CO2CRC Submission to the Joint Select Committee on Australia's Clean Energy Future Legislation

Introduction

The Cooperative Research Centre for Greenhouse Gas Technologies (CO2CRC) is one of the world's leading collaborative research organisations focused on carbon dioxide capture and geological storage (known as either geosequestration, carbon dioxide capture and storage, carbon capture and storage, or CCS). CO2CRC is a joint venture between Australian and global industry, universities, Australia and New Zealand research bodies, and Australian Commonwealth, State and international government agencies. Its funding comes from the Federal Government Cooperative Research Centres Program, other Federal and State Government programs, CO2CRC participants, the US Department of Energy and overseas bodies.

CO2CRC welcomes the opportunity to make a submission to the Joint Select Committee on Australia's Clean Energy Future Legislation. Through its pioneering research efforts, initiated in 1998, and widespread international engineering and technology connections, CO2CRC has a unique perspective on Australia's carbon emission problems and the technologies that will be pivotal to meeting our emissions reduction targets. CO2CRC scientists and engineers are working to develop low cost technologies that will reduce CO_2 emissions from large scale, emission intensive energy and industrial processes. CO2CRC activities cover a wide range of highly significant emissions, from electricity generation – from both natural gas combustion and coal combustion - to natural gas production and liquefaction and other CO_2 emitting industries. It is deeply involved in the technologies to manage and mitigate these emissions.

CO2CRC is concerned that some political advocates who champion the shut-down of the fossil fuel sector and a rapid switch to renewable energy do not recognise that CCS is an essential ingredient of the clean energy transition phase. It is important to develop and deploy next generation renewable energy technologies, but we are concerned that the long term potential contribution of CCS should not be overlooked. In addition the current polarised approach does not offer scope for combining clean energy technologies (such as biomass plus CCS) which have a potentially important role to play. It is essential that emissions policy is based on a sound integration of economics, science and technology to find and provide the lowest cost emissions pathway for Australia to meet its targets and to optimise the national economy.

Summary

CO2CRC supports the need for action on climate change and the establishment of a price on carbon that will help steer Australia towards a low emission future in an efficient and cost-effective way. A balance between the evolving price on carbon and the impact on the economy will be a primary factor in the policy's success. The initial low price on carbon ($23/tonne) provides a starting point for managing emissions, but it will not drive new technology development and deployment fast enough to meet the national 2050 target for emissions reduction of 80 per cent below 2000 levels.
To meet those targets, complementary mechanisms are required, focussed on technologies that are realistically capable of managing our unique set of emission circumstances, resulting in the lowest cost outcome to the economy and the community. Australia is blessed with significant coal and natural gas assets. Global energy agencies such as the International Energy Agency (World Energy Outlook 2010) and BP (BP Energy Outlook 2030) consider this important to future energy needs domestically and internationally. These valuable national assets, assessed in tandem with our current and projected future emissions profile, suggests that managing emissions from fossil fuel use must be a vital part of Australia's technology support mechanism.

CO2CRC considers that fossil fuels utilising carbon capture and storage (CCS) technology will be critical to the future energy mix, particularly as CCS costs drop and the carbon price rises. Federal Treasury has identified CCS as part of Australia's energy future, and it is seen by the International Energy Agency as a major contributor to meeting global emissions targets. Studies suggest that significant global emissions reduction without CCS could cost 70 per cent more (IEA Energy Technology Perspective 2008). Recent Australian Treasury modelling indicates that without CCS, Australian emissions will be 25 Mtpa higher and Gross National Income will be 0.2% lower by 2050. CSIRO/ABARE modelling in 2006 indicated an even greater impact without CCS, estimating 32 Mtpa higher emissions and 0.8% lower GDP. Given the potential of CCS in Australia and because of Australia's natural advantages in fossil energy, Australia needs to be at the international forefront of research and development in this technology. CO2CRC is amongst the global leaders at this cutting edge.

CO2CRC is concerned that multi-billion dollar complementary mechanisms in place or proposed, such as the Renewable Energy Target (RET) and the Clean Energy Finance Corporation (CEFC), are very much focussed on supporting CO_2 reduction predominantly through renewable technologies. Apart from funding under the Clean Energy Initiative through the CCS Flagships Program, CCS has been excluded. This is extraordinary considering the nation's extensive energy resources and emissions from fossil fuels in current power plants, which constitute considerable long-term assets. As discussed, authoritative studies (see above) indicate that CCS is an essential part of the lowest-cost pathway to meet national and international targets. CCS has the potential to tackle our biggest

emission problems at the lowest cost, but needs to be supported, at least to the equivalent level of renewable energy technologies in the first 15-20 years of the carbon tax/emissions trading scheme.

Placing the major focus of support onto renewable energy will not lead to the emission reductions for 2050 that the Government has as its policy. It will disadvantage the community and the national economy as we transition to a 'green' economy. Both renewable energy and technologies to abate fossil fuel emissions must be considered partners in the evolution to the new energy future.

Getting the Balance Right

The dilemma for Australia, as for many countries wanting to play their role in global emissions reduction, is how to balance the rate of change, with the impact on the national economy. It is important to choose a price path on carbon that brings about an appropriate change in emissions, but at the same time does not unduly damage or disadvantage our economy. Much of this is about the intensity of the carbon price and its rate of change. If the price is too low, the massive and slow changing industrial sector will not be able to change fast enough to meet 2050 targets. If the price is too high and too fast, there will be an unacceptable impact on the economy and the people of Australia.

What is not well understood is that the large carbon dioxide-emitting industries cannot be replaced overnight, and that the lead times to major change are measured in decades. Large industries and power generation facilities that produce a significant proportion of our CO_2 are slow to build, slow to give economic returns for the massive capital deployed, and slow to change. They also represent a massive investment which cannot just be thrown away. Substantial new technologies in this arena can take 30-40 years from discovery/concept to becoming mainstream. For this reason the deployment of gas is the first choice for replacing or providing new power. The current plans for a carbon price will see the energy sector build a lot of new gas plants for baseload power. This will be conventional technology.

In time these new gas plants themselves will have a carbon problem, and are likely to require CSS to manage their emissions. The lead times on CCS are strongly driven by the time taken to explore and assess acceptable storage sites.

Technologies such as solar PV and wind can be applied at small to moderate scale and are often modular. Design, planning and approval phases are thus shorter than for large fossil fuel/ CCS projects. Some of these new technologies can be developed at small scale by the private sector when the price on carbon is low, particularly with assistance from the RET, but at significant cost to the economy [1]. To progress the technologies that will make a big difference to large scale fossil fuel use, moving from small scale to large scale demonstration at a time when the carbon price is low (and at a rate sufficient to meet our targets) is difficult. It will require carefully planned complementary measures and commitment from government.

An almost exclusive renewables technology focus does not take into account the inherent competitive strengths of the nation and our plans to continue to produce, use and export fossil fuels.

The current strategies, if pursued to the exclusion of other low emission technologies such as CCS, will result in Australia either not meeting its targets or having a significantly weaker economy which, in turn, will affect Australian families' quality of life and jeopardise our carbon abatement targets. Australia's industries will be less efficient, and energy and energy infrastructure will be less reliable.

1. According to the Productivity Commission report, existing small scale/modular solar PV subsidies (i.e. feed in tariffs) are some of the most expensive ways to mitigate CO_2.

CCS and Australia's future use of fossil fuels

Australia has a massive reserve of fossil fuels, from natural gas and coal production. As stressed by the Government's climate change advisor, Ross Garnaut, our rich endowment is particularly vulnerable to the impact on the household and national budgets of carbon pricing if CCS technology is not deployed.

Natural gas production often involves separating the CO_2 mixed with the gas in its natural state and venting the CO_2 to atmosphere. With a price on carbon, this will progressively become less sensible and carbon storage will be required. This is already planned for the massive Gorgon Project joint venture in Western Australia, set to be the world's largest CO_2 storage project. As we move to develop lower quality gas fields, many with higher CO_2 content, CCS will become even more important.

Gas-fired generation to support LNG production will increase, as will gas-fired generation for the general economy. The government's own modelling shows that with a carbon price there will be a strong move to natural gas power production, and that by the mid-2030s CCS will be necessary for natural gas power stations. Many of our coal-fired power stations have long lives and could still be producing power in 2050. CCS is likely to be essential to their continued use and it does not make sense at certain projected future gas and carbon prices to prematurely close some of the modern coal-fired power stations.

Australia exports coal worth tens of billions of dollars each year [2]. All projections at a global and national level see that increasing. This increase is expected to come from those countries with limited access to electricity as they look to provide energy to their developing economies at the lowest cost, which currently means coal. A relevant emerging trend is in those advanced, energy-hungry countries such as Japan that are seeking to redefine their energy portfolio to lower emissions. Japan has little carbon storage capacity relative to its fossil fuel energy use. Consideration is being given to making low emission fuels such as dimethyl ether and hydrogen, for import to Japan. Such low emission fuels can be made in countries that have fossil fuels (such as natural gas and low cost coal) and combined with carbon storage opportunities. If this concept develops it represents a new export paradigm for Australia, building on both our carbon storage resources.

Coal (or gas) to liquids and/or hydrogen are likely to be part of the emerging global energy mix. Those companies and consortia investigating these options often envisage leaving the CO_2 produced from these processes at source, by using geological storage close to the site of production. This will ensure that countries such as Japan can secure low emission fuels from a low emission value chain.

[2] A$43 billion in 2010. ABARE predicts up to $A60 billion in coming years. DFAT Composition of Trade.

CCS is seen by the International Energy Agency (Energy Technology Perspectives, 2008) as a major contributor to meeting global emissions targets, providing 19 per cent of the total mitigation effort. This percentage is likely to rise in countries which do not have nuclear power as an option. Australia, because of its natural advantages in fossil energy, resource extraction experience and technology capability must be a world-leader in this emerging new technology. Importantly, large-scale industrial processes like CCS have different technology deployment timeframes and pathways to those for renewable technologies which are often based around small production units such as wind turbines or solar panels.

The pathway for CCS does not need many demonstration projects, but they will be large and take up to a decade to deploy. While the carbon price is relatively low in the early years of its deployment, there will be little or no investment in CCS, particularly since the individual investments required are significant. The $20-30bn that Australians are mandated to pay to support renewable energy through the Renewable Energy Target (RET) has no policy analogue in CCS technology development. The $1.6 billion CCS flagship funding seems pathetically small in comparison, particularly for a technology that is strategically important to our nation. The Government is now proposing that its clean energy technology support mechanisms be even further biased towards renewable technologies, with CCS deliberately excluded.

CO2CRC notes that the bulk of the complementary mechanisms currently in place or proposed, such as RET and the Clean Energy Finance Corporation are primarily supporting emissions reduction through renewable technologies. CCS has been excluded despite the fact that many studies (Garnaut, IEA, CSIRO/ABARE, Treasury, Stern) indicate that CCS is an essential part of the lowest cost pathway to meet national and international targets, and indeed CCS can be part of a Clean Energy Investment Plan under the Bill. Putting the major focus of transition support onto renewable energy will hurt the Australian economy and quality of life.

Bluntly, there is no transition to a clean Australian economy without CCS. The technology has the realistic potential to tackle our biggest emission challenges, but it needs to be supported to at least equivalent levels of renewable energy over the next 15-20 years.

Australia needs to deploy some $10billion dollars for the demonstration of CCS to stimulate five to six demonstration projects in the next 10 years.

Conclusion

CO2CRC supports the Government's plans for Australia's Clean Energy Future but believes that relying solely on market mechanisms to achieve this will not be sufficient. Market mechanisms alone have not driven renewable energy technologies and we do not expect this to be the case for the more significant challenge of major CO_2 emission reduction. In order to meet this challenge CO2CRC encourages the Government to;

1. Recognise the full range of low emissions technologies that will be required for a final energy mix;
2. Unambiguously acknowledge that CCS is part of Australia's clean energy future.
3. Develop mechanisms such that $10 billion can be made available to support the development of five to six medium scale CCS demonstrations projects over the next 10 years. This will initiate projects that will take some 10 years to come to fruition and in turn provide the basis for significant growth of low cost CCS. This is essential as the caps and carbon price move into zones that will require significant CO_2 reduction from fossil fuel production and use.
4. Develop other policy instruments to aid a transition that makes productive use of Australia's asset base and energy endowment. Such policy instruments could include;
    a. Hypothecation of funds back to clean energy research and development, including research & development of CCS, to be shared across the low energy portfolio mix.
    b. A mandatory low emission technology program, similar to the Renewable Energy Target, but recognising the benefits of other low emissions technology including CCS.
    c. Reviews of the electricity market and carbon market interface and how that might need to be designed or modified to support the progressive development of a range of low emission technologies.

These policies would need to be in place until low emissions technologies reach full maturity and are naturally taken up in a fully functioning energy and carbon market.

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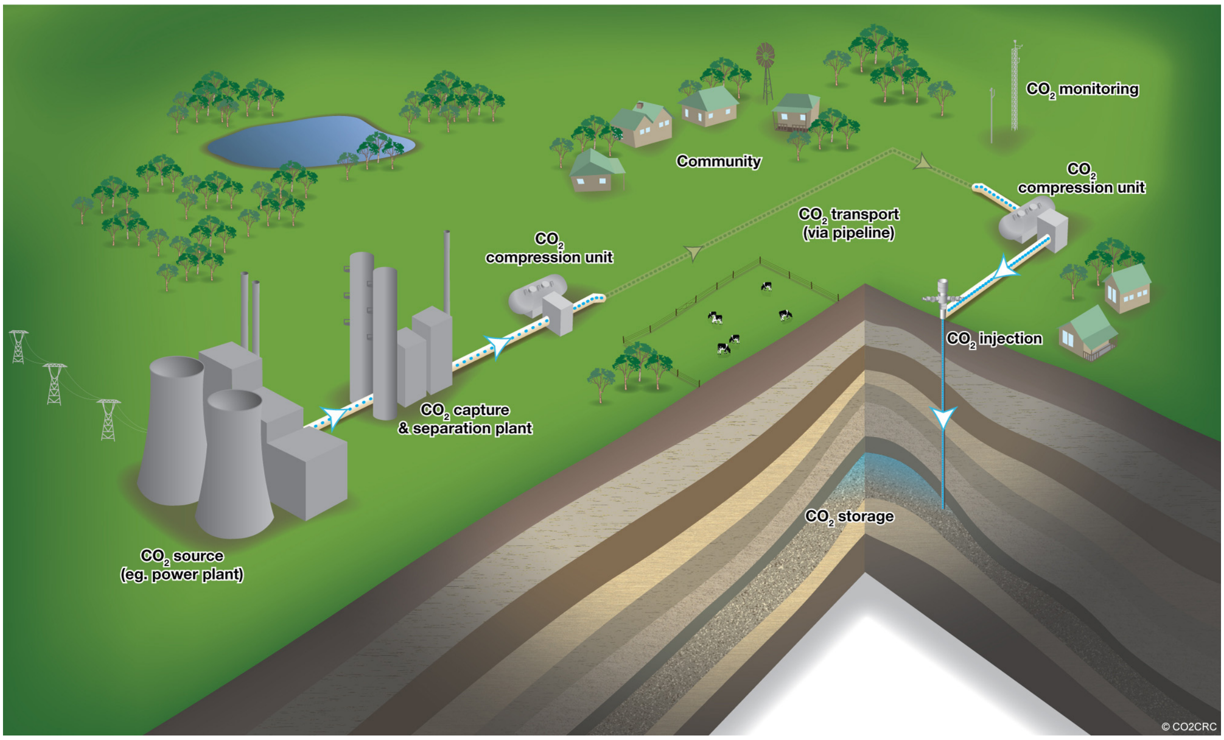
Appendix

Carbon Capture and Storage

Carbon capture and storage (CCS) involves capturing carbon dioxide that would otherwise be emitted into the atmosphere, compressing it, transporting it to a suitable site, and injecting it into deep geological formations where it will be trapped for thousands or millions of years.



Carbon capture and storage is also referred to as geological sequestration, or geo-sequestration, carbon capture and geological storage (CCGS) or carbon dioxide capture and storage.

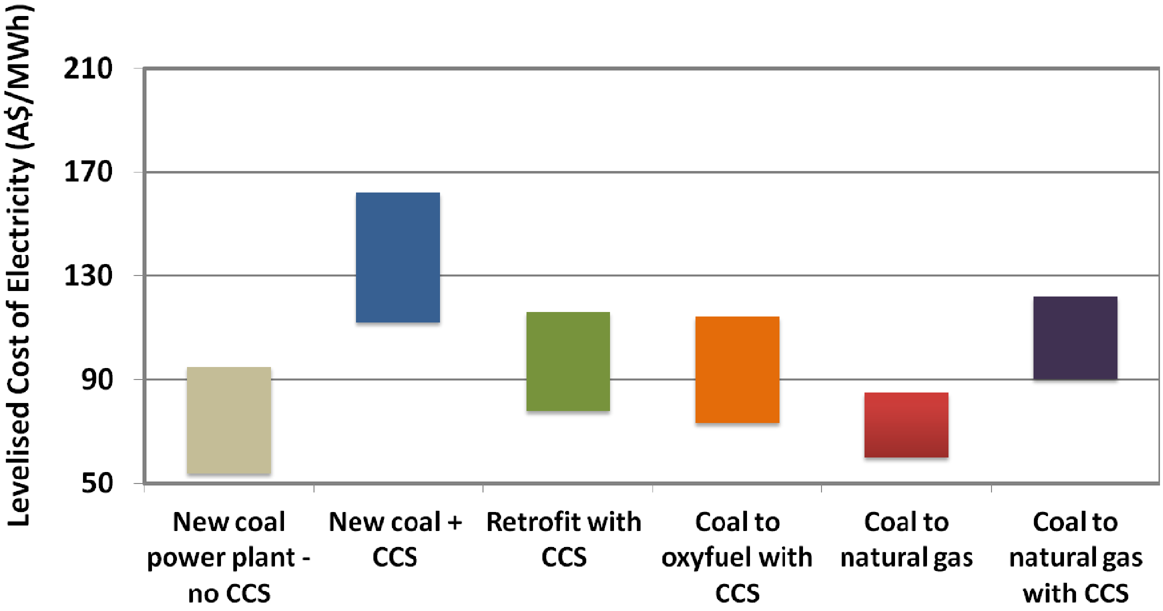
CCS can be used to store carbon dioxide from the combustion of fossil fuels (oil, gas and coal). Applying CCS to the generation of electricity using fossil fuels can result in reducing emissions from a power station by up to 90 per cent. It is one of many processes which can make reductions in greenhouse gas emissions from the combustion of coal (called low emission coal technology).

CCS can be used to capture and store carbon dioxide emitted from a range of other industrial processes, such as the manufacture of cement and some fertilisers, in purifying natural gas, and in conversion of gas or coal to liquids.

While the concept of CCS as a means of reducing greenhouse gas emissions has arisen relatively recently, CCS uses technologies that have been widely practiced in different industries for many years.

New insights on the costs associated with CCS

One potentially lower cost implementation pathway for CCS is to retrofit the capture technology to existing power plants, often with some degree of upgrading (repowering) of the facilities and/or heat integration. The figure below shows the estimated levelised costs of electricity (LCOE in A$/MWh) for black coal power plants under different levels of retrofit compared to building new coal-fired power plants or natural gas plants.



In the figure, the estimated LCOE for with CO_2 capture excludes transport and storage costs. Data is based on original values used by EPRI (2010) Australian Electricity Generation Technology Costs – Reference Case 2010, Electric Power Research Institute.

The reduction in costs for retrofits is understandable; the capital cost for a new build CCS facility comprises approximately 50 per cent of the cost of the power plant itself. Avoiding the need for a completely new power plant dramatically reduces the upfront capital cost of the CCS retrofit facility.

One of the largest contributors to the costs of retrofitted CCS is the energy required for carbon dioxide separation (parasitic loss of power).

Further reduction in the parasitic power loss is a key research issue for CO2CRC and we have already developed significant insights into how the process and heat integration of CCS with the power plant is best undertaken to drastically reduce such losses. These insights into the relatively low efficiency power plants in Australia [3] appear to offer considerably reduced parasitic power options (~20%)

compared to those previously reported (35-40%). This can result in a reduction in capture costs of up to 25%.

New processes/developments

Many of the reported techno-economic studies in capture are based on the use of Monoethanolamine (MEA) as a solvent in an absorption stripping removal process. Improvements in capture technologies over the recent past suggest that more efficient processes and configurations exist, even now, that significantly reduce the cost of capture. There is no cause for pessimism – predicted costs are trending downward for well known and identifiable reasons.

CO2CRC is actively working in this space and has been working on low volatility robust carbonate solvents that promise to drive down the energy costs of capture. The CRC has recently been awarded both Australian and US patents for the first generation of these carbonate solvent processes and has submitted a further provisional patent on the next generation of the solvent process. This work is being supported through a range of trials and on-site demonstrations by CO2CRC and its partner organisations BCIA and ANLEC R&D.

The new process promises to reduce capture costs by 15% in comparison with the current benchmarks. This work along with research into fit-for-purpose equipment for large scale CCS and heat integration will provide the necessary capture cost reductions to make CCS viable in the coming years.

Similarly, there are other opportunities in membrane, adsorbent, hydrate and cryogenic capture that the CO2CRC is working on that also hold promise of significant capture cost reductions.

[3] Harkin, T., A.F.A. Hoadley, B. Hooper (2008), Process integration analysis of a brown coal-fired power station with CO_2 capture and storage and lignite drying, in *Ninth international conference on greenhouse gas technologies (GHGT-9) 2008*, Elsevier: Washington DC, USA