August 2007

CLIMATE CHANGE: A GLOBAL CHALLENGE REQUIRING A GLOBAL SOLUTION

Key Messages on Climate Change

1. Climate change is a global phenomena. The minerals industry recognises the need to significantly reduce anthropogenic global greenhouse gas emissions over time.
2. Reducing global greenhouse gas emissions will require a global response that includes a pro-growth approach to poverty alleviation with policies that promote sustainable development, recognising economic progress is a key enabler for technologies to improve environmental management.
3. Growing global energy demand, economic growth and concerns about energy security mean that fossil fuels will continue to play an important part in the global energy mix for the foreseeable future.
4. Climate change has environmental, social and economic impacts as will the measures we use to address it. Ultimately final consumers – particularly households – as well as energy producers and users who cannot pass on all their increased costs will bear the cost of meeting this challenge.
5. The reality is that reductions in greenhouse emissions in Australia do not translate into a solution to the problem unless the reduction is part of a concerted global effort.
6. To achieve the proposed large emission reductions required for atmospheric stabilisation a range of renewable technologies and a suite of "next generation" fossil fuel low emission technologies for power generation will be needed.
7. The main greenhouse gas emissions in Australia come from the stationary energy sector, particularly electricity generation, followed by the agriculture and transport sectors.
8. Australia can further reduce greenhouse gas emissions through:
   a. abatement measures including ***energy efficiency*** improvements and ***demand management***;
   b. ***technology development, demonstration and deployment*** across a range of energy sources; and
   c. development of an ***effective international response*** involving the world's major emitters and encompassing ways to preserve the competitiveness of industries whose international competitors are not parties to that response.
9. Each energy source has its own unique challenges and its contribution to Australia's energy mix will vary but ultimately Australia will need energy from a full range of competing sources including renewables to meet our growing energy demand.
10. The most cost effective investment that can be made now to reduce our emissions over the long term is in developing and commercialising a range of low emission technologies, including renewables.
11. Investment in a suite of "next generation" low emission technologies will accelerate their development for timely commercial deployment, reduce their cost and provide further opportunities for deployment particularly in developing countries, which will continue to use fossil fuels to meet their expanding energy demand – notably for base load electricity supply.
12. Whatever we do must involve a comprehensive international response that:
    a. recognises economic development aspirations;
    b. retains trade/industry competitiveness;
    c. takes a long term perspective – short term policy settings should be consistent with achieving long term objectives;
    d. reduces regulatory uncertainty for industry;
    e. generates incentives for early movers or mitigates the current disincentive;
    f. recognises energy demand and security requirements, and resource endowments; and
    g. incorporates adaptation strategies.
13. There are activities we need to undertake now. In particular, further research and development on transparent, equitable and efficient market mechanisms to effectively deploy low emission technologies is just as important as Research, Development and Demonstration (R,D&D) on the technologies themselves. We should learn from other international experiences and instruments.
14. Both technology "push" and "pull" policies will be required for the large scale commercial deployment of "step-change" low emission technologies. The policy timing must be consistent with the technology development. In the absence of suitable step-change technologies, costs imposed in one country would merely drive activity to another country that does not have the same restrictions.
15. Even when step-change technology solutions have been demonstrated, there is an important commercialisation or learning by doing phase between R,D&D and deployment. It should not be assumed that a market price signal will "pull" technologies from the demonstration stage to commercial deployment. All "next generation" low emission technologies will require a long lead-time for significant commercial deployment.
16. A well designed national emissions trading scheme will form an important element of the suite of measures adopted by Australia in response to climate change. Such a scheme will assist in the discovery of low cost, environmentally effective abatement options. To ensure its effectiveness, the emissions trading scheme along with all climate change abatement and adaptation measures needs to be environmentally effective, economically efficient and socially acceptable.
17. Australia needs to maintain an appropriate balance between the national resources devoted to adaptation and mitigation.

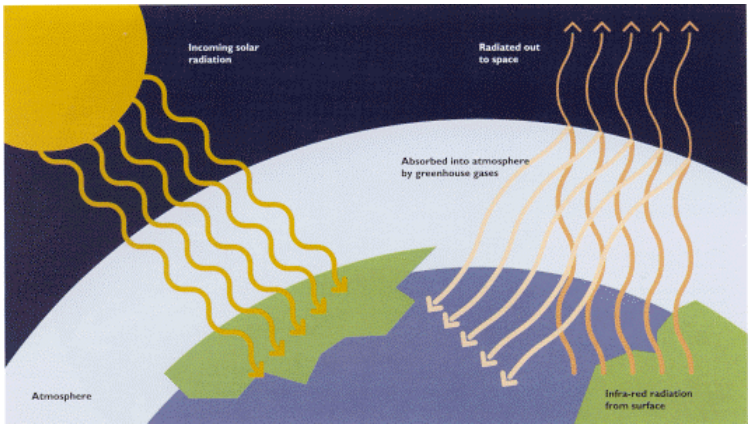
What is Climate Change?

Naturally occurring greenhouse gases in the atmosphere – the largest being water vapour – help regulate our earth's temperature by trapping solar radiation and making our world liveable. This is known as the ***greenhouse effect*** (see **Figure 1**).

Human activities such as agriculture and the burning of fossil fuels produce additional greenhouse gases[1] that are accumulating in the atmosphere and contributing to an "enhanced" greenhouse effect. This is often referred to as "***global warming***" where the physical manifestations on earth are the final link in a causal chain called "***climate change***".

[1] The major greenhouse gases of concern are carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulphur hexafluoride (SF_6).

Figure 1: The greenhouse effect



Why is a Global Response Important?

Climate change is a global concern that requires international action. While the physical impacts of climate change are likely to be experienced locally the greenhouse gas emissions that contribute to these impacts are a result of a multitude of global actions. Furthermore, abatement actions today will only have climate effects in many years to come as past emissions already influence climate changes occurring now. This means the response to climate change will remain a challenge over the lives of many government administrations now and in the future and all around the world.

Australia produces about 1.4% of world greenhouse gas emissions. It is clear that actions by Australia alone – in the absence of an international response – will be ineffective and prove costly to our economy and international competitiveness.

The International Energy Agency projects (in its "reference scenario") that world energy use will be more than 50% higher in 2030 than today. [2] A majority of this growth will come from developing countries. To put this into perspective it is estimated that China is building the equivalent of Australia's entire electricity capacity every 9 months and will have another 36 cities the size of Sydney by 2025. Most of the energy required to power these new cities and meet growing energy demand will come from fossil fuels.

Scientists have identified a range of greenhouse gases that need to be carefully monitored. They include: carbon dioxide, methane (21 times more greenhouse intensive than CO_2), nitrous oxide, hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride.

The United Nations Intergovernmental Panel on Climate Change (IPCC) has said that if left unchecked increasing levels of carbon dioxide and other human induced greenhouse gases in the atmosphere could lead to detrimental impacts on our environment – temperature rises, rising sea levels and varying weather patterns.

The Australian Context

Carbon dioxide and methane emissions are derived from a range of sources (eg. the power generation, transportation, mining, energy intensive manufacturing and agriculture sectors). It is important to remember however that these sectors underpin the Australian economy and deliver products and services used by the population every day.

Developed economies like Australia have enjoyed a high standard of living and the benefit of low cost and reliable energy for many decades. Much of this has been made possible due to utilisation of fossil fuels for producing energy and international trade.

At present mineral resources including coal and uranium energy exports account for over 40% of Australia's export trade, supplying jobs for some 320,000 Australians (directly and indirectly) and ensuring Australia's electricity prices are amongst the lowest in the world.

The main source of greenhouse gas emissions in Australia is the stationary electricity generation sector. Agriculture and transport are the next most significant (see **Figures 2 and 3**).

Figure 2: Contribution to Australia's total net CO_2-e emissions by sector, 2005

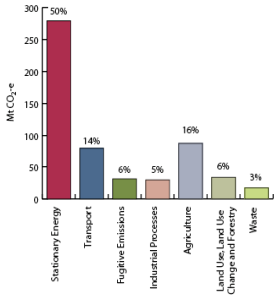
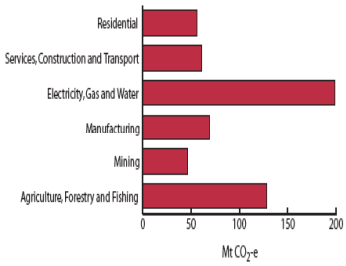


Figure 3: Australia's greenhouse gas emissions by economic sector, 2005



Source: Department of the Environment and Water Resources (2007), *Australia's National Greenhouse Accounts – National Greenhouse Gas Inventory 2005* page 1, and *National Inventory by Economic Sector, 2005,* page 1.

The minerals (including coal) sector's direct emissions in 2004 represented 10.5% of total emissions. We add to this an estimated further 10% through purchased electricity. Australia is a major exporter of coal although this represents less than 1% of global coal use in energy generation. Australia relies on coal to generate over 80% of electricity.

The IPCC has assessed a range of scenarios for achieving stabilisation of greenhouse gas concentrations in the atmosphere. In order to stabilise concentrations at 550 ppm (parts per million) CO_2-e by 2050, global emissions of greenhouse gases will need to be reduced below 2000 levels by then. [3] This will be a significant challenge given that the global economy will also triple during this time and our demand for energy will double by 2030.

Why is Technology Important?

Since the industrial revolution technology has been the driving force behind social, economic and environmental change. If we are to meet the challenge of dramatically reducing greenhouse gas emissions, technology must play a critical role – unfortunately there is no "silver bullet" so a range of policy measures will be needed.

The minerals industry recognises the significance of climate change and the need to significantly reduce greenhouse gas emissions over time. A broad suite of technologies will be needed for reducing emissions from fossil fuels but also to improve the efficiency, reliability and capacity of renewable energy technologies.

Low emission technologies can deliver the necessary long term emission reductions. Significant investment in these "next generation" technologies will accelerate development and demonstration reducing the cost and making them available sooner for commercial deployment in both developed and developing economies. **But** this is only part of the solution – economically efficient and environmentally effective measures to improve energy efficiency, renewables and abatement across other

[2] Dr F Birol (2006) Chief Economist IEA, *World Energy Prospects and Challenges*, www.iea.org.

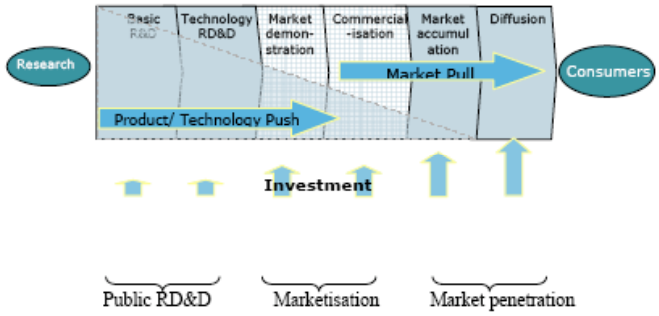
[3] IPCC, 2007: Summary for Policymakers. In: Climate Change 2007: Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [B. Metz, O.R. Davidson, P.R. Bosch, R. Dave, L.A. Meyer (eds)], Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA (www.ipcc.ch). CO_2-e (or CO_2 equivalent) of greenhouse gas emissions is a standard unit of measurement. It estimates the "equivalent" mass of CO_2 that has the same global warming potential as the sum of the impacts of the individual greenhouse gases being emitted by a factory or industry, say, over a set number of years.

sectors (e.g. transport, agriculture, manufacturing and mining) are also necessary.

Investment in low emission technologies will also provide a pathway towards a future hydrogen economy.

As illustrated in **Figure 4,** even once "next generation" step-change technology solutions have been demonstrated, there is an important commercialisation or "learning-by-doing" phase between R,D&D and deployment.

Figure 4: Main steps in the innovation chain



Source: Michael Grubb (2004), *Technology innovation and climate change policy: an overview of issues and options,* **Keio Economic Studies** 41(2): 103-132.

Minerals and the Australian Economy

The Australian mineral resources sector (which includes all energy exports) underpins much of our economic prosperity and growth. Australian exports of energy resources in 2006/07 (including oil and gas) are estimated by the Australian Bureau of Agricultural and Resource Economics (ABARE) to have been around A$40 billion. Exports of other minerals were about A$66 billion.

While Australia is an internationally competitive supplier of energy to the rest of the world, ordinary Australians also enjoy access to low cost, reliable energy – Australia has amongst the most competitive electricity prices in the world. This has proved a competitive advantage in attracting global industry investment here.

In 2006/07 the Australian minerals sector earned A$89 billion in export income – this is estimated to account for over 40% of total Australian exports. The coal industry plays a vital role in the Australian economy. It employs over 130,000 Australians directly and indirectly, it is the fuel source for over 80% of Australia's electricity and is our largest commodity export (~A$22 billion annually). Australian alumina and aluminium exports represent over A$12 billion in export revenue in 2006/07 and Australia is a world leader in nickel, gold, copper, zinc, lead, silver and synthetic rutile smelting/refining.

What is the Policy Context?

Climate change requires an innovative policy framework approach that includes both short and medium term measures and regional and international actions to deliver a long term objective/goal.

Australian climate change policy should:

- take effective action that does not damage industry international competitiveness and economic growth;
- avoid measures causing Australian costs to increase ahead of competitors or imposing (mandating) high cost solutions;
- be part of effective international and regional action;
- be comprehensive and equitable across all sectors;
- stimulate technology responses;
- be incentive based and balance abatement and adaptation strategies; and
- create partnerships (public/private) and co-operation.

The introduction of any efficient market measure to reduce greenhouse gas emissions should be applied internationally (with transitional measures that maintain Australian industry's competitiveness), and should include all significant emitters, and market competitors thus creating a "level playing field" that:

- recognises economic development aspirations;
- retains trade/industry competitiveness;
- takes a long term perspective – short term policy settings should be consistent with achieving long term objectives;
- reduces red tape – by ensuring an individual country adapts the global scheme uniformly within its borders and that this replaces state/territory schemes that have been introduced to curtail emissions;
- reduces market and regulatory uncertainty for industry;
- generates incentives for early movers or mitigates the current dis-incentive; and
- recognises energy demand and security requirements, and resource endowments.

The Climate Change Policy Response

The industry accepts the precautionary principle underpinning the need for action to reduce anthropogenic greenhouse gas emissions. This action must take the form of a comprehensive suite of policies for a long term integrated policy approach that is environmentally effective, economically efficient, and socially and politically acceptable. It must be centred on:

- a government-industry partnership in the development and deployment of step-change abatement/low emission technologies – this simply will not be driven by the market, pre-competitive technologies rarely, if ever, have been; and
- efficient market mechanisms to determine a carbon price in a future carbon constrained world.

Market-based instruments can include taxes, charges, subsidies and tradeable permits. Their goal is to take into account the greenhouse costs of production and consumption decisions where they are not adequately priced into goods and services by the market.

Most countries have introduced various forms of market-based mechanisms to achieve other policy objectives. This includes environmental objectives where the impacts are of a local nature – such as the impact of sulphur dioxide emissions or the impact of fluoride emissions on water management – and where the actions can be closely linked with outcomes in both time and location. However, while the physical impacts of climate change are likely to be experienced locally the greenhouse gas emissions that contribute to the impacts are a result of a multitude of global actions.

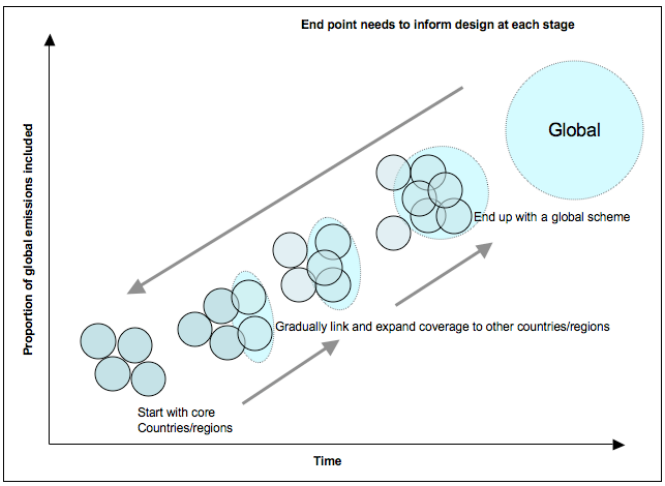
Emissions trading can be an efficient market mechanism in determining a carbon price in a carbon constrained world and in the discovery of low cost, environmentally effective abatement measures. To ensure this the emissions trading system along with all climate change abatement and adaptation measures needs to be consistent with three equal and fundamental high level principles:

- **environmental effectiveness**, that is, ensuring that actions taken reduce the adverse effects of human influence on climate change;
- **economic efficiency**, which itself requires that policies are as broadly based as possible — covering all greenhouse gases and all sectors. Policies must be multilateral or global in focus, take account of Australia's comparative advantage in energy intensive activities, and ensure energy security; and
- **social acceptability**, which includes the equity aspects of any measures taken and the political acceptance of those measures.

To be an effective mechanism, a national emissions trading scheme would:

- be part of a suite of measures and not considered a panacea;
- be structured so that the disciplinary measures (the cap and the penalty price) are aligned with the development and deployment of step-change technologies – ensuring there is capacity in the market to change industrial behaviour and not merely penalise it (and raise revenue);
- accommodate the potentially long run competitiveness challenges faced by trade-exposed and emissions intensive industries, to mitigate against distortions to resource allocation and "carbon leakage" (ie. an exodus of affected industries offshore without environmental benefit);
- replace the multitude of State and Territory differentiated policies and measures in favour of national consistency across and within various jurisdictions,
- make provision for transitioning through short to longer term pricing and permit allocations, and provide for complementary measures for sectors (agriculture and transport) not readily comprehensively covered by a "cap and trade" system; and
- transition to a global system progressively integrating national emissions trading schemes into regional and eventually more international systems (as illustrated in **Figure 5**).

Figure 5: Global system



Business "certainty" will not necessarily be delivered on the basis of a future price of emissions. However, **certainty will best be served by a clear and sound policy framework within which price risk can be assessed and managed**. This should include certainty about the emissions trading allocation processes and rights, and about the property rights attached to those permits.

Actions being taken by Australian Industry

The mineral industry is taking a proactive approach to addressing reductions in greenhouse gas emissions. Many private companies are members of government initiatives (such as the Greenhouse Challenge Plus Programme) or involved in multi-national initiatives like the *Asia Pacific Partnership on Clean Development and Climate* and *the Carbon Sequestration Leadership* Forum.

Boxes 1-3 provide more detailed information on what the Australian minerals sector, coal industry and aluminium industry have been and are doing to reduce emissions, improve energy efficiency and stimulate research, development and demonstration.

Box 1: Examples of Australian Minerals industry actions to abate greenhouse gas emissions

The Australian minerals sector currently earns around A$ 97 billion in annual export income (representing over 40% of total Australian exports).

> Leading Australian minerals companies have been involved in the **Greenhouse Challenge Program** for over a decade. The Australian Aluminium Council and all individual aluminium smelters and alumina refineries are members of this joint Australian Government and industry program. In 2005, the aluminium industry extended the coverage to include bauxite mining activities. The Australian Coal Association also has a cooperative agreement with the program and the Minerals Council of Australia a facilitative agreement. All three organisations have formally supported the program since its inception 10 years ago.

> Minerals companies for over 20 years have employed consultants and share advice with electricity wholesalers and retailers as to how they can improve their **energy efficiency**.

> Australia's **low-emission energy exports** (LNG, uranium and renewable technologies) and **clean coal technologies** are helping other countries to lower their emissions profile. Australia currently exports about 4 400 PJ of energy in uranium for use in nuclear power plants involving virtually no CO_2 emissions over their life cycle.

> The Australian **HIsmelt process** has the potential to revolutionise the global iron and steel industry. In theory, the process bypasses two greenhouse emission steps in steel making – the conversion of coal to coke and iron ore to a sintered product. At its current level of development, it is comparable to the most efficient blast furnaces in the world in terms of energy utilisation and greenhouse gas emissions and over 50% more efficient than many blast furnaces in operation today. Another Australian promising "bath" smelting technology, which also would replace coke ovens and sinter plants, is **Ausmelt**, which could find opportunities in smaller applications (300,000 to 500,000 tonnes per year). Ausmelt has sold its technology around the world to produce copper, tin, lead and other metals. (*Business Review Weekly*, October 26-November 1 2006, page 62 ff)

> Xstrata Technology transfers energy efficient technologies, such as **ISASMELT** (smelting) and **IsaMill** (ultrafine grinding), across Xstrata's operations and the operations of other companies. IsaMill almost halves energy use and utilises a waste product – such as waste smelter slag at Mount Isa and a fraction screened from McArthur River ore – as media in this process. The resultant IsaMill technology has reduced energy consumption and improved yield for Xstrata's McArthur River, George Fisher and Black Star open cut ores. IsaMill is currently being used by companies including Kalgoorlie Consolidated Gold Mines, Anglo Platinum, Lonmin, Centerra Gold and Phelps Dodge. ISASMELT is being applied by Southern Peru Copper Corporation at one operation to increase SO_2 capture from 30% to about 95%. New smelters in China and India are also using ISASMELT technology in their plants and a smelter in Zambia has been operating since 2005. (Xstrata *Sustainability Report* 2005, page 79)

> Under the Greenhouse Challenge Plus Program, recovery of **methane from coal mines** has increased from a negligible amount in 1995 to 4Mt in 2005. This represents 20% of total Greenhouse Challenge Plus emissions reduction so far achieved annually. Additional capture and use of methane gas from coal mines occurs under the Greenhouse Gas Abatement Program and through other initiatives by coal miners.

The industry is committing millions of dollars to the development and deployment of low emission technologies and improvements in energy and eco-efficiency, notably through:

> the **Low Emissions Technology Development Fund** – a Government/Industry Partnership of direct spending in the order of $1.5 billion and more from industry;

> the **Australian Coal Association's COAL21 Program and the COAL21 Fund** – a world-first whole of industry initiative in the development and deployment of clean coal technologies, expending in the order of $1 Billion from industry over 10 years;

> **Cooperative Research Centres** in Sustainable Development and Greenhouse Gas Technologies and the **Centre for Low Emissions Technologies.**

Further, the Australian minerals industry is a strong advocate and participant in a number of international initiatives, including the:

> **Asia Pacific Partnership on Clean Development and Climate** – involving India, China, South Korea, USA, Japan and Australia – established to canvass, develop and promote technologies for managing climate change and clean development;

> **Carbon Sequestration Leadership Forum** – 22 countries and the European Commission committed to the research, development and deployment of carbon capture and storage (CCS);

> **Methane to Markets Partnership** – to promote the capture and utilisation of methane from coal mining and other sources;

> **International Partnership for the Hydrogen Economy** – the development of hydrogen and fuel cell technologies;

> **Bilateral Climate Action Partnership** arrangements between Australia and China, USA, Japan, New Zealand, South Africa and the European Commission for the exchange of scientific expertise, technology and innovation, involving the business and science communities;

> **'Generation IV' nuclear power forum** – established in May 2001 to lead the collaborative efforts of the world's leading nuclear technology nations to develop next generation nuclear energy systems to meet the world's future energy needs; and

> **"Iter" – the international project on nuclear fusion** – an international collaboration to build the first fusion science experiment capable of producing a self-sustaining fusion reaction, as a way of generating a clean, safe, renewable electrical energy.

Box 2: Australian Coal industry actions to abate greenhouse gas emissions

Australia's black coal mining industry plays a pivotal role in the Australian economy. Black coal is Australia's biggest commodity export (earning around $22 billion in export revenue annually), directly employs over 30,000 Australians and a further 100,000 indirectly, provides 58 per cent of our electricity generation and is vital for steel making and other industrial processes. In addition, Australian lignite (brown coal) is the major feed stock for Victoria's electricity generating industry. Some 72 Mt of brown coal are mined annually providing around 26% of Australia's electricity generation. (Sources: Australian Bureau of Agricultural and Resource Economics and the Energy Supply Association of Australia)

The security, reliability and comparatively low-cost of Australia's coal-based electricity supply (derived from both black and brown coal) underpins the competitiveness of a significant proportion of Australian industry and provides affordable power for Australian households.

Australian Black Coal Industry Action on Climate Change

The Australian black coal industry has long been proactive in addressing environmental issues associated with the extraction and use of coal.

> Since 1992, the **Australian Coal Association Research Program** (ACARP) has been funding R&D into coal production and use, including clean coal technologies. ACARP currently invests over $14 million per annum on industry-related research via an industry-wide levy on coal production.

> Through ACARP, the industry also supports key research via its membership to the:

- Cooperative Research Centre (CRC) for Coal in Sustainable Development (CCSD);
- CRC for Greenhouse Gas Technologies (CO2CRC); and the
- Queensland Centre for Low Emissions Technology (cLET).

A number of coal producers have also elected to become individual participants in these Centres.

> In 2003, the Australian Coal Association (ACA) brought together representatives from the coal and electricity industries, unions, federal and state governments and the research community to form the **COAL21** partnership. The **COAL21 Action Plan**, launched in 2004, aims to accelerate the demonstration and deployment of clean coal technologies that will reduce greenhouse gas emissions from coal-based electricity generation.

> In 2006 the ACA announced the establishment of the **COAL21 Fund** as part of a world-first whole-of-industry funding approach to support greenhouse gas abatement. The **COAL21 Fund** will raise up to $1 Billion over 10 years from a voluntary levy on coal production to support the pre-commercial demonstration of low emissions technologies in the power generation sector (where over 95 per cent of emissions from coal occur) and supporting R&D.

> In addition to ACARP and the COAL21 Fund individual Australian black coal producers are providing significant direct funding for demonstration projects – in Australian and international projects such as FutureGen in the USA.

> The coal industry continues to support R&D projects into the mitigation of methane in mine ventilation air (MVA) in the following areas:

- using MVA as the combustion air with another primary fuel, eg gas turbines or nearby power stations;
- using MVA supplemented with secondary fuels, with energy recovery;
- developing catalytic systems for converting ultra-lean air-methane mixtures; and
- developing a system for concentrating methane in MVA, eg by methane adsorbents or membranes.

> The coal industry, the Australian Coal Association and its Members are active participants in a number of national and international programs and fora related to greenhouse issues and technology development including the Greenhouse Challenge Plus Program, the Asia Pacific Partnership on Clean Development and Climate, International Energy Agency (IEA) Clean Coal Centre, the Carbon Sequestration Leadership Forum (CSLF) and the Australia-China Joint Co-ordination Group on Clean Coal Technologies.

The **Victorian Brown Coal sector**, through various cooperative mechanisms including the State Government's Energy Technology Innovation Strategy (ETIS) and Commonwealth programs, is advancing a number of clean coal technologies at both R&D and demonstration stages.

The technologies being targeted by the black and brown coal sectors will assist energy use to grow in a sustainable way and are part of the transition to new energy systems. The ultimate prize is to achieve substantial reductions in greenhouse gas emissions while maintaining a secure, reliable and affordable energy supply.

Various studies are under way in the iron and steel sector to enhance iron-making technologies involving **metallurgical coal** & improve energy efficiency.

Further information on the black coal sector is available at www.australiancoal.com.au and www.coal21.com.au.

Box 3: Australian Aluminium industry actions to abate greenhouse gas emissions

Both alumina and, especially, aluminium are energy-intensive industries. Energy represents about one third of the aluminium sector's operating costs. Around 80% of all Australian alumina and aluminium production is exported – representing over A$12 billion per year.

Smelters and refineries are very long life assets. Australia must compete with other investment locations for new facilities and any expansions to existing facilities. Clearly alumina and aluminium involve emissions in their production; where aluminium is substituted for steel in transport vehicles (road, rail, air and sea) its relatively low weight reduces the amounts of fossil fuels needed to propel these vehicles. Aluminium is also a renewable resource. It can be recycled indefinitely, and the recycling process uses only 5% of the energy needed in the original processing.

> The aluminium sector has **significantly reduced its direct emissions** from 6.3 million tonnes of CO_2-e in 1990 to 4.0 million tonnes in 2006 despite a 56% increase in production.

> On a per unit of production basis the reduction shows an even greater improvement falling from 5.1 tonnes of CO_2-e per tonne of metal produced down to 2.1 tCO_2-e per tonne of metal.

> Driving the long-term improvement has been the industry **management of perfluorocarbons** (PFCs), a potent greenhouse gas. Smelter pot technology also influences the level of PFCs generated. With the investment in point feed prebake technology replacing older side worked prebake technology, significant reductions in PFC emissions can be achieved via the improved management of the smelter pot conditions. Australian smelters have all been upgraded - and the Australian PFC performance reflects this situation. Combined with sound potroom management practices, Australian PFC emissions intensity is now below 0.4 tonnes CO_2-e, well below the International Aluminium Institute (IAI) 2010 global objective of 0.88 tonnes CO_2-e (down from a global level of 4.4 tonnes CO_2-e in 1990).

> Australian alumina refining has achieved a 20% reduction in greenhouse gas emissions intensity (on a tonne for tonne basis) since 1990. Australian alumina producers have reduced energy intensity (per unit of output) by around 10% since 1990 – and the industry is continuing to seek cost-effective improvements.

> Alumina is the perfect co-generation partner, particularly in an Australian climate; a refinery's requirement is for constant heat demand, enabling electricity co-generation and resulting in a combined outcome of around 80% energy efficiency. The industry is introducing co-generation facilities where market opportunities allow.

> **Indirect emissions** from the purchase of electricity for aluminium smelting have risen in absolute terms, but at a rate below the increase in production showing an improvement in overall energy efficiency in the smelting/reduction activity. Production is up by 56% over 1990, indirect emissions attributable to electricity generation is up by 37% but down by 12% on a per tonne of metal produced basis.

> Working with the International Aluminium Institute (IAI), the Australian aluminium industry has established an effective, cooperative engagement within **the Asia Pacific Partnership on Clean Development and Climate** member countries. This aims to enhance its greenhouse performance, in a positive framework addressing the greenhouse footprint of the production process, reducing emissions intensity (as opposed to capping growth) and seeks to build further on the existing industry cooperative arrangements to enhance information sharing and data collection. It also aims to realise efficiency, technical and process management improvements across the sector.

> Within the Asia Pacific Partnership, aluminium industry representatives have established an Aluminium Industry Memorandum of Understanding (MoU) for voluntary action in the areas of cleaner air, energy conservation, recycled materials and improved industrial efficiencies. The Aluminium Task Force Work plan includes a number of projects designed to realise significant improvements in greenhouse gas emissions within the sector.

> Other research areas include development of advanced aluminium smelter methods and processes to reduce carbon consumption and improve energy efficiency.

Further information is provided in the Australian Aluminium Council's *Sustainability Report* available at www.aluminium.org.au.