Centre for Energy and Environmental Markets

Parliament of Australia, House of Representatives: *Standing Committee on Science & Innovation*
Inquiry into geosequestration technology

Summary notes for the Committee Hearing, 30th October, 2006

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The UNSW Centre for Energy and Environmental Markets (CEEM) undertakes interdisciplinary research in the design, analysis and performance monitoring of energy and environmental markets and their associated policy frameworks. It brings together UNSW researchers from the Faculties of Engineering, Business, Science and Arts and Social Sciences of Commerce and Economics. Its work includes analysis of a range of current and possible future energy technologies including CCS.

Geosequestration or Carbon Capture and Storage (CCS), is a promising but, at this time, still somewhat unproven set of technologies for capturing CO_2 emissions from fossil fuel combustion and a range of other industrial processes, and then safely sequestering them in geological reservoirs. The primary motivation for considering potential widespread deployment of such technologies is our growing concerns about climate change.

The key context for this Parliamentary inquiry, then, is firstly our present understanding of climate change and the likely scale and timing of emissions reductions required to avoid dangerous warming; and secondly what are our various options for achieving such reductions and how might they be compared.

Avoiding dangerous climate change seems likely require to global emissions to peak before 2020, followed by substantial overall reductions by 60% or more from current levels in 2050. Delays in taking action will then require faster reductions to a lower level of emissions. A 20 year delay in undertaking emission reductions might require levels to then be reduced at 3-7 times the rate if action begins now.

Key questions for this inquiry in our view, are the potential role of CCS in any effective response to climate change; and the appropriateness of the current policy framework in light of such an assessment.

There are a range of existing abatement options including end-use energy efficiency, lower emission fossil-fuel technologies including Natural Gas Combined Cycle (NGCC) and Cogeneration plants, a range of renewable energy sources and nuclear power. Technical progress, however, is clearly essential. Much of this will be ongoing improvement of our existing options, however, there are also important innovation opportunities in promising but still emerging technologies including CCS but also others; eg. 'hot rock'.

Assessing and comparing these options requires a risk-based technology assessment framework that considers factors including current technical status, present costs where known and possible future costs, potential scale of abatement, potential speed of deployment and other possible societal outcomes.

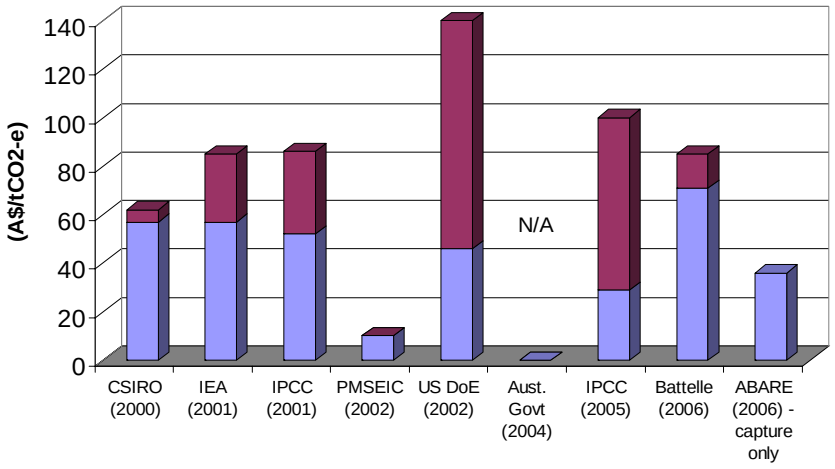
CCS is a promising but still somewhat unproven option that potentially offers very significant abatement potential and good integration into the existing energy industry. There are, however, outstanding questions regarding its effectiveness and safety, its delivered abatement is likely to come at significant cost and it is unlikely to be able to make a significant contribution to emission reductions for a decade or more.

The science underpinning geosequestration technology: There are number of promising technology developments that could offer commercial solutions to separation and capture of $C0_2$ but considerable ongoing uncertainty: *"It is generally not yet clear which of these emerging technologies, if any, will succeed as the dominant commercial technology for energy systems incorporating CO_2 capture."* (IPCC, 2005).

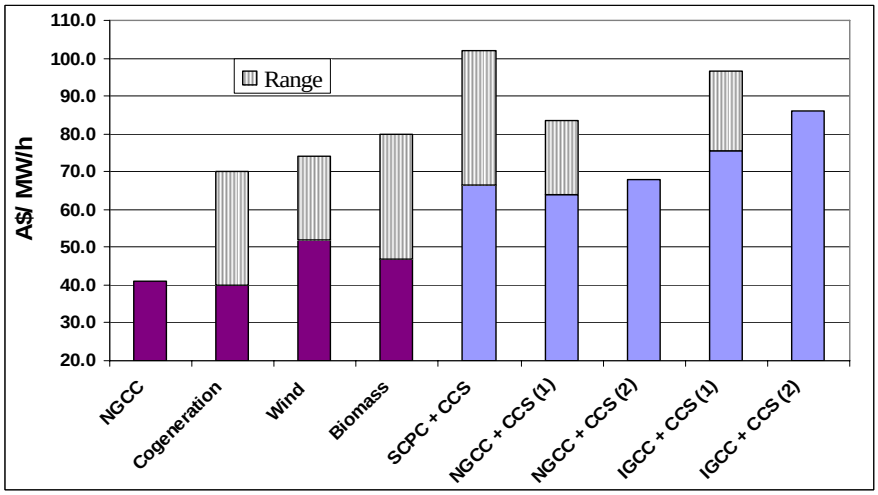
There are good physical reasons and some experience to date that suggest that CO_2 injection into appropriately chosen geological reservoirs can stay securely sequestered for thousands of years. Early demonstration projects are promising although there continue to be surprises. However, it will still likely take decades to achieve a high degree of certainty that injection does indeed equate to effective storage

and all the issues involved in selecting appropriate sites.

The potential environmental and economic benefits and risks of such technology: These can only be sensibly assessed in terms of our other options for reducing greenhouse emissions. Key issues are costs – direct ($/MWh) and in terms of delivered abatement – and the potential speed of deployment.



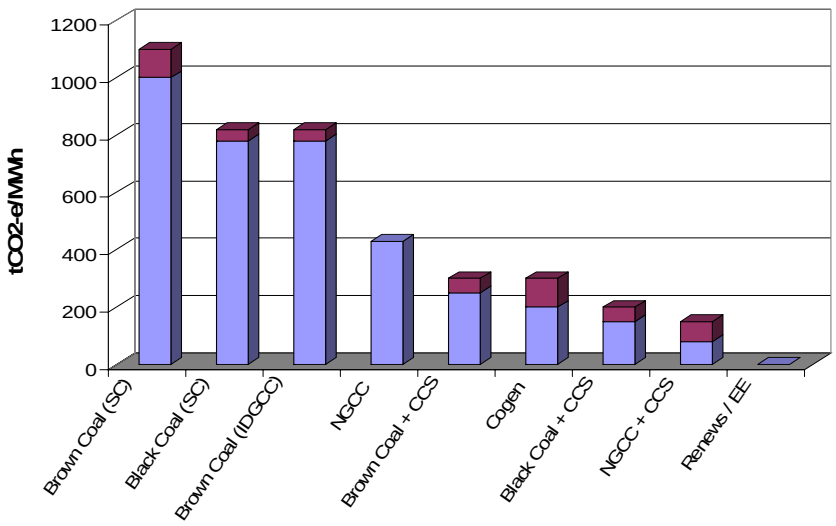
Various estimates (including uncertainty ranges) of the effective abatement cost (A$/tC0$_2$) of CCS. This highlights the challenges and continuing uncertainty in estimating the costs of CCS.



Cost estimates ($/MWh) for a range of existing and possible future generation options in Australia. Note that there are existing low emission options that would seem to be potentially cost effective in comparison with future CCS.

Sources:

NGCC	Council of Australian Governments, "Energy market Review" Nov 2002
Cogeneration	Sinclair Knight Merz 2000. "A review of the viability of Cogeneration in Australia" DITR
Wind	MMA 2006. "Renewable Energy - A Contribution to Australia's Environmental and Economic Sustainability"
Biomass	MMA 2006 (ibid)
SCPC + CCS	IPCC 2005 - Special Report "Carbon Dioxide Capture and Storage" September 2005
NGCC + CCS (1)	IPCC 2005 (ibid)
NGCC + CCS (2)	MMA 2006 (ibid)
IGCC + CCS (1)	IPCC 2005 (ibid)
IGCC + CCS (2)	MMA 2006 (ibid)



Estimated emission intensities (tCO2/MWh) for a range of existing and possible future generation options (Australian Government, 2004). There are existing generation options of similar emissions intensity to possible CCS options.

Study scenario	Approximate period where significant deployment of CCS in electricity generation begins
PMSEIC (2002)	2005
IEA (2004)	2010
DoE (2004)	2020
IPCC (2005) MiniCAM MESSAGE	 2015-20 2040
ABARE (2006)	2015
CO2CRC (2006)	2030
Battelle (2006)	2025

Approximate period of significant commercial deployment of CCS in electricity generation for a number of different study scenarios. There is considerable potential delay between demonstration (a number of proposed projects demonstrating CCS for power generation might enter service around 2012-15) and eventual commercial application.

Australian policy issues with respect to CCS: We don't know yet what role CCS can play in our abatement efforts and shouldn't rely on it, or any other particular technology, to answer all our challenges. What is needed is a policy framework that will resolve the question of what role CCS might play in the medium to longer term for Australia and elsewhere, while reducing risks and maximising opportunities through much greater and immediate support of existing, technically proven, abatement options.

The present R&D and demonstration support for CCS is appropriate and should be greatly expanded. Much will rely on international technology developments and support for greater international effort on climate change policies would be helpful in this regard.

More importantly, Australia needs a coherent policy framework including a price on carbon to support greater deployment of existing options including NGCC and cogeneration, greater energy efficiency and renewables. This will also drive early CCS opportunities and motivate more private R&D investment.