CIAB

COAL INDUSTRY ADVISORY BOARD

International Coal Policy Developments in 2011

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FOREWORD FROM THE CIAB CHAIRMAN

The *Coal Industry Advisory Board* (CIAB) is a group of high level executives from coal-related industrial enterprises, established by the International Energy Agency Governing Board in July 1979 to provide advice to the IEA from an industry perspective on matters relating to coal. There are currently 46 CIAB Members representing 21 countries, typically Chief Executives or senior executives from coal mining, transportation and machinery companies, from major power generation or other coal consuming companies, or from industry trade associations.

The original task of the CIAB was to assist the IEA in the practical implementation of the "Principles for IEA Action on Coal" – measures aimed at ensuring a ready supply and trade of coal to underpin energy security. In recent years the CIAB has focused additionally on developments in the technology of coal use required to enable coal to contribute to energy security in this era of climate change concern; and on issues arising from increasingly liberalised energy markets, such as the restructuring and privatisation of coal and electricity industries in many countries.

The CIAB has produced an *"International Coal Market and Policy Developments"* report annually for the Governing Board, Standing Committees and Secretariat of the International Energy Agency. This year, the CIAB has supported the IEA in producing its first annual *"Medium Term Coal Market Report"* that will cover much of the market and investment commentary included in previous annual CIAB reports. Accordingly, this *"International Coal Policy Developments in 2011"* report focuses primarily on policy issues and includes only brief coverage of market developments. It draws on contributions from Associates of CIAB Members to highlight policy and other issues that CIAB Members regard as pertinent to the development of coal as a secure, clean and competitive energy source.

We hope that this report will also be of interest to a wider audience.

J. Brett Harvey
CIAB Chairman

1 CIAB POLICY ADVICE

1. At present over 20% of the world's population, 1.4 billion people, lack access to electricity and on current trends this will reduce only to 1.2 billion by 2030[1]. To meet the UN Millennium Development Goal of eradicating extreme poverty by 2015, 395 million more people need access to electricity. There is a strong correlation between electrification and improvement in the United Nations' Human Development Index.

2. Coal's important role in supporting development and helping to alleviate energy poverty continues to be supported by new evidence every year. Over the last 40 years there has been a very good correlation between increases in global electricity from coal and global GDP. Coal accounted for nearly 30% of world energy consumption in 2010, its highest share since 1970, while its share is now over 70% in China and nearly 53% in India. China accounted for approaching half of global coal consumption in 2010.

3. The profile of developing countries dependent on coal must be raised. Understanding the true direction of Chinese policy, given rapidly growing energy demand and China's focus on achieving significant efficiency improvements in its coal-fueled power generation fleet, requires particular attention. Increasingly, energy security in OECD countries and the achievement of global climate change mitigation targets are becoming dependent on the policies of non-OECD developing economies.

4. IEA energy scenarios[2] predict rising global energy demand and a continued reliance on fossil fuels for the next twenty five years, driven by the rapidly developing electricity and energy needs of developing economies. They further illustrate the necessary role for coal in a sustainable energy future. Even the WEO 2010 450 Scenario shows significant growth in coal use to 2020, although a rapid substitution of nuclear and renewable electricity generation is projected to occur in the subsequent fifteen years.

5. Although the coal industry is currently investing in new production capacity, energy projections such as those made by the IEA that consistently under-estimate the role that coal is playing, and will continue to play, in world energy markets are potentially detrimental to maintaining investment. Inadequate and irregular investment in coal production, supply and use infrastructure, particularly for internationally traded coal and in the commercial deployment of clean coal technologies (CCTs) and carbon capture and storage (CCS) including carbon capture use and storage (CCUS), could precipitate medium to longer term security of supply concerns. The last year has seen yet more policy developments detrimental to coal's future production and use in OECD economies, while concerns are being raised about the industry's ability to meet the rapidly increasing and uncertain coal import requirements of China and India.

6. Governments have important roles in providing stable, effective and predictable regulatory frameworks but the direction of current policy is far from explicit in its support for investment in future clean coal use. This is adversely affecting the timely demonstration and deployment of cutting-edge CCT and CCS/CCUS technologies, which has serious implications for achieving energy security and climate change mitigation targets.

7. There needs to be greater and pro-active engagement with OECD governments and non-governmental organisations in order to develop an appreciation for the role of coal in providing sufficient and affordable electricity, particularly in developed economies.

[1] IEA "World Energy Outlook 2010", Chapter 8
[2] IEA "World Energy Outlook 2010"

Unfortunately, the evidence is ever stronger that the trend is counter to this requirement.

8. The coal industry has serious concerns about the growing disconnect between CO_2 emissions reductions scenarios such as the IEA's 450 Scenario, which is being used to inform policy and investment decisions, and the reality of rapidly growing energy demand and coal use in non-OECD countries. In light of this the 450 Scenario now looks almost impossibly challenging. For example, it is not clear by what mechanisms the dramatic reductions in the use of coal in non-OECD countries assumed in the 450 Scenario (almost a 30% reduction between 2020 and 2035) could be achieved in practice. Policy makers must focus on encouraging the development and deployment of "clean" technologies for all fossil fuels in order to achieve sustainable mitigation of CO_2 emissions. Further policy instruments that encourage a switch to natural gas are not a sustainable response to the CO_2 emissions mitigation challenge.

9. National governments must also provide for a legal framework for long-term carbon storage, which must address liability, indemnification and transfer of title to the government after a facility has completed carbon injection and has been certified. At the same time, governments need to engage the public on the issue of carbon storage and its safety.

10. Achievement of the G8 objective of broad deployment of CCS by 2020 looks unlikely, given recent reductions in government funding for CCS demonstration and funding difficulties experienced by commercial companies participating in CCS demonstration projects. A policy shift to fewer, better funded projects would seem to be a much more realistic approach going forward.

11. There must be greater focus on innovative research into cleaner, better ways of using coal – including CCTs and CCS/CCUS. Technology deployment is essential to meet the world's environmental goals. High efficiency thermal coal generation and CCS/CCUS are among the most transformational green technologies that exist today. Moreover, basic research needs to be encouraged and no possible option for reducing greenhouse gas (GHG) emissions can be ignored, although many governments now appear to recognise that CCS/CCUS technology is currently the most promising option for reconciling the continued use of fossil fuels including coal with GHG reduction objectives.

2 CIAB ACTIVITIES IN 2011

12. During 2010 it became increasingly evident that the ability of CIAB Associates to service the CIAB workload had diminished as their own companies' demands on their time had steadily increased in recent years. Therefore, in preparation for a debate at the November 2010 CIAB Executive Committee and Plenary meetings, a small working group headed by Roger Wicks (CIAB Chairman at that time) reviewed CIAB strategic priorities and work planned for 2011.

13. The strategy development process considered options for the CIAB in its role as advisor to the IEA Governing Board and Secretariat on matters related to coal production, transport, trade and utilisation as well as on environmental issues associated with coal use. The need to balance work aspirations with available resources (personnel and financial) was clearly recognised; and resulted in the adoption of a 2011 work programme different in nature from those of previous years. The planned focus on coal in forthcoming IEA publications including *"World Energy Outlook 2011"* and a proposed *"Medium Term Coal Market Report"* was recognised, and the CIAB's work in 2011 has therefore concentrated on reinforcing coal information and other resources available to the IEA.

14. In addition to the specific topics mentioned below, the CIAB interfaces with the IEA Secretariat through regular working contact, its annual CIAB Plenary meeting for CIAB Members and Associates, and two Associates meetings each year.

CIAB Coal Information Working Group

15. The CIAB recognises that access to accurate and timely coal industry data is of critical importance to the IEA; and that CIAB Members' market experience and analysis must form an important input to IEA thinking. As a result, CIAB Members endorsed the formation of a CIAB Coal Information Working Group led by Mr. Carlos Fernández *(Senior Coal Analyst, IEA)* to formalise and improve the provision of coal market information to the IEA.

16. In particular, the CIAB provides input aimed at improving understanding of;

- prospects for, and barriers to, coal industry investment;
- coal markets and trade;
- coal in non-OECD countries, particularly the influence of rapid growth in coal use by China and other developing economies;
- the role of coal in alleviating energy poverty;
- the effects of ageing coal use infrastructure on coal demand and energy security, for example through electricity production flexibility in times of energy crisis;
- new uses of coal including coal-to-liquids, coal bed methane and coal gasification.

17. Early in 2011 the working group formulated a questionnaire to collect a range of non-confidential industry information covering all aspects of the coal production value chain. Working group members provided the information for their own country or region and this was submitted to the IEA in April, giving sufficient opportunity for it to be used in the initial analysis work for WEO2011. Individual working group members also met specific IEA ad-hoc information requests and the working group will continue to address such requests as they arise.

World Energy Outlook 2011 Coal Workshop

18. In addition to information provided through the Coal Information Working Group, several CIAB Associates or other nominated individuals from their companies participated in a WEO 2011 Coal Workshop. This was organised by the IEA and hosted by Shenhua in Beijing on 14 April 2011. The workshop discussions provided valuable insight into issues facing coal-related industries in the light of continued rapid growth in world coal demand, particularly from China and India, coal investment and trade infrastructure challenges, and slow deployment of carbon capture and storage technology.

CIAB-supported secondments to the IEA

19. In recognition of the IEA's desire to improve its analysis and coverage of coal markets, the CIAB agreed during the latter part of 2010 to financially support a secondment to the IEA and sought appropriate individuals from within its Members' companies or other organisations. As a result, two PhD students from the Institute of Energy Economics at the University of Cologne (Energiewirtschaftliches Institut an der Universität zu Köln, or EWI) have worked consecutively at the IEA offices in 2011 to provide support for the IEA's coal-related work on *"World Energy Outlook 2011"* and the new *"Medium Term Coal Market Report"*. If sufficient financial support can be provided through CIAB Members, consideration will be given to extending this or a similar arrangement into 2012.

CIAB Clean Coal Technologies working group

20. The CIAB Clean Coal Technologies Working Group (CCTs WG) has been re-formed under the leadership of Mick Buffier, Associate to CIAB Member Mr. Peter Freyberg (Chief Executive, Xstrata Coal, Australia), and has engaged with the IEA Secretariat on the development of an IEA High Efficiency, Low Emissions (HELE) Coal Roadmap. Several CIAB Associates participated in the first HELE Coal Roadmap workshop chaired by John Topper on 8/9 June in Paris.

Plenary Meeting discussion sessions

21. In order to widen the discussion of topics relevant to coal with senior representatives of the IEA, CIAB Members and others made a series of presentations at the November 2010 CIAB Plenary meeting. A note of these discussions is available on the CIAB website at https://www.iea.org/ciab/papers/CIAB_Plenary_Discussion_Report_Nov_2010.pdf The November 2011 Plenary meeting will include presentations and discussions on:

    - Climate Change Targets and Technology Developments;
    - Developments in Major Regional Coal Markets; and
    - Public Policy Developments and Coal Investment.

IEA Greenhouse Gas R&D Programme

22. The CIAB has continued its formal sponsorship of IEA GHG, financed by contributions from CIAB Members. A CIAB representative attends IEA GHG Executive Committee meetings and the interface is managed through a small group of CIAB Associates led by Ms. Gina Downes, Associate to CIAB Member Dr. Steve Lennon. The group's aim is to influence the IEA GHG work programme by submitting ideas for IEA GHG Executive Committee consideration, encouraging CIAB participation in IEA GHG events, co-ordinating responses to draft IEA GHG reports, and disseminating IEA GHG reports and

other output to CIAB Associates and then into the relevant parts of their organisations.

IEA Publication "Resources to Reserves 2011: Oil, Gas and Coal Technologies for the Energy Markets of the Future"

23. The IEA is planning to publish a report updating its September 2005 publication and for the first time including coverage of coal resources and reserves. The CIAB has previously prepared material for the sections of the report covering coal, co-ordinated by the CIAB Energy Security working group with comprehensive support from BGR (the German Federal Institute for Geosciences and Natural Resources). Further updated data and commentary on draft text was provided in March 2011.

"The Global Value of Coal"

24. Following a discussion at the November 2010 CIAB Plenary meeting, it was agreed that a report prepared jointly with the World Coal Association should be published through the IEA. The initial draft has been prepared by Dr. Frank Clemente of Penn State University, USA, kindly sponsored by Peabody Energy, and CIAB Associates have subsequently made substantial input. The paper highlights the contribution that coal has made to world economic and social development, together with its potential to contribute further in a carbon constrained world. The paper will be published shortly.

CIAB report "International Coal Policy Developments in 2011"

25. It was agreed by CIAB Associates that this annual CIAB report should be shorter than in previous years, in view of IEA plans to produce a *"Medium Term Coal Market Report"* that will cover much of the market and investment commentary included in previous annual CIAB reports. It serves as a report to the IEA Governing Board on CIAB work during 2011, covers coal-related policy developments during 2011 and makes recommendations to the IEA. Only a brief overview of coal markets is now included. It has again been based on contributions and comments from CIAB Associates, and the policy recommendations have been endorsed by the CIAB Executive Committee.

3 COAL IN WORLD ENERGY MARKETS

26. The world's coal reserves are extraordinarily large and widely dispersed. Coal is safe and easy to transport, and it can be readily stored. Reflecting these attributes, as well as the reserves base of developing economies including China and India, the use of coal continues to grow strongly relative to other fossil fuels.

3.1 Overview

27. ***Total world primary energy consumption***[3] grew strongly again by 5.6% in 2010, after declining by 1.5% in 2009. Growth in China and India was 11.2% and 9.2% respectively and those two rapidly growing economies now account for almost a quarter of total world primary energy consumption. OECD total primary energy consumption grew by only 3.5%. World ***coal*** consumption grew by 7.6% in 2010, the fastest growth since 2003, while both China and India increased coal consumption by over 10%. Coal accounted for 29.6% of world energy consumption in 2010, its highest share since 1970, while its share is now over 70% in China and nearly 53% in India. China accounted for approaching half of global coal consumption in 2010.

28. According to IEA figures, coal consumption has grown at a rate of over 2.4% a year on average over the last thirty years. More notably, this growth has accelerated to over 4.8% on average over the last ten years.

29. Historically, IEA statistics show coal accounting for 24-27% of world energy use and its share was 27%[4] in 2008. The IEA's[5] New Policies Scenario assumes the introduction of cautious new measures to implement the broad policy commitments that have already been announced, including national pledges to reduce greenhouse gas emissions. In this scenario, the IEA expects total world primary energy use to grow by 1.2% a year on average to 2035 and coal use to grow by 0.6% a year. Coal's share will remain at 27% in 2020, before declining to 23.5% in 2035, with coal demand growing by 19% in total over the whole period.

30. In the 450 Scenario, which analyses how global energy markets could evolve if countries take co-ordinated action to restrict the global temperature increase to 2^{o}C, total world primary energy use is projected to increase by 1.2% a year to 2020, but only by 0.4% a year between 2020 and 2035, averaging 0.7% a year over the whole period. In this scenario, coal retains its share of the total market until 2020 before declining rapidly to hold a share of less than 17% in 2035, broadly equivalent to coal demand in 2003 and 25% lower than in 2008. But achievement of the outcomes required in this scenario to restrict the global temperature increase to 2^{o}C is now seen as very challenging. It requires the carbon intensity of the energy sector to be reduced by 5.3% a year between 2020 and 2025; four times the rate achieved between 1990 and 2008[6]. In the face of yet another year of observed strong growth in world energy demand, in particular in China and India, the mechanisms by which such a reversal in the current trend of carbon intensity growth would be delivered are far from clear.

31. With appropriate policy and investment signals, coal has the ability to meet further long term increases in demand, to support economic growth and to enhance the security of

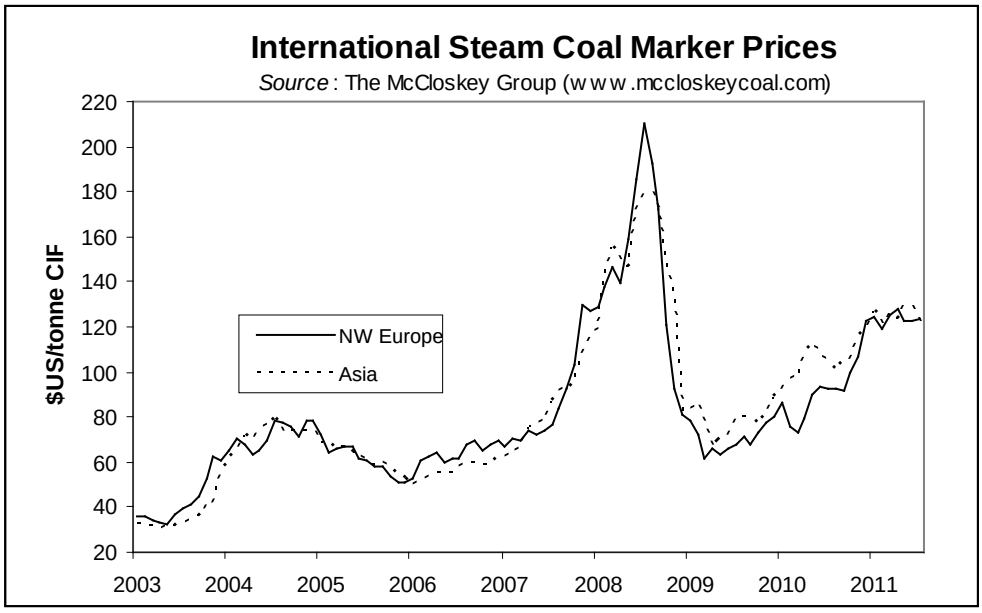
[3] Figures in this paragraph are derived from *"BP Statistical Review of World Energy June 2011"*.
[4] There are definitional differences between BP and IEA figures. Coal's share of primary energy consumption in 2008 is 27% based on IEA figures and 29% based on BP figures.
[5] OECD/IEA *"World Energy Outlook 2010"* (2010)
[6] OECD/IEA *"World Energy Outlook 2010"* (2010)

world energy markets through the development of national coal resources and increased international trade. Current indications[7] are that proved coal reserves (405 billion tonnes of sub-bituminous coal and 456 billion tonnes of anthracite and bituminous coal) at the end of 2010 are sufficient to satisfy the current production rate for 118 years. This is far higher than reserves/production ratios for oil (46 years) and natural gas (59 years), while the benign geography of coal reserves reduces the risk of supply disruption relative to other fossil fuels.

3.2 International Coal Trade

32. Thermal coal trade continued its growth in 2009 and 2010, following its first ever decline (-6.5%) in 2008, increasing by 3.8% in 2009 and by 2.6% to 676 million tonnes in 2010 of which 597 million tonnes was traded by sea. Over the last 10 years, seaborne thermal coal trade has increased by 75%, showing average growth of 26 million tonnes a year compared to average growth of 16 million tonnes a year in the previous ten years. Coking coal trade increased by 28% to 262 million tonnes in 2010. Australia remains the largest hard coal (thermal and metallurgical coal) exporting country, with nearly 300 million tonnes of exports (31.2% of the world market) in 2010[8].

33. China remains the key driver of international coal markets. In 2009 it transformed from a net coal exporter to a net coal importer, with net imports of 126 million tonnes in 2009 and 160 million tonnes in 2010. The massive size and rate of change of its domestic coal production and consumption, the latter driven by increasing industrial demand and electricity consumption, makes it a potential source of future price volatility in international coal markets.



34. Prior to 2007, international thermal coal prices had peaked in the second half of 2004 with the ARA CIF delivered price reaching about US$79/tonne. Prices delivered to European distribution ports were on a declining trend during 2005 and the ARA CIF delivered price was down to US$51/tonne by the end of the year, with Asian market prices apparently following the Atlantic market. However, prices increased steadily throughout 2006 and 2007, with rapid increases in Asian market prices from March 2007

[7] *"BP Statistical Review of World Energy June 2011"*., page 31
[8] IEA "Coal Information 2011", Part III, Tables 3.1 and 3.2

leading the way and illustrating the effect that Chinese demand for coal, other commodities and shipping continues to have on world markets. In the second half of 2007 and into 2008, European spot prices again led the rapid increase in prices, driven by demand in that region and influenced by continuing infrastructure constraints affecting Australian exports. NW European prices peaked at US$210/tonne in July 2008, with Asian prices reaching US$179/tonne.

35. By April 2009 however, both Asian and European prices had fallen rapidly to US$66-67/tonne. Since then, there has been a slow but steady increase in Asian prices, followed by European prices, which both reached the mid-US$120s/tonne by January 2011 and have remained around that level until mid 2011.

3.3 Regional Developments

Australia

36. Australia accounts for around 6% of the world's black coal production and is the world's largest coal exporter. In 2009/10 Australia produced 356.7 million tonnes of black coal and 68.7million tonnes of brown coal.

37. According to the Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES)[9], black coal production has increased at an average annual rate of 3.8% between 2005/06 and 2009/10, encouraged by strong global demand and supported by commissioning of new mines, rail networks and ports in Queensland and New South Wales.

38. 'Advanced' (under construction or committed) black coal mine projects are valued at AU$9.4 billion by ABARES and would add more than 53 million tonnes by 2014. Less advanced coal mine projects have a potential capital expenditure of well over AU$40 billion (ABARES) and potentially could add over 475 million tonnes of new capacity if all projects were to proceed. In addition to this, ABARES projects potential investment of up to AU$21.7 billion in coal export infrastructure (rail and port) to 2016, including those projects classified as 'less advanced'.

Japan

39. The earthquake and the subsequent tsunami that struck the Pacific coast of northeast Japan on 11 March 2011 caused a significant loss of coal-fired electricity generation and coal import facilities as well as the more publicised nuclear capacity losses. About 1,300MW of coal-fired power generation was expected to return to service during summer 2011 but 5,850MW of capacity, normally using almost 10 million tonnes of steam coal per year, is not expected to return to service until after the end of the year.

40. Coal consuming industries such as steel, pulp and paper located in the area were also damaged, but were not out of service for extended periods. However, damaged ports meant that recovering industries needed to use coal import facilities located on the Sea of Japan, with associated additional inland transportation costs.

Indonesia

41. Indonesia has abundant un-tapped coal resources, classified by the Government of

[9] On 1 July 2011 a new Bureau of Resource and Energy Economics (BREE) was established and assumed responsibility for analysis and publications previously carried out by the resources and energy branch of ABARES. BREE is a professionally independent agency within the Department of Resources, Energy and Tourism.

Indonesia (GOI) as comprising mineable reserves of 20.98 billion tonnes (of which 14% is bituminous coal, 66% subituminous and 20% lignite) and a further 104.76 billion tonnes of estimated resources requiring more detailed exploration before they can be classified as proven reserves. Most of coal deposits are located in East Kalimantan, South Kalimantan and South Sumatera.

42. Revitalization of coal mining began in 1973 when the state owned mining company rehabilitated old coal mines in Sumatera, following which GOI introduced a coal contract of work (CCOW) to attract foreign investors in the late 1970s. At the same time, GOI launched an electrification policy involving the development of a number of coal-fired power plants. Since then the production of coal had been increasing steadily. In 2010, Indonesian coal production reached 325 million tonnes, a fourfold increase in 10 years, and Indonesia became the fifth largest world producer after China, USA, India and Australia.

43. Indonesian domestic consumption remains low (60 million tonnes in 2010), with no new coal-fired power plants or cement factories developed between 1998 and 2008. Domestic users of coal are coal fired power plants (65%), the cement industry (9%), and textile, paper and pulp and other industries (26%). The contribution of coal in the national primary energy mix is expected to increase from only 26% today to 33% in the year 2025 in line with a GOI policy objective to reduce dependency on declining oil and gas production.

44. Coal exports have increased strongly from only 58.7 million tonnes in 2000 to 229.6 million tonnes in 2009 and 265.0 million tonnes in 2010, mainly to Asian countries including India, China, Japan, Korea, Taiwan and Hong Kong. Small amounts of mainly high calorific value, low sulphur coal are also exported to European countries. Coal exports to China increased from only 142 thousand tonnes in 2000 to 38.46 million tonnes in 2009, while exports to India increased from only 3.4 million tonnes in 2000 to 38.9 million tonnes in the 2009.

45. Most of coal mined in Indonesia is from open-pit/surface mines using the power shovel-truck system. Because of limited transportation infrastructure, most coal is transported from mine to coal jetties by river, from where it is transported by barge and transhipped to larger vessels at sea. Some coal companies also own coal terminals and/or blending facilities, and only one company transports coal via rail. According to a joint study done by GOI and JCOAL of Japan, existing infrastructure capacity is sufficient to support about 600 million tonnes per year.

46. Currently there are several proposals from government/local government or commercial coal companies to improve coal transport infrastructure. For example, the provincial government of central Kalimantan has a plan to build a rail transportation system from Central Kalimantan to the south coast that will increase export capacity from BHP Billiton and Adaro's two large coal mines. Another large project is the development of a new rail system from Tanjung Enim in South Sumatera, where the state owned company PT Bukit Asam operates, to the coast. This project will be developed in line with the upgrading of the existing railway in Lampung Province to double capacity. In total this will increase the production capacity of Bukit Asam from 13 million tonnes per year at present to 40 million tonnes per year in the next ten years.

47. In addition to these projects, many special mine road and over-land conveyor projects will be developed by mining companies to transfer coal from mines to the coast because transporting coal on public roads is strictly prohibited.

Germany

48. The role of coal in Germany remains significant. In 2010 it accounted for 22.8% of total

primary energy consumption, amounting to 57.8 million tonnes coal equivalent of hard coal and 51.5 million tonnes coal equivalent of lignite in total primary energy consumption of 479.6 million tonnes coal equivalent.

49. Coal is mainly used for power production and accounted for 263 TWh (42.4%) of the total 621 TWh gross consumption in 2010. 147 TWh was produced from lignite and 116 TWh from hard coal.

50. Total hard coal use increased by 15.4% in 2010, mainly as a result of increased steel production and increased use for power generation. Hard coal imports increased by 15% to 43.9 million tonnes coal equivalent and domestic production declined by 7% to 13.2 million tonnes coal equivalent. Almost 75% of Germany's hard coal demand is met by imported sources for power generation, steelworks and the heating sector. Key suppliers of imported steam coal include Russia (30%), Colombia (24%), Poland (12%), South Africa (11%) and the USA (9%). In the metallurgical coal market, the major importers are Australia (44%), USA (33%) and Canada (13%).

51. Lignite production decreased 0.3%, from 169.9 million tonnes (52.2 million tonnes coal equivalent) in 2009 to 169.4 million tonnes (52.3 million tonnes coal equivalent) in 2010. Note that the average heating value of the mined lignite was higher in 2010. More than 90% of the lignite that was produced in ten surface mines is being used for power generation, mainly close to the mines.

Turkey

52. Estimated lignite reserves are 11.5 billion tonnes in total, of which nearly 10 billion tonnes (86%) are proved. 86% of total reserves are in state ownership. Existing state-owned coal lignite production capacity is 73.5 million tonnes/year. Total Lignite production reached 65 million tonnes in 1999, but had declined to 43.7 million tonnes by 2004 as power station demand for the fuel declined. However, production then increased steadily to reach 76.2 million tonnes in 2008, driven by government energy policy favouring domestic lignite-based electricity generation and completion of two new lignite based power stations, Can 18 Mart and Elbistan B. Production declined only slightly to 75.6 million tonnes in 2009. State-owned lignite production fell by 10% in 2010, a trend expected to continue.

53. Lignite is consumed in three sectors: thermal power stations, industry and households, but power generation is the main consumer. While the share of lignite in electricity generation reached its highest value of 47% in 1986, this had declined to 17% by 2010 as a result of an increase in the use of natural gas in electricity generation. 46.5% of electricity generated in 2010 used natural gas.

Finland

54. As the country lacks its own natural gas, oil and coal reserves, approximately 70% of energy consumed in Finland is imported; and its energy policies recognize the importance of diverse energy supplies. Renewable energy (biomass, i.e. wood and wood-based fuels, and hydropower) provides a quarter of Finland's total energy consumption and accounts for more than a quarter of its power generation.

55. Nuclear power accounted for around a quarter of the total electricity supply in 2010. Approximately one third of electricity is produced in combined heat and power (CHP) plants, which operate with efficiency rates of 80–90% and are used by industry and for district heating and cooling. Coal and natural gas are the main fuels for CHP plants. In 2010 coal's share was about 16% (of 77TWh) in electricity production and 23% (of 64TWh) in district heat production. All coal is imported; typically about 5 million tonnes of steam coal for energy production, I million tonnes of coking coal for the steel industry, and smaller quantities for the cement industry.

4 POLICY DEVELOPMENTS

4.1 Overview

56. IEA scenarios project total energy demand increases of 22-47% to 2035 (from 2008), depending on the extent of action taken to mitigate increases in greenhouse gas emissions[10]. In order to maintain a stable and affordable energy supply whilst keeping economic, social and environmental objectives in balance, it is essential that energy be obtained from a wide variety of sources.

57. A compelling economic and social case can be made for sustaining the role of coal in the future energy mix, given that it is an affordable, reliable and secure source of energy. All fossil fuels must address the challenge of greenhouse gas emissions reduction, most important for coal because it is the most carbon intensive fossil fuel. The following paragraphs highlight recent policy developments that impact on this challenge for the coal industry.

58. In summary, progress has been slow or negative. The tsunami in Japan has increased energy policy uncertainty, not only in Japan but also in other countries with plans for nuclear power expansion. Policy changes in Germany will increase that country's reliance on imports of electricity and coal, although CO_2 emissions concerns following the closure of nuclear power plants will increase future uncertainty on coal's position in the energy mix. A raft of impending new environmental regulations affecting coal use in the USA will likely stall development of any new coal-fired electricity generating capacity for many years, while the lack of an integrated climate policy adds to future uncertainty.

59. Climate change concerns are also increasing opposition to coal-fired power generation amongst governments and the public in many countries. Subsidies continue to be offered for uneconomic renewable energy, mostly wind turbines, while support for the development of carbon capture and storage demonstration projects is reducing rather than increasing. The development of potential carbon storage sites is becoming particularly difficult; and focus in the USA is turning to the use of CO_2 for enhanced oil recovery as a means of improving CCS demonstration project economics.

60. In Australia, proposed new Minerals Resource Rent Tax and carbon taxes will unfavourably impact the economics of coal mining and act as disincentives to investment. The proposed carbon tax and a 20% renewable energy obligation introduce considerable additional risk to investing in new fossil fuel electricity generation plant.

61. These developments are set out in further detail below. In the coal industry's view, their effect on the ability to maintain the role of coal in carbon-constrained world, particularly in OECD economies, is becoming a major concern for electricity supply and energy security.

4.2 The Role of Coal

Japan

62. The Japanese Basic Energy Plan is normally reviewed every three years and the latest plan was agreed at a cabinet meeting in June 2010. The Plan advocated increasing nuclear power capacity, focusing on increasing energy security and reducing carbon emissions. However, the Fukushima nuclear accident triggered by the 11 March tsunami has eroded confidence in nuclear power technologies in Japan. In light of this the Prime

[10] OECD/IEA "World Energy Outlook 2010" (2010)

Minister has announced an early review of the Plan.

63. The Ministry of Economy, Trade and Industry is aiming to draft a new Plan within a year and the Minister of Economy, Trade and Industry announced in May the formation of a panel of seven experts, including four academics, that is expected to discuss options for the new Plan.

Germany

64. The "Energy Concept" setting out the framework for energy developments in Germany to 2050 was adopted by the German Government on 28 September 2010. It focuses on meeting climate goals while still maintaining reliable energy sources and power supplies at affordable prices. Long-term goals include:

    - a reduction in primary energy demand of 20% by 2020 and 50% by 2050 compared to 2008 levels;
    - reductions in greenhouse gas emissions (GHG) of -40% by 2020, -55% by 2030, -70% by 2040 and as much as 80-85% in 2050 compared to 1990 levels; and
    - 80% of power sourced from renewable sources by 2050.

65. In the "Energy Concept", the German coalition government agreed to a controversial lifetime extension for its 17 existing nuclear plants. The effects of the Japanese earthquake have caused individual countries to re-assess their nuclear power programmes. Many countries (including China) have announced additional safety checks on current and proposed plants and others, while still assessing their responses, are expected to do so.

66. The most significant immediate response was from Germany, which announced the temporary closure of 8.3 GW of nuclear capacity comprising the seven pre-1980 reactors and Krümmel. Subsequently, all political parties in Germany have agreed to a complete phase out of nuclear energy in the first half of the next decade at the latest. On 30th May 2011 the German government agreed that the seven oldest reactors and Krümmel will remain permanently closed, six newer reactors will be taken offline by 2021 and the remaining three will close by 2022 at the latest. The agreement prohibits its revision by future governments.

67. All political parties are in favour of increasing the rate of expansion in use of renewable energy, which contributed 9.4% to primary energy consumption and nearly 17% to power production in Germany in 2010. A prerequisite is a massive investment in electricity grids and storage capacity.

68. According to a study done for the German Industry Federation (BDI), the lost nuclear output will be partly replaced by increased generation from existing coal-fired units, where operation could be extended 6-7 years, and output from coal-fired stations currently under construction. Higher output from gas-fired power stations will also be required; and Germany is expected to become a net importer of electricity in contrast to its position as a net exporter in recent years. Furthermore a replacement of nuclear power production by fossil-fired power production will have an impact on CO_2 emissions and wholesale electricity prices.

Finland

69. The core framework for Finnish energy policy comes from Europe's Energy and Climate Policy (the 20-20-20 rule). Finland must implement integrated energy and climate policy measures which emphasise energy efficiency, energy saving and the increased use and production of renewable energy sources. The goal is to increase the share of renewable

energy to 38% by 2020, in line with the obligation for Finland stipulated by the EU Commission.

70. A range of subsidies including feed-in tariffs and investment subsidies encourage the use of renewable energy (biomass, solar and wind) for power generation. There is great public opposition to the use of coal and its use will decline, although it will remain stable in the short term. The increasing cost of CO_2 emissions permits means that existing plants are co-firing biomass with coal and that no new coal-fired plants will be built.

United Kingdom

71. At the end of December 2010, coal-fired electricity generating capacity owned by major power producers in the UK was 23 GW, 28% of the 83.2 GW total transmission entry capacity. Coal accounted for nearly 35% of fuel used for power generation in 2010. Some 6 GW of coal-fired power plants have "opted-out" of the Large Combustion Plants Directive, requiring that they close by the end of 2015 or after 20,000 hours of operation from 1 January 2008, whichever is the sooner. A proposed Emissions Performance Standard will also reinforce the existing requirement that no new coal is built without carbon capture and storage.

4.3 Climate Policy

United States of America

72. Comprehensive U.S. climate change legislation is unlikely in the near term. The economic recession has increased political sensitivity toward increased energy costs and other economic impacts of climate regulation. For example, the American Clean Energy and Security Act of 2009, a comprehensive "cap and trade" climate bill, was passed by a vote of 219 to 212 in the House of Representatives.[11] In contrast, the "Energy Tax Prevention Act of 2011," which would prohibit US EPA from implementing additional regulations that would limit greenhouse gas emissions, was passed by the House of Representatives in April 2011 by a vote of 255 to 172[12].

73. Given the poor prospects for comprehensive climate legislation, other more narrow approaches have received attention. In his State of the Union address[13], President Obama called on Congress to enact a "Clean Energy Standard" (CES) which would require 80% of U.S. electricity generation in 2035 to come from "clean" energy, including coal-based power with CCS. The Senate Committee on Energy and Natural Resources pursued this concept through issuance of a White Paper and call for stakeholder input in March 2011[14], but the Committee chairman was recently cited as expressing pessimism regarding the passage of CES legislation[15].

74. However, it is likely that legislation funding continued research on climate mitigating technologies, including CCS, will be enacted, and federal subsidies for renewable energy continue. Additionally, narrowly focused legislation on certain aspects of CCS, such as

[11] H.R. 2454, passed June 26, 2009. Similar legislation was not passed by the Senate, so the bill did not become law.
[12] H.R. 910, passed April 7, 2011. Similar legislation was not passed by the Senate, so the bill did not become law.
[13] Remarks by the President in his State of Union Address, the White House, January 25, 2011, http://www.whitehouse.gov/the-press-office/2011/01/25/remarks-president-state-union-address .
[14] Clean Energy Standard White Paper, Senate Committee on Energy & Natural Resources, http://energy.senate.gov/public/index.cfm?FuseAction=IssueItems.View&IssueItem_ID=7b61e406-3e17-4927-b3f4-d909394d46de
[15] "Outlook bleak for passing CES, repealing oil subsidies – Bingaman", *Greenwire*, May 16, 2011.

the long term liability for geologically stored CO_2, may be enacted. Legislation supporting additional, relatively expensive, CCS commercial demonstration projects is problematic given Congressional concerns regarding both the level of federal debt and the ongoing U.S. budget deficit, which now exceeds US$1 trillion per year.

Australia

75. The Australian Government has announced that it will introduce a carbon pricing regime from 1 July 2012, with fixed prices for the first 3 years (starting at AU$23/t$CO_2$e and rising to AU$25.40 in 2014-15). The fixed price period will be followed by carbon trading within a price floor and cap for a further three years, and then open trading and flexible prices from 2018-19 onwards subject to various restrictions including in respect of international trading of permits/offsets.

76. The proposed Australian scheme is distinctive in that it will apply to fugitive emissions from coal mining in addition to emissions from fossil energy use. No other established or proposed trading scheme applies to coal mine fugitive emissions in this way,

77. Also, the Australian scheme will raise almost AU$400 in revenue per capita in its first year, in contrast to the European Emissions Trading Scheme which has raised less than AU$2 per capita per annum since its commencement in 2005. Trade exposed industries, including coal, have expressed concerns about the impact of the scheme on Australia's international competitiveness. The Government has announced that AU$9.2 billion over 3 years will be available to assist the most emissions-intensive activities which are exposed to international competition, although coal mining is specifically and permanently excluded from these arrangements.

78. According to modelling commissioned by the Australian Coal Association (ACA) based on the Government's previous proposed carbon pricing scheme, the tax would impose a cumulative AU$18 billion cost on the coal mining industry by 2020 and would result in 18 mine closures, 9,000 job losses and reduced investment in new mines.

79. The Government has announced a 'coal sector jobs package' which would provide assistance of up to AU$1.264 billion over 5 years to the most emissions-intensive mines only. New mines and expansion of production at existing mines will not be eligible. The Government also announced AU$70 million to develop carbon abatement technologies for coal mines.

80. The coal industry has argued that the carbon pricing scheme should:

    - adopt a phased approach to the auctioning of emissions permits for trade-exposed industries; and
    - phase-in the inclusion of coal mine fugitive emissions in step with Australia's coal export competitors and over a time frame consistent with the development of fugitive abatement technologies from their current experimental stages to reliable, deployable equipment at commercial scale.

South Africa

81. The government's climate change Green Paper released in November 2010 has been the key climate policy development in South Africa, with legislation expected later in 2011. The Green Paper provides guidance on the issues that will be addressed in that legislation and some of the areas that will potentially impact the coal and electricity industries are highlighted below.

82. The Green Paper recognises the part that low cost electricity fuelled by abundant cheap coal has played historically in job creation and income growth; but also recognises that it

has been difficult for renewable energy and energy efficiency options to compete with coal based power. South Africa has a high level of renewable energy potential. It presently has in place a target of 10,000 GWh of renewable energy by 2013 and is committed to review and scale up this target to avoid jeopardising international competitiveness in a future, carbon-constrained, global economy. Concern is also expressed that trade barriers on coal and carbon intensity are being proposed by some developed countries that would have serious consequences for South African exports.

83. South Africa has targeted its greenhouse gas emissions to peak between 2020 and 2025, remain stable for a decade and then decline in absolute terms from around 2035. In December 2009 and in the context of this trajectory, South Africa committed at Copenhagen to reduce its greenhouse gas emissions by 34% by 2020 and 42% by 2025 below business as usual, on condition that it receives the necessary finance, technology and support from the international community. The burning of coal as a fuel accounts for over 60% South Africa's total greenhouse gas emissions.

84. Limited availability of international finance for large scale fossil fuel infrastructure in developing countries is emerging as a potential risk for South Africa's future plans for development of new coal fired power stations. Where such plants are built, investment in new, efficient, clean coal technologies will be encouraged through the introduction of more stringent thermal efficiency and emissions standards for coal fired power stations. Further, a legislative policy and regulatory framework to support carbon capture and storage will be developed.

85. South Africa will integrate a climate constraint into its energy planning tools including the Integrated Energy Plan (lEP) and the Integrated Resource Plan for Electricity Generation (IRP). It intends to use market-based policy measures such as an escalating carbon tax to price carbon and internalise the external costs of climate change, aiming to motivate or drive energy mix diversification, the implementation of far reaching energy efficiency measures and investments in the development of new and cleaner technologies and industries.

86. It plans to explore and further develop the potential for nuclear energy in terms of the national Nuclear Energy Policy, implementing a new nuclear fuel cycle strategy with a view to developing a nuclear power station fleet with the first reactors being commissioned from 2022 and a potential of up to 10 GWe by 2035.

87. A local and global transition to low carbon societies and economies would negatively impact on local coal sales and exports in the medium to long-term.

Indonesia

88. The Government of Indonesia's (GOI) commitment to lowering greenhouse gas emissions will be addressed by the government program on reducing the deforestation rate by imposing a moratorium on primary forest and peat land conversion; as well as launching a massive reforestation and tree planting campaign. In 2009 the GOI introduced the "one man one tree" program that will result in more than 240 million trees being planted; and in 2010 it launched a program called "one billion trees for the world", meaning that at least four trees must be planted for every person in Indonesia.

Finland

89. The EU emissions trading scheme has had only a minor impact on energy production based on fossil fuels, but has increased energy prices on Nordic markets. Furthermore, energy taxes have increased the cost of energy production; in particular from the beginning of 2011 when the general structure of energy taxation in Finland was changed.

90. Taxation of liquid fuels and coal now takes account of both energy content and carbon dioxide emissions and total tax rates for fuels, other than road traffic fuels, were raised considerably. The CO_2 tax rate was raised from €20/t CO_2 to €50 for traffic fuels (diesel oil) in 2012 and to €30 for heating fuels (with a 50% reduced rate for heating fuels used in CHP plants). The relative weight of CO_2 in the total tax for coal, natural gas and fuel oils was reduced, due to the introduction of the new energy component. Tax adjustments for natural gas will take place in stages up to 2015. A low, ascending energy tax for peat is being introduced in stages by 2015. The total tax on coal is €128/tonne (about €92/tonne for CHP plants) which is about a 150% increase from last year. The environmental fuel tax does not include fuels used for electricity production.

91. A number of mechanisms aimed at increasing the utilization of renewable energy, especially wood, have come into force. The high subsidies for renewable energy, together with the EU's emissions trading scheme and high taxation of fossil fuels in heating production, will lead to lower coal usage. Construction of new coal fired capacity is very unlikely; but coal may have a significant future role in biomass co-firing solutions and in multi-fuel boilers.

United Kingdom

Recent Legislation

92. On 8 April 2010, the Energy Act 2010 became law. It implements some of the key measures required to deliver the Department of Energy and Climate Change's (DECC) low carbon agenda, including the Carbon Plan 2011, first published in March 2011. This is a Government-wide plan, including domestic and international activity, which sets for each government department actions and deadlines for the next 5 years to reduce carbon emissions.

93. In May 2011, the Energy Bill 2010/2011 had its second reading in Parliament and Committee review sessions will follow. This Energy Bill has been designed to provide for a step change in the provision of energy efficiency measures to homes and businesses; and make improvements to enable and secure low carbon energy supplies and fair competition in the energy markets.

94. The Chancellor announced in the 2011 Budget the introduction of a carbon price floor for the power sector from 1st April 2013, to encourage investment in all forms of renewable energy including new nuclear power. It will start at around £16/tonne in 2013 and then rise to a target price of £30/tonne in 2020 and £70/tonne in 2030; applying to all fossil fuels used in electricity generation.

Carbon Budgets

95. The Climate Change Act 2008 introduced a long-term legally binding framework to tackle climate change by setting ambitious, legally binding 'carbon budget' targets for all of the U.K. In May 2009, the levels of the first three carbon budgets were approved by Parliament and were set in law.

96. The Carbon Budget covers emissions for all of the UK, as required by the Climate Change Act, which also requires Parliament to set the fourth carbon budget by 30 June 2011. On 17th May 2011 the Energy and Climate Change Secretary, in line with advice from the Independent Committee on Climate Change, set the fourth carbon budget of 1950 Million tonnes CO_2e for the period 2023 to 2027. This proposes to cut Britain's emissions by 50% from 1990 levels, putting the UK on course to cut emissions by at least 80% by 2050.

97. The Act requires that Government publishes a report setting out proposals and policies

for meeting the fourth carbon budget 'as soon as is reasonably practicable' after setting the new carbon budget in legislation. The Government intends to publish the report in October 2011, alongside the Carbon Plan.

98. The table below sets out the four carbon budgets announced to date:

	Budget 1 (2008-12)	**Budget 2 (2013–17)**	**Budget 3 (2018–22)**	**Budget 4 (2023–27)**
Carbon budgets (MtCO2e)	3018	2782	2544	1950
Percentage reduction below 1990 levels	23%	29%	35%	50%

99. However, there is a caveat. The Government will continue to argue for an EU move to a 30% target for 2020, and further ambitious action in the 2020s and will review progress in EU climate negotiations in early 2014. If at that point the UK's domestic commitments place it on a different emissions trajectory to the EU Emissions Trading System trajectory agreed by the EU, the Government will revise its budget upwards as appropriate.

4.4 Clean Coal Technologies

United States of America

100. A general overview of active US DOE-funded CCS demonstration projects can be found on the US DOE/NETL website[16]. As part of the effort to inject money into the U.S. economy during the 2008 recession, Congress provided over US$3 billion of new money for CCS commercial-scale demonstration projects, both in the electric power sector and the industrial sector, and the money has since been awarded to a number of CCS projects:

- US$800 million to expand the Clean Coal Power Initiative;
- US$1,520 million for industrial CCS projects;
- US$50 million for geologic sequestration site characterization;
- US$20 million for geologic sequestration training and research; and
- US$1,000 million for FutureGen 2.0.

101. However, additional appropriations for large scale demonstration projects did not occur in the federal Fiscal Year 2010 (FY2010) budget, the FY2011 budget, or the FY2012 budget proposal by the Administration. Moreover, grants to these large commercial demonstration projects generally require at least 50% cost sharing by the collaborating private sector sponsor of the project. The stagnant economy and absence of regulatory requirements for major CO_2 emission reductions have led to speculation that some of the CCS projects that have been awarded large grants by US DOE may not go forward due to lack of private sector funds[17]. It is possible that only three out of the ten major CCS

[16] CCPI and ICCS Demonstration Projects, US DOE/NETL, September 2010, http://www.netl.doe.gov/publications/proceedings/10/co2capture/presentations/thursday/Anthony%20Zinn%20-%20CCPI%20and%20ICCS%20Demonstration%20Projects%20Overview.pdf

[17] For example, in December 2010, Basin Electric announced that it was suspending the 120 MW CCS project at

demonstration projects that were to have received government stimulus funding may survive.

102. At the research and development (R&D) scale, covering technology development prior to its demonstration at commercial scale, funding for CCS technology at the US DOE has dropped from approximately US$400 million in Fiscal Year 2010 to a level of US$290 million requested by the Administration for Fiscal Year 2012.

103. A possible effect of the financial barriers facing CCS projects in the U.S. is the choice of storage systems. Of the large scale CCS field test and demonstration projects selected for funding by US DOE, only the FutureGen and AEP-Mountaineer projects plan to store the captured CO_2 in saline geologic formations. The remainder will use the CO_2 for enhanced oil recovery (EOR), which provides a revenue stream for the projects.

104. Despite the setbacks and continued challenges facing CCS demonstration, it should be noted that early CCS research activities are beginning to be replicated at larger scale. Alstom announced successful operation of the 20 MW "chilled ammonia" CCS project, which operates on a slipstream of flue gas from AEP's Mountaineer power plant in West Virginia. Capture rates varied from 75-90%, injection into a saline reservoir averaged 7,000 tons per month, and the system was available more than 90% of the time. The unit has been storing CO_2 since October 2009[18].

Australia

Government CCS Funding

105. The Australian Government announced funding cuts to CCS programs in the 2011/12 Budget, including:

- *CCS Flagships Program* – funding reduced by AU$250.9 million with a further AU$420 million re-phased to later years (2015/16 and beyond). Originally a AU$2 billion program to support 2-4 large-scale CCS projects; it is now a AU$1.68 billion program.
- *Global CCS Institute* – funding reduced by AU$95 million with a further AU$5 million re-phased to later years. Total funding for the Institute now stands at AU$305 million.
- *National Low Emissions Coal Initiative* – a AU$12.8 million reduction over 5 years from the AU$385 million fund to support CCS development and demonstration.

106. An additional AU$60.9 million was announced in the Budget for the establishment of a National CO_2 Infrastructure Plan to accelerate the identification and development of suitable long-term storage sites within reasonable distances of major energy and production emissions sources.

107. As part of the 'Clean Energy Future' (Carbon Tax) package, the Government announced a AU$10 billion Clean Energy Finance Corporation which will invest in clean and renewable energy technologies. CCS has been specifically excluded from these funding arrangements.

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its Antelope Valley power plant indefinitely, even though it had been selected to receive US$100 million in US DOE funding, http://www.bismarcktribune.com/news/local/article_a5fb7ed8-0a1b-11e0-b0ea-001cc4c03286.html?mode=story

[18] Alstom announces successful results of Mountaineer CCS project, Alstom, http://www.alstom.com/china/news-and-events/press-releases/press-releases-xn-52/ .

National CCS Council

108. The National CCS Council was established in March 2011 to advise the Australian Government on the accelerated development and deployment of CCS in Australia. It comprises representatives of the coal and gas industry, governments, researchers and coal and gas-fired power generators. The National CCS Council will build on the work of the previous National Low Emissions Coal Council, including the updated *National Low Emissions Coal Strategy* which was released in December 2010.

CCS Project Developments

109. The Australian Government short-listed four CCS Flagship demonstration projects in 2009 which have received initial pre-feasibility funding:

- Wandoan Power Project, 330MW Integrated Gasification Combined Cycle (IGCC) with CCS in (Queensland);
- ZeroGen project, 400MW IGCC with CCS (Queensland);
- Collie South West Hub, integrated geosequestration infrastructure with 3.3 million tonnes a year capacity (Western Australia); and
- CarbonNet, integrated geosequestration infrastructure with 3-5 million tonnes a year capacity (Victoria).

110. Following an announcement by the Queensland State Government in December 2010 that it would transition out of ownership of the ZeroGen project, this project has commenced wind-up proceedings and will not receive further financial support from the three major funders – Commonwealth and Queensland Governments and the black coal industry (COAL21 Fund). The focus of the project is now on consolidating and sharing the project's experience and learning.

111. The Queensland Government also announced it would not pursue an IGCC power plant at this time and instead would focus its efforts on identifying suitable CO_2 storage, with AU$50 million available for this work. The focus on storage is supported by the black coal industry which is examining the Carbon Transport and Storage Company (CTSCO - the storage arm of the Wandoan project) proposal for CO_2 storage in the Surat Basin while considering alternative capture options for an integrated CCS project in Queensland.

Japan

112. In July 2009, J-POWER and The Chugoku Electric Power Co., Inc. established the "Osaki CoolGen Corporation"[19] to construct and demonstrate a 170MW oxygen-blown IGCC employing EAGLE technology[20] associated with CO_2 capture. Environmental assessments and preparation for construction will commence in FY2012, with a target of FY2016 for the start of operation. J-POWER and The Chugoku EPCo consider that the technological feasibility of Integrated Coal Gasification Fuel Cells (IGFC) can also be tested through the CoolGen demonstration.

Finland

113. Finland does not have suitable geological formations for CO_2 storage. The Meri-Pori Carbon Capture and Storage project involved retrofitting the Meri-Pori power plant with

[19] See press release http://www.jpower.co.jp/english/news_release/news/news090729.pdf

[20] The "EAGLE Project", with a pilot-scale plant of oxygen-blown 150 tonnes/ d coal feed had been successfully tested by the New Energy and Industrial Technology Development Organization (NEDO) and J-POWER before March 2007. The EAGLE Project has continued to capture CO_2, since November 2008.

CCS equipment and transporting the CO_2 by tanker to the North Sea. However, the project has now been cancelled because of unacceptable technological and financial risks and the uncertain future prospects for coal-fired power generation.

Germany

114. The German federal cabinet in April 2011 adopted a bill on the demonstration and application of carbon capture and storage. In this bill, however, the government gives the federal states a right of veto over CO_2 storage; and this will be a major obstacle to the implementation of onshore CO_2 storage.

115. Within the scope of a comprehensive clean coal strategy, electricity producers in Germany are supporting the use and advancement of highly efficient and low-impact power generation technologies. This includes an increase in efficiency, by pre-drying lignite for example, and CCS technology.

116. In lignite-fired electricity generation, RWE is developing a capture technology, CO_2 scrubbing, for conventional power plant that can also be retrofitted in existing power plants. Since 2009, a CO_2 scrubbing pilot plant has been in operation at the Niederaussem lignite-fired power plant in the Rhineland to promote the development of this technology for subsequent commercial-scale application. The next planned step is a scale-up to demonstration plant size.

117. Vattenfall built a pilot plant to test oxyfuel technology in 2008. Based on the findings obtained during three years of trial operations, a demonstration plant with an electric capacity of 250 MW is planned for the Jänschwalde site. At the same time, post-combustion technology is to be demonstrated in an existing boiler.

118. In parallel with the development of power plant technology, the issue of carbon storage is being explored. Potential storage options are depleted gas fields and deep saline aquifers. In projects of their own and in research consortia, the producers of lignite-based electricity are developing technologies that allow carbon dioxide to be safely stored in these formations. At Ketzin in the state of Brandenburg, for example, over 40,000 tonnes of CO_2 have already been injected as part of a saline aquifer project.

119. In addition to storage, RWE is developing long-term options of using CO_2 to reduce emissions. For this purpose, research projects were launched to investigate carbon usage in chemical, biological and biotechnological production processes. In chemical use, CO_2 could replace the carbon that has so far been derived from fossil sources to produce certain types of plastic; the biological process uses the photosynthetic performance of fast growing microalgae; and for biotechnological use, research is being conducted into micro-organisms that convert carbon via bacterial metabolism pathways.

The Netherlands

120. The Dutch government has ruled that onshore Carbon storage will no longer be facilitated, so permits for CO_2 storage in depleted gas fields in the North of Netherlands will not be granted. The A.o. Nuon/Vattenfall and RWE/Essent CCS projects are affected by this decision. Now only one industrial CCS project with offshore storage has passed the Dutch selection for Europe NER300.

121. The MEP subsidy regime for biomass co-firing in coal plants (and SDE subsidy system for other renewables) will likely be replaced by a *supplier obligation system.* This system is now in the design phase and will oblige electricity suppliers to buy a quota of renewable energy. Since biomass co-firing is one of the most competitive renewable energy uses on a price per KWh basis, it will enable coal fired stations to co-fire biomass and receive compensation for that. Biomass co-firing forms half of Dutch renewable

energy use and the remainder is wind. Biomass comprises pelletized sawdust, currently sourced from North America and Scandinavia, and co-firing it with coal does not significantly reduce power plant efficiency. The target for co-firing is 10% of the Dutch coal-fired power plant fuel use; and this will increase each year until 2020. 20-50% biomass co-firing on coal plant is required to meet renewable obligation targets. 20% co-firing does not significantly reduce power plant efficiency, but increasing the proportion of biomass to 50% will require additional investments in logistics, special high capacity power station mills and other investments. The new system is expected to start in 2015.

United Kingdom

122. During May 2011 the Government submitted 12 applications from UK projects to the European Investment Bank for consideration in the next round of the EU's New Entrant Reserve scheme, to support CCS and innovative renewable projects across the EU. Up to three projects may be supported per Member State.

123. Of the 12 applications submitted, seven are for CCS projects. Two CCS applications were withdrawn voluntarily by the Project Sponsors. The seven CCS applications are:

- Alstom Limited Consortium: new oxyfuel supercritical coal-fired power station on the Drax site in North Yorkshire;
- C.GEN: new integrated gasification combined cycle (IGCC) power station (pre-combustion with CCS on the coal-feed) in Killingholme, Yorkshire;
- Peel Energy CCS Ltd: post-combustion amine capture on new supercritical coal-fired power station in Ayrshire, Scotland;
- Don Valley Power Project (formerly known as the Hatfield Project): new IGCC power station in Stainforth, Yorkshire;
- a consortium led by Progressive Energy Ltd; pre-combustion coal gasification project in Teesside, North East England;
- Scottish Power Generation Limited: post-combustion amine capture retrofitted to an existing sub-critical coal-fired power station at Longannet, Scotland; and
- SSE Generation Limited: post-combustion capture retrofitted to an existing CCGT power station at Peterhead, Scotland.

124. Also, the Department of Energy & Climate Change has not awarded the contract for the first UK CCS demonstration project resulting from the competition launched in 2007. Only one competitor had not withdrawn (the Scottish Power Project at Longannet), but the Government announced on 19 October 2011 that it had been unable to reach agreement on funding that project. It said that it would pursue other projects with the £1 billion of available funding; and that the Government's long term vision for CCS deployment and a selection process for further CCS projects would be published.

4.5 Coal Production

United States of America

125. The Mine Safety and Health Administration ("MSHA") proposed in October 2010 new rules concerning miners' exposure to coal dust. MSHA's proposal would reduce the allowable respirable coal dust standard from 2mg to 1mg per cubic metre, and has led to a series of ongoing discussions and comments from the industry regarding the scientific basis underlying the proposed new standard. The consultation period closed on 20 June 2011 and the final rule will be published after consideration of comments received.

Australia

126. The Australian Government is developing a new Minerals Resource Rent Tax (MRRT) regime to apply to new and existing iron ore and coal projects in Australia from 1 July 2012. In addition the existing Petroleum Rent Resource Tax (PRRT) is to be expanded to cover land based petroleum production. The MRRT and PRRT will be levied on profits at the rate of 30% (with a 25% extraction allowance, making an effective rate of 22.5%) and 40% respectively, and will apply in addition to existing income taxes.

127. Clearly, any profits tax reduces the profitability of projects over their life and thus must have some impact on investment decisions. However, there are three important practical aspects of the MRRT that reduce its impact:

- The MRRT itself is tax deductible at the corporate tax rate.
- The tax is only paid if a AU$50 million profit threshold is exceeded thus addressing the competitive interests of small to medium sized producers.
- The tax is only applied after a series of allowable deductions.

    (a) The MRRT will provide a full credit for current and future state royalties paid by a taxpayer in respect of a mining project. In addition, if a company has paid more state royalty payments than its MRRT liability then it can carry forward the excess payments and deduct them against future MRRT obligations (although excess royalty credits cannot be transferred to other projects).

    (b) Under the MRRT, capital expenditure will be immediately written off rather than applied over many years. This will allow mining projects to access mining investment depreciation deductions immediately (for the purposes of the MRRT), and means that a project will not have an MRRT liability until it has made enough profit to pay off its up-front investment.

    (c) A company with both new and existing projects can offset new project MRRT losses against MRRT profits relating to another project. It is also important that MRRT losses can be transferred to offset MRRT profits derived within a company group.

Legislation will be introduced for debate in Parliament.

Indonesia

128. In January 2009, the Government of Indonesia issued a new mineral and coal law (mining law No.4/2009) which replaced the old mining law no.11/1967. This new law is aimed at improving opportunities to invest in the mining industry without discrimination. It will change the existing scheme of mining permits, comprising the Contract of Work (COW) for foreign investment in metallic mineral mining, the Coal Contract of Work (CCOW) for foreign and domestic investment in coal mining, and the Mining Authorization, Regional Mining Permit Letter for domestic investors in non metallic minerals and stone aggregates. Under the new law, these contracts and mining licenses are replaced by the Izin Usaha Pertambangan (IUP)/Mining Permit (MP). Existing CCOWs and COWs will remain valid until the end of their contract terms; although some contract provisions, with the exception those related to government earnings, may be adjusted.

Germany

Hard Coal

129. At the end of 2010, there were five hard coal mines in operation in Germany with a total production of 14.11 million tonnes. Domestic coal production continues to fall as the result of mine closures; from a total of 18.98 million tonnes in 2008 and 14.97million tonnes in 2009.

130. Mines currently operating and annual production levels include:

- West – 2.85 million tonnes
- Prosper Haniel – 3.44 million tonnes
- August Victoria – 3.27 million tonnes
- Ensdorf (Saar) – 1.54 million tonnes
- Ibbenbüren (anthracite coal) – 2.02 million tonnes

The Ost mine was closed in September 2010, the last mine with significant coking coal output. The Ensdorf mine is scheduled to close in June 2011 and West in 2012.

131. The German mining industry is reliant on government subsidies to make up the difference between actual costs and the price determined by international market conditions. The German Coal Importers Association (VDKi) estimates average domestic production costs of €154/tonne, far above import prices for steam coal in 2010. The international spot market price of hard coking coal has only briefly reached German mining costs, when flooding cut Australian production. As a result of the EU legislation which ends government subsidies to the coal mining industry, the remaining five German mines will cease operation by the end of 2018.

Lignite

132. There are twelve opencast lignite mines in operation in Germany, with a total production of 169.4 million tonnes (52.3 million tonnes coal equivalent) in 2010. Production and investment has remained relatively stable.

133. In the Rhenish basin, RWE Power AG produced 90.7 million tonnes in 2010 from its three opencast mines Hambach, Inden and Garzweiler. This required removal of 469.1 million cubic metres of overburden; an overburden/coal ratio of 5.2:1 (cbm:t). At the E.ON Kraftwerk Gmbh Schöningen opencast mine, overall lignite production was 2.0 million tonnes with an overburden/coal ratio of 3.4:1. The five Lausatian mines of Vattenfall Europe Mining (Cottbus-Nord, Jänschwalde, Welzow-Süd, Nochten and Reichwalde) produced a total of 56.7 million tonnes with an overburden/coal ratio of 7.2:1. The MIBRAG mines in the Central German basin (Profen and Vereinigtes Schleenhain, owned by CEZ and EPH) produced 19.6 million tonnes in 2010, while Romonta mined 0.4 million tonnes, mostly used for montan wax products.

United Kingdom

134. Environmental Planning legislation continues to hamper surface mine development and access to finance has affected investment. Shafts at the mothballed Haworth Colliery are being closed as a result of the inability to secure capital investment; and Powerfuel's Hatfield Colliery assets are being controlled by its bankers. In 2010 13 underground mines were operating, with 5 large mines producing 95% of total output. One large mine closed during the year and one remains in care and maintenance. 26 surface mines were operating and 9 were in development. UK coal production remained broadly stable at just over 18 million tonnes in 2010, 7 million tonnes was lifted from stock and imports reduced

by 30% to 26.5 million tonnes, their lowest level for ten years.

4.6 Coal Utilisation

United States of America

135. Policy towards coal use in the USA has been greatly influenced by four significant events since the summer of 2009:

- failure of a comprehensive climate change mitigation bill to be approved by the Senate, although a comprehensive climate bill passed the House of Representatives in June 2009;
- the global recession which began in 2007 and had technically ended in mid-2009. The associated financial crisis continued to cause broad economic hardship, leading to unacceptable levels of unemployment which persist today;
- a political shift toward a more economically conservative Congress with a large interest in job creation that ran counter to advocates of broader government legislation to address environmental issues; and
- the cumulative effect of a series of court decisions leading to the development of multiple regulatory initiatives under existing legal authority and directed toward establishment of new regulations impacting coal-fired power plants, including regulations to reduce CO_2 emissions from both new and existing power plants.

136. In the USA, environmental regulation occurs at both the national and State level, with much of the State regulation driven by national legislation. Regulations adopted by the US Environmental Protection Agency (EPA) generally have the most significant impact on the operation of coal-fired power plants. Several such regulations have been adopted over the past year, or are scheduled to be adopted over the coming year, including regulations to:

- reduce emissions of SO_2 and NO_X contributing to non-attainment of national ambient air quality standards;
- reduce emissions of mercury and other hazardous air pollutants;
- reduce thermal stress on animal and plant life in rivers and other bodies of water (from cooling water);
- protect the environment from pollution arising at poorly designed landfills and impoundments for ash and scrubber sludge;
- apply national standards for CO_2 control at both new and existing power plants; and
- require best available control technology for CO_2 emissions from new power plants.

137. The federal government has not evaluated the combined effect of these multiple regulatory initiatives on coal use by power plants in the U.S., but a number of private sector studies have attempted to do so.[21] Projected impacts varied both within studies (with multiple regulatory scenarios) and between studies, and generally predicted retirement of between 10% and 30% of the U.S. coal-fired power plant fleet, or between 40GW and 100 GW of coal-fired electricity generating capacity. 6-8% of US coal production will be lost within 8-10 years at the lower end of this range unless Congress

[21] For example, Potential Impacts of Environmental Regulation on the U.S. Generation Fleet, ICF International for Edison Electric Institute, January 2011; Growth From Subtraction, Credit Suisse, September 2010; 2010 Special Reliability Scenario Assessment: Resource Adequacy Impacts of Potential U.S. Environmental Regulations, North American Electric Reliability Corporation, October 2010.

allows power producers more time to comply with these regulations.

138. Among several trade associations, the National Mining Association has taken a lead role in educating Members of the US Congress about the impact of this series of EPA rulemakings. The regulatory challenge extends beyond air emissions and coal use. Other hydrocarbon fuels are also under scrutiny by EPA, and the maze of rulemakings underway that impact the use of coal, diesel and related transport fuel is expansive.

139. Pursuant to guidance issued by the US EPA in March 2011, new power plants must apply "best available control technology" for control of CO_2 emissions[22]. Furthermore, under a settlement agreement signed by the US EPA in December 2010 and subsequently amended, the US EPA will propose nationwide emission standards for CO_2 emissions from power plants by 30 September 2011, and promulgate final rules by May 2012[23]. The stringency of these regulations, and whether they will require CCS technology in the near term, is unknown at this time.

Australia

140. Most of Australia's electricity is produced using coal, which accounted for 77% of total electricity generation in 2008/09 (ABARES). Black coal accounted for 54.9% and brown coal 21.8%. Coal's share of the energy mix is expected to decline over time and the Australian Bureau of Agricultural and Resources Economics and Sciences (ABARES) projects that it may comprise only 43% of Australia's energy mix by 2030.

141. The proposed introduction of a carbon price, together with the 20% Renewable Energy Target (RET) by 2020 and the development of coal seam gas reserves in New South Wales and Queensland has led to a virtual stalling of investment in new coal-fired power plants. According to ABARES there are up to 9 'less advanced' black and brown coal-fired power plants under consideration in Australia (representing up to 4,000MW of new capacity). However, many of these are in pre-feasibility stages and some are proposed as low emission coal/CCS demonstration projects which are unlikely to go ahead in the absence of significant public funding.

142. A recent report by Deloitte commissioned by the Australian Government found that "practically no investment in coal is forthcoming in Australia with the exception of some refurbishment projects in Western Australia"[24].

143. In 2010 the Prime Minister made an election commitment to introduce emissions standards and a 'CCS-ready' standard for all new coal-fired power generation by the end of 2011. Funding was allocated in the 2011/12 Budget to support the implementation of this Initiative. The coal industry has argued that the policy would discourage new investment in coal-fired generation and would favour investment in (unabated) gas-fired capacity. CCS-ready standards in particular may be premature given the current stage of development of the technology and the lack of identified large-scale storage in Australia. As at September 2011 the Government has not confirmed if or when the proposed standards will be introduced.

South Africa

144. Under new electricity generating capacity regulations, the Minister of Energy has the authority to determine the extent, location and technology mix of new generating capacity.

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[22] PSD and Title V Permitting Guidance for Greenhouse Gases, US EPA, March 2011, http://www.epa.gov/nsr/ghgpermitting.html .
[23] US EPA, http://www.epa.gov/airquality/ghgsettlement.html .
[24] Deloitte "Electricity Generation Investment Analysis" Final Report 14 April 2011 p47.

The latest plan allows for 56.5 GW of additional capacity by 2030. Apart from the 10.1GW of new coal plant already committed or under construction, the new capacity will predominantly comprise renewables and nuclear. Any delay in implementing this programme will result in consequent delays in decommissioning old coal-fired plant. Electricity price increases of 25% have been authorised for each of 2010, 2011 and 2012, followed by increases totalling 40% by 2019.

145. There is also an intention to introduce a carbon tax, although the proposal is not yet well defined. Projects incorporating CCS would result in a carbon tax exemption. The most recently permitted power station was required to be "CCS ready" and all large future plants will be required to be capture ready. However, the extent of offshore CO_2 storage potential has not yet been identified.

Germany

146. The total installed power plant capacity (net) in Germany was 166.2 GW at the end of 2010. The split by energy source was :

Nuclear energy:	20.5 GW
Hard coal:	27.9 GW
Lignite:	20.2 GW
Natural gas:	25.5 GW
Oil:	6.0 GW
Pumped storage:	5.7 GW
Renewables:	54.4 GW
Others:	6.0 GW

147. Renewable energy has been the fastest growing segment of installed capacity. In 2010, installed wind capacity increased to 27,200 MW (a 1,551 MW increase on 2009) and photovoltaic installations increased to 17,000 MW (a 7,400 MW increase). The sharp increase in solar power is due to the German Renewable Energy Act which finances new solar installations via a feed-in-tariff. Subsidies were estimated to be nearly €1 billion per month during the year.

148. For fossil energy fired power plant, investments in new capacity have amounted to 13.5 GW in recent years for start of construction between 2006 and 2008 and start of operation between 2010 and 2013. The split of this investment is:

- 8.4 GW hard coal
- 2.8 GW lignite
- 2.2 GW gas
- 0.3 GW others

149. At the end of 2010, eight hard coal-fired stations were under construction or approved in Germany with a total installed capacity of almost 8.4 GW. The efficiency rate of the new coal-fired power plant is about 46% (hard coal) and more than 43% (lignite). The largest hard coal projects include: 1.6 GW Hamburg-Moorburg (Vattenfall), 1.6 GW Hamm (RWE) and 1.1 GW Datteln (E.ON). The largest lignite project is at Neurath (2.2 GW, RWE) which is due to come online in the latter half of 2011.

United Kingdom

150. The UK Department of Energy and Climate Change (DECC) has reiterated its seven strategic objectives as

- securing global commitments which prevent dangerous climate change;
- reducing greenhouse gas emissions in the UK;

- ensuring secure energy supplies;
- promoting fairness through climate and energy policies at home and abroad;
- ensuring the UK benefits from the business and employment opportunities of a low carbon future;
- managing energy liabilities effectively and safely; and
- developing the Department's capability, delivery systems and relationships;

Electricity Market Reform

151. With a quarter of the UK's generating capacity shutting down over the next ten years as old coal and nuclear power stations close, more than £110bn in investment is needed to build the equivalent of 20 large power stations and upgrade the electricity grid.

152. "Planning our electric future: a White Paper for secure, affordable and low-carbon electricity" was published on 12 July 2011. It sets out key measures to attract investment, reduce the impact on consumer bills, and create a secure mix of electricity sources including new nuclear, renewables and carbon capture and storage. The Government intends to legislate for the key elements of this package starting in May 2012, so that the first low-carbon projects can be supported under its provisions around 2014.

153. Key elements of the reform package include:

- a **Carbon Price Floor** (announced in the 2011 Budget) to reduce investor uncertainty and provide a stronger incentive to invest in low carbon generation;
- the introduction of new **long-term contracts** (a Feed-in Tariff with Contracts for Difference) to provide stable financial incentives to invest in all forms of low-carbon electricity generation;
- an **Emissions Performance Standard** (EPS) set at 450g CO_2/kWh to reinforce the requirement that no new coal-fired power stations are built without CCS, but also ensure that necessary short-term investment in gas can take place; and
- a **Capacity Mechanism**, not yet defined in detail but including demand response as well as generation, to ensure future security of electricity supply.

154. Electricity Market Reform will be underpinned by a series of measures to improve energy efficiency, including the flagship **Green Deal programme**, which will provide households and business with the opportunity to make energy efficiency improvements, at no up-front cost, with consumers repaying through the savings they make on their energy bills. Market reform will also be supported by a strategy for future electricity networks and work led by Ofgem to improve competition, to move away from the current position where around 99% of UK customers are supplied by only six energy companies.

5 CONCLUDING REMARKS

155. The information given in this report has been compiled with the help of CIAB Associates and using some additional published sources. It describes developments over the last year in environmental/energy policy in various countries from the perspective of individuals active in the coal, electricity and transport industries.

156. Section 1 contains the industry's policy recommendations derived from the body of the report and other CIAB work, while other sections have highlighted relevant developments in international policy frameworks that potentially impact the investment necessary to sustain coal's role in supporting energy security in increasingly carbon constrained world energy markets.

157. During the last year, the focus of CIAB work has been on supporting the IEA Secretariat in understanding and modelling the particular challenges for coal, bringing the expertise of CIAB Members and their Associates to the issues through meetings, workshops and interaction with the IEA Secretariat.

158. Of particular concern to the coal and associated industries has been the slow or negative progress on the development of carbon capture and storage, which the coal industry sees as essential to the continuation of coal's role in OECD economies; while rapidly growing economies including China and India continue to rapidly increase their use of coal in power generation to support economic and social development.

CIAB, October 2011