential to generate jobs, industrial activities, transportation, commerce, micro-enterprises and agriculture outputs. Most staple foods must be processed, conserved and cooked, requiring heat from various fuels.	<ul style="list-style-type: none"> >> 40% of the world's electricity comes from coal, providing secure, reliable energy. >> The rapid electrification in South Africa, India and China has been heavily dependent on affordable coal. >> Coal directly provides 7 million jobs worldwide and coal production is the key to economic activity in many communities.
Achieve universal primary education	To attract teachers to rural areas electricity is needed for homes and schools. After dusk study requires illumination. Many children, especially girls, do not attend primary schools in order to carry wood and water to meet family subsistence needs.	<ul style="list-style-type: none"> >> In addition to providing reliable affordable electricity, many coal companies provide education and facilities within their communities. >> The Brazilian Coal Association has worked with companies in the Santa Caterina area to develop a unique educational and skills training centre, meeting the needs of children and adults alike.
Promote gender equality and empower women	Lack of access to modern fuels and electricity contributes to gender inequality. Women are responsible for most household cooking and water boiling activities. This takes time away from other productive activities as well as from educational and social participation. Access to modern fuels eases women's domestic burden and allows them to pursue educational, economic and other opportunities.	<ul style="list-style-type: none"> >> Coal provides reliable and affordable electricity, with more than 1 billion people gaining access via coal in the past two decades. >> Converting coal to ultra clean liquid fuels for domestic use can make an enormous difference to women's lives, as well as to children and the elderly who are disproportionately affected by indoor air pollution. >> Liquid fuels from coal can significantly reduce pollutants that impact local air quality such as nitrogen oxides and particulates. Liquid fuels from coal are sulphur free. >> China has, with financing from the International Finance Corporation (the private sector arm of the World Bank), set up the first Coal-to-Liquids plant to provide ultra clean fuels for domestic use. >> If CTL fuels are produced using carbon capture and storage, CO₂ emissions can be reduced by as much as 20% over the full fuel cycle compared to conventional oil products.
Reduce child mortality	Diseases caused by unboiled water, and respiratory illness caused by the effects of indoor air pollution from traditional fuels and stoves, directly contribute to infant and child disease and mortality.	<ul style="list-style-type: none"> >> If CTL fuels are produced using carbon capture and storage, CO₂ emissions can be reduced by as much as 20% over the full fuel cycle compared to conventional oil products.
Improve maternal health	Women are disproportionately affected by indoor air pollution and water- and food-borne illnesses. Lack of electricity in health clinics, illumination for night time deliveries, and the daily drudgery and physical burden of fuel collection and transport all contribute to poor maternal health conditions, especially in rural areas.	

Millennium Development Goal	Importance of Energy	Coal
Combat HIV/AIDS, malaria and other diseases	Electricity for communication such as radio and television can spread important public health information to combat deadly diseases. Health care facilities, doctors and nurses, all require electricity and the services that it provides (illumination, refrigeration, sterilisation etc) to delivery effective health services.	<ul style="list-style-type: none"> >> Affordable and reliable electricity from coal can play a direct and major role in combating deadly diseases – through powering communication, equipment and services. >> Coal companies also play a direct role in health care provision, often ahead of state services. >> In South Africa, coal companies have been operating major HIV/AIDS treatment programmes, providing free antiretroviral drugs. >> In Colombia, coal companies work with local organisations to provide 'health brigades' to indigenous peoples. Recent activities include widespread vaccination against yellow fever.
Ensure environmental sustainability	Energy production, distribution and consumption has many adverse effects on the local, regional and global environment, including indoor, local, and regional air pollution, local particulates, land degradation, acidification of land and water, and climate change. Cleaner energy systems are needed to address all of these effects and to contribute to environmental sustainability.	<ul style="list-style-type: none"> >> Coal is facing up to its environmental challenges and promotes the use of clean coal technologies which reduce local, regional and global impacts. >> Gasification of coal can reduce emissions of particulates, sulphur oxides and nitrogen oxides by up to 99%. >> Carbon capture and storage (CCS) must be included in any portfolio of mitigation options where significant reductions in CO₂ emissions are to be achieved. >> CCS is recognised as reducing the costs of overall mitigation by 30% or more and global storage capacity is immense.
Develop a global partnership for development	The World Summit for Sustainable Development called for partnerships between public entities, development agencies, civil society and the private sector to support sustainable development, including the delivery of affordable, reliable, and environmentally sustainable energy services. <i>Source: UN-Energy "The Energy Challenge for Achieving the Millennium Development Goals", 2005</i>	<ul style="list-style-type: none"> >> FutureGen is an international public-private partnership to build a commercial scale, coal-fuelled, near-zero emissions power plant using coal gasification and carbon capture and storage. The project will be operational in 2012. >> Coal companies participate in the Carbon Disclosure Project - the world's largest institutional investor collaboration on the business implications of climate change. >> Members of the coal industry also participate in the Global Reporting Initiative - an international collaborative network for reporting on economic, environmental and social performance.

About the World Coal Institute

The World Coal Institute is the only organisation working on a global basis on behalf of the coal industry. The World Coal Institute promotes:

- » Coal as a strategic resource, essential for a modern quality of life, a key contributor to sustainable development and an essential element in enhanced energy security.

and represents:

- » A progressive industry, committed to technological innovation and improved environmental outcomes within the context of a balanced and responsible energy mix.

The World Coal Institute is a non-profit, non-governmental association, funded by coal enterprises and stakeholders and operated from a London-based Secretariat.

WCI members

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Underground Coal Gasification Partnership

For more information on the activities of the World Coal Institute, please visit our website: www.worldcoal.org

World Coal Institute
2nd Floor, 22 The Quadrant
Richmond
TW9 1BP
United Kingdom

t: +44 (0) 20 8940 0477

f: +44 (0) 20 8940 9624

e: info@worldcoal.org

w: www.worldcoal.org

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