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Power to Change: Carbon Capture and Storage (CCS)

Courtesy of The Cooperative Research Centre for Greenhouse Gas

Key Findings

1. **Coal and gas are widely used for energy production as well as in manufacturing and are a major contributor to global warming. Reducing greenhouse gas emissions from coal and gas presents an enormous challenge for not only power generation but much heavy industry.**
2. **As one of the technologies that can be part of a suite of mitigation solutions to avoid dangerous climate change, carbon capture and storage (CCS) is well positioned to reduce emissions from coal and gas-fired power generation by around 80%.**
3. **Given the urgency to reducing emissions:**
 - **Construction of large-scale CCS facilities must begin within the next two years to be on track for large-scale testing of the technology; and**
 - **Testing of large-scale CCS (greater than 300MW capacity) is needed within the next five years.**
4. **The companies that will benefit most from CCS technology in the future need to contribute more money and leadership now.**

“Global warming is a huge threat to the future of humanity and the planet. The CFMEU does not resile from the challenge – we have faced many great challenges in advancing the interests of working people over more than 100 years. The use of coal and gas has been critical to the history of Australia and to its current prosperity. And it is clear that the developing world will rely on coal and gas for decades to come. But we must reduce emissions from their use if we are to stop dangerous climate change.”

Tony Maher
National President, CFMEU

“Carbon capture and storage has the potential to help us create a climate safe future. We have the ability to make this technology work, particularly for coal-fired power stations. What we need now is the full financial support and expertise of industry. We must see the construction of the first commercial scale CCS power plant by 2013, and Australia is naturally suited to be the home of this technology.”

Greg Bourne,
CEO, WWF-Australia

About the Participants

The Construction, Forestry, Mining and Energy Union is one of Australia’s principal trade unions with substantial membership in coal mining and power generation. It recognises the severity of the global warming problem and supports the increased deployment of renewable energy and the introduction of emissions trading. It sees the development of CCS as critical to the future of coal use in a carbon-constrained world.

WWF-Australia is part of the WWF-International Network; one of the world’s largest and most experienced independent conservation organisation. It has close to five million supporters and a global network active in more than 100 countries. WWF’s mission is to stop the degradation of the planet’s natural environment and to build a future in which humans live in harmony with nature, by:

- conserving the world’s biological diversity
- ensuring that the use of renewable natural resources is sustainable
- promoting the reduction of pollution and wasteful consumption.

Carbon capture and storage technologies have been known for more than half a century – but until now there has not been a commercial reason to develop and integrate them. With carbon dioxide recognised as the primary greenhouse gas pollutant, and prices being placed on carbon through emissions trading, the business case for CCS is being transformed.

While CCS has great potential, it is not yet an “off-the-shelf” set of technologies - markets and infrastructure will require massive adaptation and investment. While governments must lead in developing market structures and incentives, the companies who will benefit most from CCS need to contribute more for large scale testing of the technology.



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Australia – A Home for CCS Technology

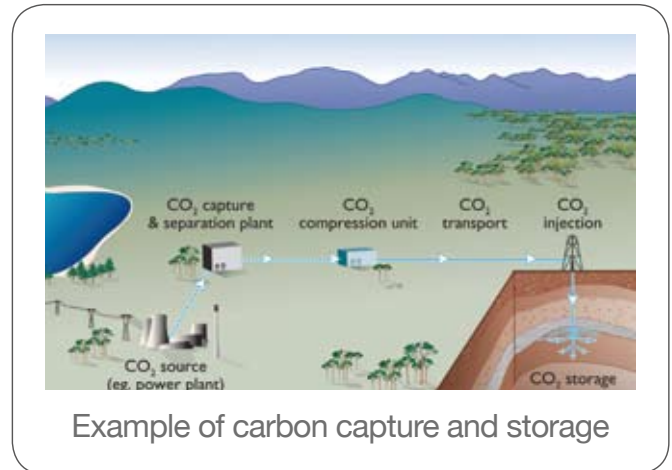
The potential for CCS in Australia

Australia has vast reserves of easily accessible and therefore low cost coal. Black and brown coal accounts for about 84% of electricity production in Australia¹ – much higher than in Europe (around 30%²) or the United States (around 50%³).

This means that around 37% of Australia’s greenhouse gas emissions come from fossil fuel-fired electricity generation (i.e. coal and gas), making this industry Australia’s single largest polluter⁴.

Australia’s emission-intensive industries (like aluminium smelting, cement manufacture and steelmaking) contribute around 15% of emissions. Other mining and manufacturing processes (like LNG production and processing, coal mining, and producing chemicals) contribute around a further 25% to Australia’s greenhouse gas emissions. In the longer term, carbon capture and storage could be used to help reduce emissions from many of those industries.

How CCS works



Source: Courtesy of CO₂CRC

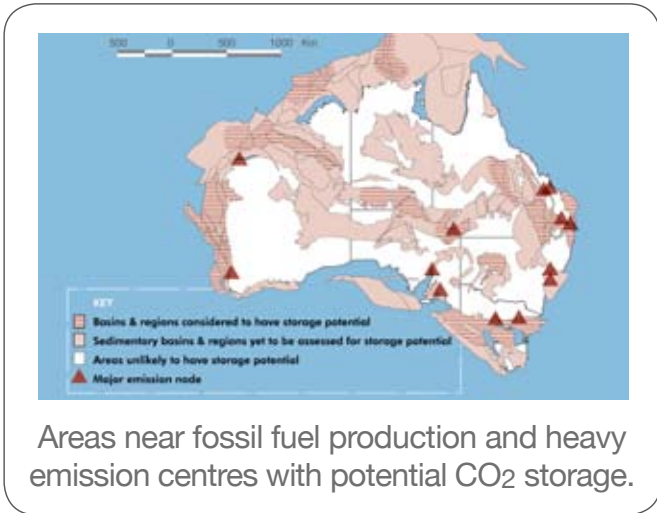
Carbon capture is a collection of several technologies which either separate the carbon dioxide (CO₂) before the combustion process through chemical conversion, or capture the CO₂ from the waste stream afterwards. The technologies include:

- Integrated Gasification Combined Cycle (IGCC), an established technology that converts coal into hydrogen, with the CO₂ being removed before combustion.
- Numerous Post-Combustion Capture (PCC) options, which rely on chemical or other processes to scrub the CO₂ from the waste stream.

The CO₂ gas can be compressed into a liquid for transport that is 1/300th of its original size and piped to storage sites. There are already many thousands of kilometres of CO₂ pipelines worldwide as it is used for Enhanced Oil Recovery (EOR).

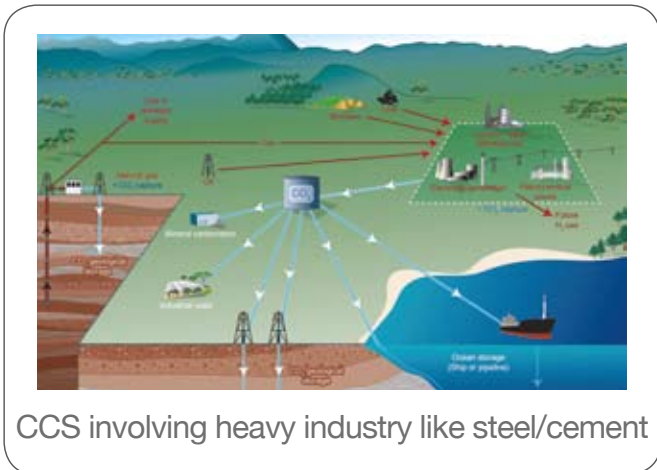
The storage component is already proven for use in depleted oil and gas reservoirs, though careful monitoring systems are required. Less proven is storage in deep saline aquifers, which are much more common worldwide than oil and gas reservoirs. Saline aquifers are layers of porous rock that can store liquid and that are beneath impervious rock layers that will prevent the CO₂ escaping.

On a per person per year basis, with emissions of over twenty tonnes of carbon dioxide (compared with China with just under five tonnes), Australia has the highest emissions from energy use in the world.



Areas near fossil fuel production and heavy emission centres with potential CO₂ storage.

Courtesy of The Cooperative Research Centre for Greenhouse Gas Technologies (CO₂CRC)



Source: Courtesy of CO₂CRC



Creating Jobs Across Regional Australia

Companies can afford to do more for regional jobs

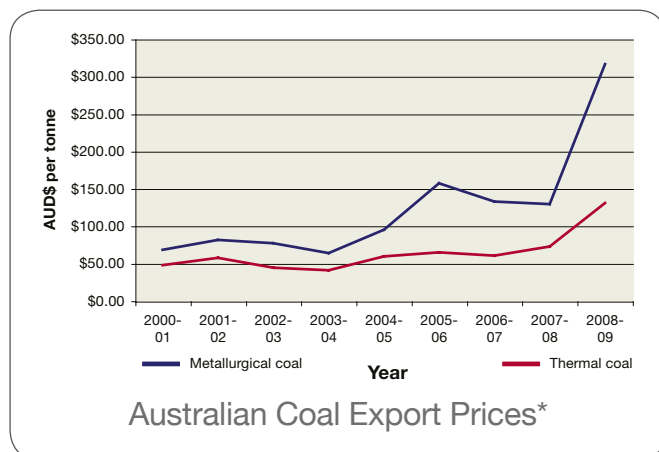
Huge demand from rapidly industrialising nations for coal and gas is causing massive investment in Australia in new projects and infrastructure. In April 2009 (well into the Global Financial Crisis) there were 42 energy projects, with a combined value of \$43 billion⁵, in an advanced state of construction or planning.

With a substantial amount of existing and planned power generating capacity worldwide being based on coal and gas, the critical challenge for Australia and the world is to transform fossil fuel use so that its waste product is no longer dumped into the atmosphere.

Australia exports more energy than it consumes. In fact coal is Australia's largest export industry, with an estimated export revenue in 2009-10 of almost A\$30 billion. Most of this is metallurgical coal for steelmaking⁶, though thermal coal for power generation accounts for over A\$11 billion⁷.

LNG exports are substantial and growing rapidly, and are forecast to be worth over A\$7 billion in 2009-10⁸. As with coal, without CCS, emissions from LNG will contribute significantly to Australia's emissions. LNG projects can have a serious impact on coastal and marine natural (and cultural) values. The industry's total 'footprint' needs to be reduced. This might require the higher footprint gas processing plant and marine infrastructure to be some distance from CCS infrastructure (if CCS is in a more sensitive environment). This opportunity has so far not been adopted for the Gorgon gas project, and WWF-Australia has raised strong concerns about the environmental risk that this project represents.

Coal and gas companies are generally highly profitable, riding a wave of global demand for energy. Even during the Global Financial Crisis, resources companies with coal, oil and gas operations have done best. Coal prices in 2009 are still the second highest on record, and a long way above previous long term trends.



Source: Taken from ABARE statistics (see endnote*)

Coal and gas companies have traditionally shunned involvement in how their product is used. But with emissions from their use becoming a key problem for customers, there is a justifiable onus on them to help clean up their product.

BHP Billiton earned US\$5.3 billion in profit before tax and interest from Australian coal in 2008-09 but its total commitment to CCS over five years is US\$300m. The record with other major companies is similar. The effort is not enough.

The Australian Coal Association's Coal21 program around CCS is funded by a 20¢ per tonne levy on black coal production and anticipates raising up to \$1 billion over ten years. But for most coal companies that is an insignificant amount. The industry is not showing leadership in cleaning up its emissions problems.

The Australian Government has committed \$2.5 billion to CCS projects, including \$2 billion for large-scale "flagship" CCS power plants over nine years from 2009. Right now the public sector is doing more on CCS than the private sector, even though all the profits from coal and gas are made privately.

Coal and gas projects are major employers in regional areas. Coal mining alone provides over 33,000 direct jobs. There is a strong regional multiplier effect from resource projects, because substantial local operating costs are incurred, and because coal and gas workers enjoy relatively high wages and spending power.

The potential jobs and investment bonanza from CCS is huge. New and retrofitted power stations will require both large workforces and billions of dollars. While the CCS pipeline network will start off small (e.g. a pipeline from the brown coal fields in Victoria to the depleted oil and gas reservoirs of the Bass Strait) it would ultimately equal the existing natural gas pipeline network - up to 5,000km of pipes and \$30 billion of investment.

Challenges for coal and gas companies

Fossil fuel and power generation companies must play a leading role in cleaning up their greenhouse gas pollution. The coal and gas industries must overcome a problem – they know they need to invest but are unwilling to sacrifice short-term profits. However, without immediate substantial funding and industry leadership the ongoing legitimacy of their industries will be lost. In fact in the eyes of many it has already been lost due to their lack of action and inadequate allocation of funds to support a low emission future.

The money involved in proving CCS at scale is not great relative to the profit margins and cash flows of the major resources companies. The Australian Coal Association's Coal21 Fund is a good idea but nowhere near sufficient - most member companies can afford to contribute a great deal more and a great deal more rapidly.

Over the past year we have witnessed an unedifying campaign by the coal and gas industries to seek full or partial exemptions from the proposed emissions trading scheme. Instead of taking responsibility for their own emissions, and helping their customers with their emissions from the use of coal and gas, we see an industry seeking an exemption from the charges that will be faced by most other businesses and households.

Challenges for government

Governments have a major role to play which is much broader than simply subsidising CCS development until it is sufficiently mature to be deployed commercially. Government should:

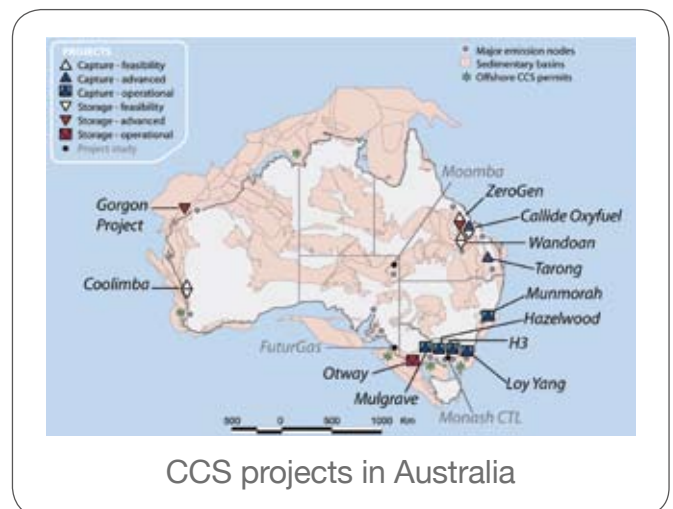
- Establish an emissions trading scheme that places a rising price on emissions;
- Establish market structures and regulatory frameworks that help make the commercial case for CCS (especially where emission permit prices are low or capped in the early years);
- Mandate either feed-in tariffs or quotas to reduce the risks where there are substantial first-mover risks (e.g. spending concerns in building a large first-generation CCS plant that other companies may leapfrog with more cost-effective second-generation projects); and
- Implement novel infrastructure financing measures (e.g. where there are collective tasks that the private sector finds difficult to coordinate – like building a CCS pipeline for customers who are not certain what their usage or costs will be).

Measuring the first steps towards success

Fossil fuel companies and government must work together to coordinate an industry-wide response. If industry funding or action lags, governments may need to impose this response. Successful cooperation can be measured by achieving two major pre-commercial development milestones in making CCS an “off-the-shelf” technology:

- Construction of large-scale CCS facilities must begin within the next two years to be on track for large scale testing of the technology; and
- Test large scale CCS (greater than 300MW capacity) within the next five years.

There are many CCS projects under development in Australia and overseas – but they will require private sector as well as government leadership to move from planning to reality.



Source: Courtesy of CO₂CRC

Fossil fuel, power generation and heavy industrial companies are putting more effort into seeking exemptions from carbon charges than they are putting into CCS.

- 1 ABARE (2009), Energy in Australia 2009, Canberra, page 21
- 2 http://www.europeanclimate.org/index.php?option=com_content&task=view&id=16&Itemid=32 (accessed 24 Sept 2009)
- 3 <http://www.pewclimate.org/global-warming-basics/coalfacts.cfm> (24 Sept 2009)
- 4 Australian Government (2009), National Greenhouse Gas Inventory, updated May 2009, p.5
- 5 ABARE (2009), Minerals and Energy -Major Development Projects – April 2009 listing, p.8
- 6 ABARE (2009), Australian Commodities journal, September quarter issue, p.508
- 7 ABARE (2009), Australian Commodities journal, September quarter issue, p.493
- 8 ABARE (2009), Australian Commodities journal, September quarter issue, p.489.

* Taken from ABARE Australian Commodity Statistics 2008, p.249 and ABARE Australian Mineral Statistics 2009, p.18.