

NATIONAL LOW EMISSIONS COAL STRATEGY

ACCELERATING CARBON CAPTURE AND STORAGE IN AUSTRALIA – UPDATE



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**ACCELERATING CARBON CAPTURE
AND STORAGE IN AUSTRALIA – UPDATE**

NATIONAL LOW EMISSIONS COAL COUNCIL

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For general inquiries about the National Low Emissions Coal Council, contact the Australian Government Department of Resources, Energy and Tourism, GPO Box 1564, Canberra ACT 2601, Australia, or email ret@ret.gov.au

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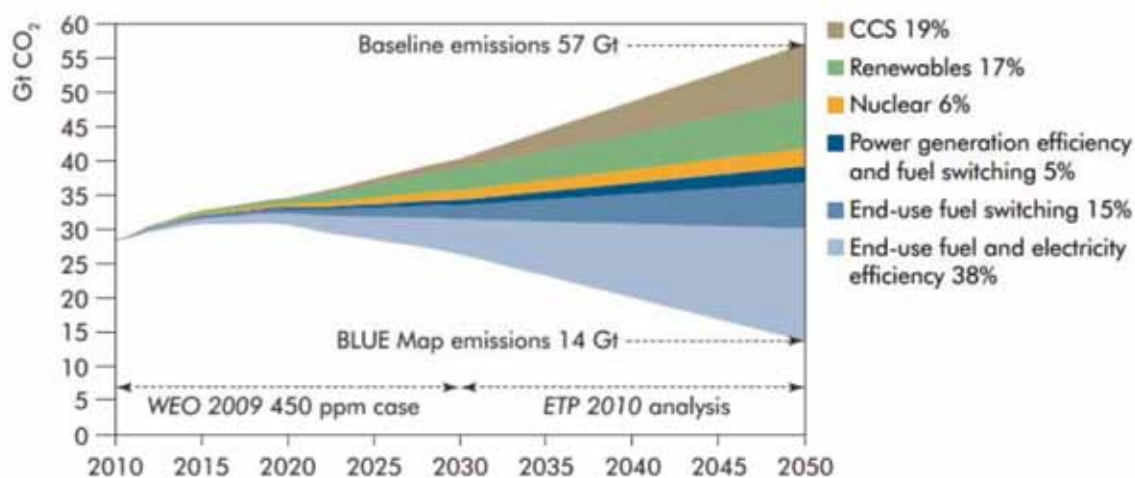
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ACCELERATING CARBON CAPTURE AND STORAGE IN AUSTRALIA – STRATEGY UPDATE

IMPERATIVES FOR ACTION REMAIN

The Australian Government is committed to achieving a reduction of our greenhouse gas (GHG) emissions by 60 per cent of 2000 levels by 2050 while maintaining secure, reliable and affordable energy supplies for households and industry. Carbon capture and storage (CCS) is the primary technology available to reduce emissions from stationary large scale fossil fuel use. Globally, CCS will need to contribute nearly one-fifth of emission reductions to reduce GHG emissions by 50 per cent by 2050 (see Figure 1).¹ Without CCS the International Energy Agency (IEA) projects that the cost of reducing global emissions will be around 70 per cent higher.²

Fig 1: Key Technologies for reducing CO₂ emissions (IEA Blue Map Scenario 2010)



Source: IEA Energy Technology Perspectives 2010

The IEA's 2010 World Energy Outlook projections for global energy demand to 2035 are based on three scenarios around government policies reflecting:³

- a continuation of current energy policies i.e. no changes as of mid 2010;
- new policies resulting from broad commitments and plans announced by governments including those made under the Copenhagen Accord of December 2009; and
- limiting the concentration of greenhouse gasses in the atmosphere to around 450 parts per million (ppm) CO₂ equivalent.

Under the Current Policies scenario, global demand for coal will continue to rise, with growth concentrating mainly in the non-OECD countries, especially in Asia and specifically in China. Under the New Policies scenario, global demand will continue to grow to 2020 from when it will level off and decrease to 2035. Demand in the non-OECD countries will continue to grow but less than under the first scenario. Under the 450 ppm scenario, global demand will grow to 2020 and subsequently decline to 2035 including in the non-OECD countries. In all three scenarios, the OECD countries will experience negative growth in the demand for coal while non-OECD countries' consumption will grow to around 75 per cent of the world's demand for coal in 2020 and to around 80 per cent in 2035 (Table 1). While remaining a dominant fuel for electricity generation coal will increasingly be replaced by gas and, coming from a low base, nuclear and renewables in all three scenarios.

1 Energy Technology Perspectives 2010 – Scenarios & Strategies to 2050, International Energy Agency, p 75

2 IEA CCS Roadmap

3 IEA World Energy Outlook 2010, p 46

Table 1: World primary coal demand by region and scenario (Mtce)⁴

			New Policies Scenario		Current Policies Scenario		450 Scenario	
	1980	2008	2020	2035	2020	2035	2020	2035
OECD	1 379	1 612	1 452	1 021	1 596	1 507	1 348	709
Non-OECD	1 181	3 124	4 213	4 600	4 557	6 037	3 998	2 856
Total	2 560	4 736	5 665	5 621	6 153	7 544	5 347	3 566
<i>Share of non-OECD</i>	<i>46%</i>	<i>66%</i>	<i>74%</i>	<i>82%</i>	<i>74%</i>	<i>80%</i>	<i>75%</i>	<i>80%</i>

Source IEA WEO 2010

The 2009 *National Low Emissions Coal Strategy*⁵ identified that, given Australia's existing reliance on and abundance of coal and gas, CCS will need to play a vital part in a portfolio of energy solutions which will include renewable energy and energy efficiency. The Carbon Storage Taskforce (CSTF)⁶ considered that with a capture rate of 90 per cent of coal-fired power and nearly 100 per cent of Liquefied Natural Gas (LNG) related reservoir gas emissions, Australia could capture, transport and store some 58 per cent of the emissions from ten major emission hubs. This amount would be equivalent to 21 per cent of total Australian greenhouse gas emissions in 2006.⁷ In addition, the successful deployment overseas of CCS technologies will enable Australia to capitalise on the anticipated global growth in energy demand through the continued export of coal and natural gas.

Australia should continue to focus on the actions required for accelerated development and deployment of industrial-scale low emissions coal technologies. The early demonstration of capture, transport and storage prior to 2020 will be a necessary precursor for deployment on a commercial basis beyond 2020. Further, as CCS is not exclusively a coal technology, the National Low Emissions Coal Council considers that the broader application of CCS should also be pursued. The knowledge gained from early deployment of CCS in Australia at the Gorgon project (reservoir gas capture and storage) and coal-fired power generation should underpin the subsequent application of CCS to gas-fired power generation and other high emitting industries, such as iron and steel, cement, chemical and petrochemical, pulp and paper. The IEA states that CCS represents potentially the most important technology option for direct CO₂ emissions reduction for the latter group of industries.⁸

DEVELOPMENTS SINCE SEPTEMBER 2009

The world's multilateral climate change agenda stalled following the 15th United Nations Climate Change Conference (UNCCC) in Copenhagen in December 2009 and due to the impact of the Global Financial Crisis (GFC). However, under the Copenhagen Accord many countries have made voluntary commitments to reduce greenhouse gas emissions. The Australian Government submitted its existing 2020 target range for reducing emissions: –5 per cent unconditional, with up to –15 per cent and –25 per cent both conditional on the extent of action taken by other countries and certain other conditions being met.⁹ The Government stated at the time that if these conditions were not resolved in 2011, it would set scheme caps consistent with the five per cent target to provide business certainty for the commencement of the first year of full trading under the Carbon Pollution Reduction Scheme (CPRS) from July 2012. However, the CPRS proposal was not adopted by Parliament and the Government has stated that it will not move to legislate the CPRS before the end of 2012.

4 IEA World Energy Outlook 2010, p 201 – table 6.1

5 *National Low Emissions Coal Strategy – Accelerating Carbon Capture and Storage in Australia*; National Low Emissions Coal Council, Sept 2009

6 *National Carbon Mapping and Infrastructure Plan – Australia*, Carbon Storage Taskforce, December 2009

7 CSTF Plan p 11

8 Energy Technology Perspectives, Scenarios & Strategies to 2050 – International Energy Agency p. 56

9 Media Release Senator the Hon Penny Wong, the then Minister for Climate Change and Water, <http://www.climatechange.gov.au/~media/Files/minister/wong/2010/media-releases/january/mr20100127.ashx>

Following the August 2010 elections, the Australian Government committed to addressing climate change initially through the establishment of a Multi-Party Climate Change Committee (MPCCC) to advise Government. Its advice and the Government's response will help shape the role of CCS to ensure the reliable and affordable supply of energy and as part of a broader energy technology portfolio. Industry input is being sought through a Business Roundtable.

Figure 2 shows that by 2030 coal and gas with CCS (carbon price not included) are expected to be among the lower technology costs options (left hand Y-axis). The ability of each technology option to mitigate CO₂ emissions is also demonstrated (right hand Y-axis).¹⁰ For a glossary of technologies see Attachment A.

Fig 2: Technology Rankings 2030

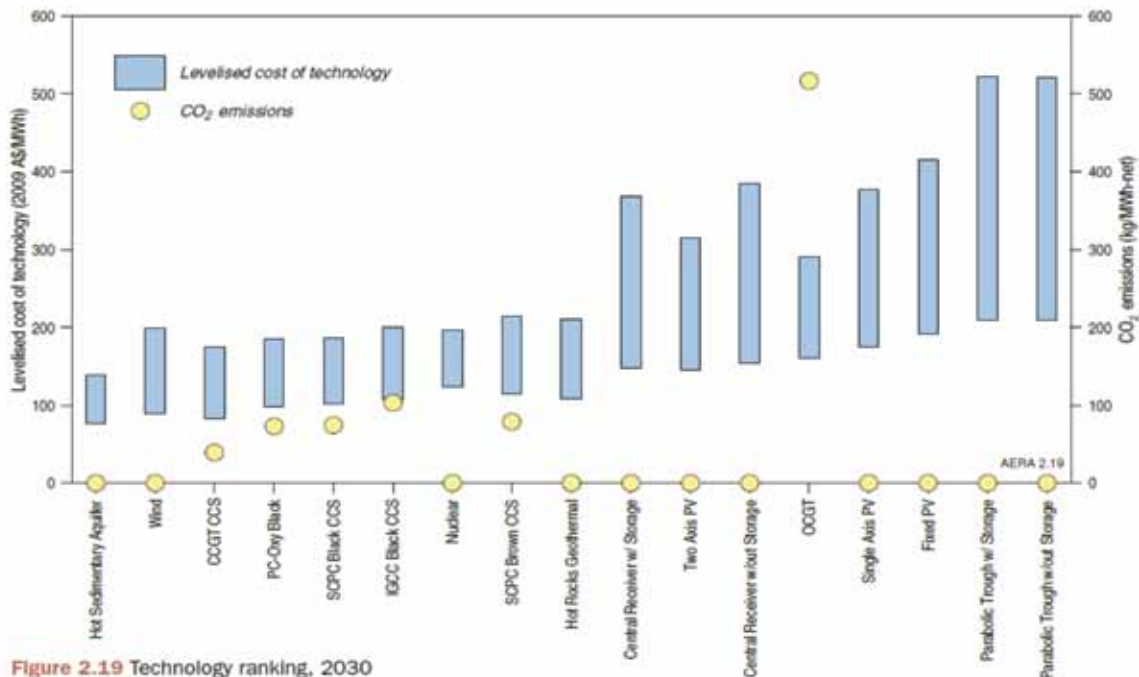


Figure 2.19 Technology ranking, 2030
Source: EPRI technology status data, 2010

During the recent elections the Australian Labor Party committed to implementing generator emission standards and CCS-Ready standards for new coal-fired power generators by 2011. Early adoption of CCS-Ready may avoid the development of power generation capacity that cannot be retrofitted which in turn would result in a significant increase of CO₂ emissions or in the cost of emission reduction in order to meet emission targets. Countries in Europe and North America are already implementing CCS-Ready requirements for electricity generation.¹¹ Some Australian States are also applying CCS-Ready requirements as a condition for investment in new coal-fired power stations.

The application of CCS will result in an energy penalty because of the extra energy that is required to separate and capture the CO₂ pre or post the combustion of the fossil fuel and to compress, transport and store the liquefied captured CO₂. This penalty (parasitic loss) can result in a net efficiency loss between 13 to 27 per cent.¹² This in turn will affect the nominal plant output and capacity to meet demand and will need to be acknowledged in public records on plant capacity and incorporated in investment planning for new plants.

Australian business remains concerned about the impact continued uncertainty about short and long term carbon price signals will have on future investment growth in Australia's resource and energy

10 Australia Energy Resource Assessment, Australian Government 2010, p 30 also at: https://www.ga.gov.au/image_cache/GA17412.pdf

11 IEA ETP 2010, p 80–81, 110,120–121, 123

12 IEA ETP 2010, p 625

sectors. Despite this uncertainty, and the GFC still affecting business confidence and the availability of corporate funding¹³, the cost of climate measures is increasingly being built into companies' investment planning decisions.

INDUSTRY AND GOVERNMENT SUPPORT

Internationally the G8 Energy Ministers, the IEA, the Carbon Sequestration Leadership Forum (CSLF), individual governments and communities have been focusing on ways to stimulate the transition to low emissions technologies, including CCS. In the past two years governments have made commitments to launch between 19 and 43 large scale CCS integrated demonstration projects by 2020. A study commissioned by the Global CCS Institute (2010) identified 80 large scale integrated projects at various stages of development around the world. Specifically governments and industry from the United States, the European Union, the United Kingdom, Canada and Australia have made significant progress. Currently there are five large scale CCS projects either in operation or being developed, including Australia's Gorgon LNG project which will come on-line in 2016.¹⁴

The UK Government currently has the most advanced set of policies for the deployment of CCS as part of a broader energy portfolio. The UK Energy Act 2010 includes provisions for: a new financial incentive for carbon capture and storage; implementing mandatory social price support; and introducing a package of measures aimed at ensuring that the energy markets are working fairly for consumers and delivering secure and sustainable energy supplies.¹⁵

Support for accelerated demonstration and deployment of CCS in Australia is being provided through the Australian Government's \$385m National Low Emissions Coal Initiative; the \$1.9 billion CCS Flagships Program and other industry and government co-funded initiatives such as the Cooperative Research Centre for Greenhouse Gas Technologies (CO2CRC), Australian National Low Emissions Coal Research and Development (ANLEC R&D) Ltd, Brown Coal Innovation Australia, Victoria's \$110m Energy Technology Innovation Strategy (ETIS) for large scale pre-commercial CCS demonstration projects¹⁶ and the Australian black coal industry's \$1 billion COAL21 Fund. The Australian Government has also taken a leading role in establishing and supporting the Global Carbon Capture and Storage Institute (GCCSI) to facilitate and drive global cooperation and knowledge sharing on CCS deployment.

CO₂ CAPTURE, TRANSPORT AND STORAGE IN AUSTRALIA

Post-combustion capture (PCC), pre-combustion capture (including integrated gasification combined cycle – IGCC) and oxyfuel have been identified as priority technology options for CO₂ capture for Australia. While at different stages of development, the Council considers that all these options should be pursued in coming years through collaborative research and demonstration projects. Australia is committed to playing an active role with our international partners in demonstrating these technologies.

The time required for the identification and development of suitable storage reservoirs is considerable – for aquifers this is estimated to be 11–13 years. If CCS is to be a viable commercial option by 2020, then exploration for suitable storage sites should start immediately.¹⁷ The Government's requirement for new coal-fired power generation capacity to be CCS-Ready from 2011 has increased the urgency of the work needed to confirm the availability and location of sizeable storage capacity both onshore and offshore, and for the development of transport and storage infrastructure networks.

The Council considers that the proving up of storage needs to be pursued as the first priority in the coming years to underpin CCS investment planning and decision making. Where storage opportunities are relatively defined or advanced, such as in the Gippsland Basin, there needs to be ongoing support for the upstream projects i.e. power generation and carbon capture to enable the early demonstration of end to end projects.

13 'Mobilising Private Sector Finance' – Climate Group, ECOFIN and GCCSI, p 11

14 Carbon Capture and Storage – Progress and next steps; IEA/CSLF Report to Muskoka 2010 G8 Summit

15 Energy Act 2010: http://www.decc.gov.uk/en/content/cms/legislation/energy_act_10/energy_act_10.aspx

16 <http://www.new.dpi.vic.gov.au/energy/projects-research-development/etis>

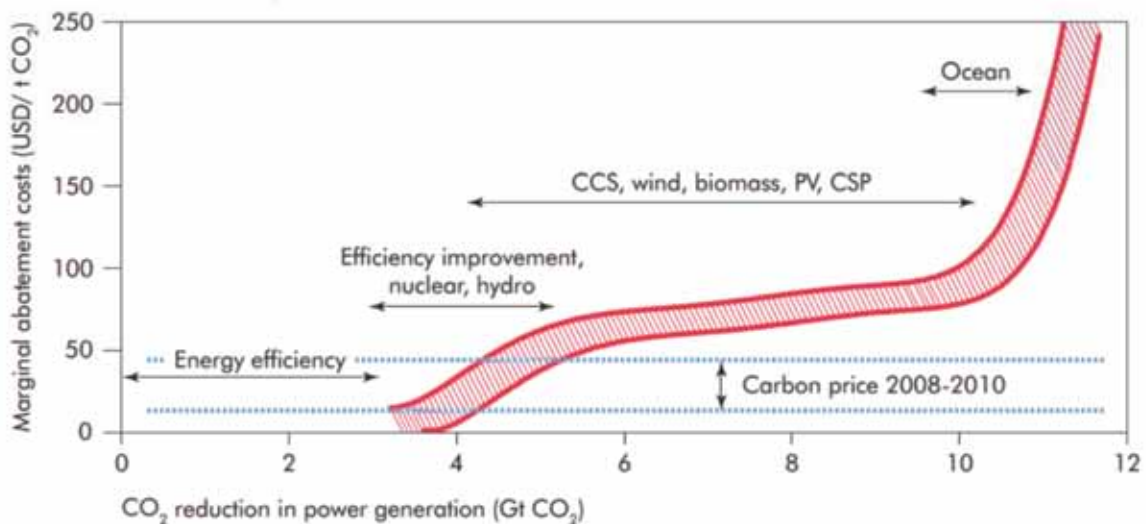
17 "A proposal for Greenhouse Gas Storage Exploration Incentives – CSTF June 2010

CO₂ pipeline transport is a relatively mature technology internationally and is being used for enhanced oil recovery for example in the United States and Canada. Apart from the proposed injection of CO₂ in the Gorgon LNG project, the transport of compressed liquefied CO₂ is a new frontier for Australia. The Council considers that work on technical and economic regulatory frameworks needs to continue to support investment in the physical transport and infrastructure networks in time. To that effect, the Council will seek to work collaboratively with the CCS Working Group of the Ministerial Council on Mineral and Petroleum Resources (MCMPR). The Council understands that this Working Group is to progress the delivery of a strong and transparent nationally consistent CCS policy and legislative regime, reduce unnecessary regulatory burdens and streamline approval processes for CCS, ensure application of occupational, health and safety, environment and community engagement best practices and provide strategic advice across Governments on key CCS issues.

INVESTING IN LOW EMISSION ELECTRICITY IN AUSTRALIA

Demonstration of CCS on a commercial scale is an essential prerequisite for broader commercial deployment of the technology and to ensure the 'bankability' of subsequent CCS projects. However in the long-term, the large-scale deployment of CCS and other carbon mitigating technologies will depend on a widespread, technology-neutral, market mechanism which imposes a cost on CO₂ emissions. Globally current mechanisms are insufficient to price CO₂ to a level where large-scale CCS investments are justified as demonstrated in Figure 3.¹⁸

Fig 3: CO₂ mitigation cost on electricity sector (2010–20) and current CO₂ prices



Source: IEA Energy Technology Perspectives 2010

Whereas in several countries carbon markets have been or are being established, in Australia this is still being considered by the Australian Government. The anticipated development path of a carbon price or tax in Australia is currently highly uncertain. During the initial years of the introduction of a market driven carbon price mechanism or a carbon tax, carbon prices are unlikely to cover the full costs of investment in emissions abatement, and a commercial gap opens up. As the Council observed in its Strategy, policy interventions are therefore required to facilitate rapid deployment of initial CCS demonstration plants and to accelerate subsequent early pre-commercial plants.¹⁹ The size of the intervention will depend strongly on the level of the carbon price or tax.

In addition, development of large scale storage hubs and the required pipeline system will not occur without policy and financial support. Developing storage infrastructure for CCS demonstration and early commercial plants will not provide the required scale of hubs. A long term view is needed, which will not be supported on a commercial basis, in the early years. Who pays for this development and how it will be charged is a key issue for resolution.

¹⁸ IEA ETP 2010, p 121, 559

¹⁹ NLEC Strategy 2009, p iii

Mechanisms to bridge the commercial funding gap across capital and operational financing needs of early demonstration and deployment include capital grants, feed-in-tariffs and carbon (contract for difference) price guarantees.²⁰ As stated in its Strategy, the Council acknowledges that such mechanisms and incentives should be tailored to the maturity of the technology and decrease over time.

COMMUNICATION AND COMMUNITY ACCEPTANCE

The Council notes that the Government is developing a public information campaign on climate change and climate science. It urges the Government to ensure that low emission technologies, including CCS, feature in this campaign to enhance public understanding of such technologies as part of a broad portfolio of energy solutions. At the same time the Council strongly reaffirms its recommendation on the urgent need to undertake a national CCS Communications Strategy, in conjunction with other stakeholders, to encourage a better understanding in the community of this key technology.

REVISED STRATEGIC FRAMEWORK FOR CCS DEMONSTRATION AND DEPLOYMENT IN AUSTRALIA

In considering the Government's objective of industrial-scale demonstration of CCS between 2015 and 2020 and commercial deployment beyond 2020, concurrent action is needed by industry and governments. Having reviewed its initial recommendations, the NLEC Council considers that these need to be re-prioritised as outlined below. The reprioritised and updated recommendations may also provide a starting point for the deliberations of the National CCS Council.

1.1 Storage availability

- The Carbon Storage Taskforce report highlighted that the critical path for large-scale deployment of CCS is the identification and assessment of storage reservoirs. The experience of demonstration projects has confirmed this and the NLEC Council considers that the identification and development of storage reservoirs should be the priority for CCS funding programs in the near-term.
- The Council recommends that, building on the storage work undertaken through the CCS Flagships program, additional funding be allocated to prove up geological storage reservoirs to a level where they can be factored into the planning for future CCS developments.

1.2 CCS research, development and demonstration

- The NLEC Council recommends that the funding base be maintained for the research underway in Australia to support demonstration and future deployment of CCS and the ongoing efforts to ensure knowledge sharing as a result of the development and implementation of CCS Flagship and NLECI funded CCS and related projects.
- The Council considers that the targeted level of electricity to be produced through the CCS Flagships should be reassessed or funding for the CCS Flagships be increased if the original 1000MW target is to be achieved, recognising that the shortlisted CCS Flagship Projects will support a range of power and industrial applications.
- Consistent with the timeframes developed by the CSTF for identification and assessment of storage reservoirs, the Council recommends that the Government revises the target date of 2015 for the commissioning of the CCS Flagship Projects to 2018 or later.
- Given the projected increased use of gas for electricity and energy generation in Australia in the medium to longer term and the CO₂ emissions from large-scale industrial processes, the Council recommends that consideration be given to CCS research requirements for gas-fired power generation and large-scale industrial applications.

1.3 A supportive regulatory framework

- The Council recommends that the MCMPR's CCS Working Group, established to progress the development and delivery of a strong and transparent nationally consistent CCS policy and legislative regime, consults with the Council in preparing CCS related advice for MCMPR's consideration.

20 IEA ETP 2010, p 559

- Matters for consideration should include: long-term liability concerns, complementary regulations and measures for other essential aspects of CO₂ transport and storage development such as easement options, technical CO₂ pipelines standards, common-user requirements, streamlined project approvals and acreage exploration release arrangements for the Gippsland, the Surat and the Perth basins.
- The Council encourages the states to participate in the development of the Australian Government proposed national CCS-Ready standard for all new build coal-fired power plants. This should ensure a nationally consistent approach.
- The Council recommends that the Government consider the feasibility of applying CCS-Ready standards to gas-fired power generation and large-scale industrial applications to ensure a level-playing field is maintained between large-scale CO₂ emitters and to ensure the development of cost-effective future emission solutions.

1.4 Transitional support and tax arrangements for CCS development and investment

- As part of the Government's frameworks to support the demonstration of low-emission technologies to contribute to Australia meeting its 2050 GHG emission reduction target, the Council recommends that the Government urgently undertakes a comprehensive review of CCS support measures. This review should include an assessment of transitional support options for CCS deployment including capital grants; performance based operational subsidies and exploration incentives.
- The Council reiterates its view that direct grant funding for CCS demonstration projects should be non-taxable to enable the full quantum of funding to be accessed by project proponents.
- The Council considers that any future pricing mechanisms on carbon should not be applied retrospectively to existing CCS demonstration or early mover projects which are CCS-Ready.
- The Council requests the Government's Policy Transition Group to include in its advice to the Australian Government on improved resource taxation reforms possible options to entice the private sector undertaking storage exploration for CCS.

1.5 Communication and community acceptance

- The Council urges the Australian Government to ensure public information and consultation on energy policy and climate change, including through the MPCCC and the Government's climate change public information campaign, gives due regard to the essential contribution of CCS in securing Australia's energy security in the future while also achieving Australia's GHG target for 2050.

1.6 Skills development

- The Council recommends that a review be undertaken in two years to assess the requirements for skilled personnel needed for CCS development and implementation, taking into account the outcomes and knowledge gained from the CCS Flagships program, state initiatives and other demonstration activities, as well as wider resources and energy sector skills and workforce strategies.

ATTACHMENT A

Glossary of technologies: X-axis Fig 2

CCGT/CCS: Combined Cycle Gas Turbine with CCS

IGCC Black CCS: Integrated Gasification Combined Cycle Black Coal with CCS

OCGT: Open Cycle Gas Turbine

PC-Oxy Black: Pulverised Coal with Oxy-combustion with Black Coal

PV: Photovoltaic

SCPC Black CCS: Single Cycle Pulverised Black Coal with CCS

SCPC Brown CCS: Single Cycle Pulverised Brown Coal with CCS

w/ : with

w/out: without

