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Department of Environment, Land, Water and Planning (DELWP)
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As a leading provider of carbon capture, utilization and storage (CCS) research, the central argument of CO2CRC is that CCS is essential to achieving climate change mitigation targets and must be considered as part of the portfolio of decarbonisation options if decarbonisation is to be achieved at the lowest cost.

The Independent Expert Panel’s report does not seriously address CCS and its potential – whether applied to coal and gas fired power plants to provide dispatchable low emissions generation capacity, or when applied to the production of hydrogen from hydrocarbon energy sources to provide the most cost-competitive means of producing clean hydrogen at scale.

This is a curious omission in view of the Victorian Government’s leadership (together with the Commonwealth Government) in CCS project development through the CarbonNet Project.

Should you require any additional information, please contact me.

Yours sincerely,

David Byers
Chief Executive Officer

About CO2CRC

CO2CRC is Australia’s leading carbon capture, utilisation and storage (CCS\(^1\)) research organisation having dedicated more than $150m to demonstrating safe capture, storage and monitoring of CO\(_2\) over the past decade. Owned and operated by CO2CRC, the Otway National Research Facility in Victoria is arguably one of the most advanced field scale CCS research sites globally. Through the collaboration of internationally respected industry, academic and government partners, CO2CRC brings tangible CCS cost reduction technologies and methodologies to the world.

Australia’s competitive advantage is fossil fuels.

CO2CRC submits that the Victorian Government should apply a technology-neutral approach to achieving emissions reduction targets. In this context, carbon capture and storage technologies offer many advantages as an appealing energy technology option.

Carbon capture, utilisation and storage (CCS) prevents carbon dioxide (CO\(_2\)) from being released into the atmosphere. The technology involves capturing CO\(_2\) produced by large industrial plants and then recycling the CO\(_2\) for utilisation or compressing it for transportation before finally injecting it deep into a rock formation at a carefully selected and safe site, where it is permanently stored. Storage of CO\(_2\) in a CCS project is an extension of existing oil and gas technologies to ensure CO\(_2\) remains trapped, just as oil and gas remains trapped for millions of years below ground.

The Expert Panel report mentions, only in passing, the potential to use CCS as a climate mitigation technology for the industrial sector and in hydrogen production from coal. This is a missed opportunity in view of the scale of emissions reduction offered through the deployment of CCS and the availability and improvements in the cost-effectiveness of the technology.

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\(^1\) The terms CCS (carbon capture and storage) and CCUS (carbon capture, utilisation and storage) are often used interchangeably. For the purposes of this submission and to retain the nomenclature used in the Independent Expert Panel Report, the term CCS is used throughout this document.
While Victoria’s and Australia’s contribution to global emissions remains small, there are strategic reasons to be investing and incentivising CCS to ensure that hydrocarbon industries have a continued license to operate and contribute to the Australian and Victorian economies.

Australia’s economy and wealth are underpinned by its abundant natural resources. Exports of hydrocarbon resources (coal, oil and gas) remains a significant proportion of federal government revenue as does iron ore which is foundational to global steelmaking. In 2018-19, coal, LNG and iron-ore collectively had an export value of over $194 billion.

Victoria is a direct beneficiary of the resources sector. Based on the 2018 Victorian State of Engineering report, Victoria is the biggest exporter of mining equipment, technology and services (METS) in Australia, with more than 1,800 METS businesses based in the state and some of Australia’s biggest mining companies, including BHP Billiton, Rio Tinto, Newcrest and Orica are headquartered in Melbourne. Importantly, coal and gas fired power plants account for 80% of Victoria’s electricity generation. In summary, the resources industry is a significant contributor to the Victorian economy and it is in Victoria’s interests to sustain and support growth of the sector while achieving low emissions targets. Victoria is already leading the way nationally in deployment of CCS through the CarbonNet Project – a joint endeavour between the Victorian and Federal Governments. CarbonNet is investigating the potential for establishing a commercial-scale carbon capture and storage (CCS) network. The network would bring together multiple carbon dioxide (CO2) capture projects in Victoria’s Latrobe Valley, transporting CO2 via a shared pipeline and injecting it into deep underground, offshore storage sites in Bass Strait. In early 2017 the Victorian and Commonwealth governments agreed to progress CarbonNet to Stage 3 – Project Development and Commercial Establishment.

The case for CCS to reduce carbon emissions

CCS is a proven technology supporting the decarbonization of the global fossil fuel industry and therefore recognized as a vital technology in achieving climate change mitigation targets. Numerous world-leading agencies, including The International Energy Agency (IEA), the Intergovernmental Panel on Climate Change (IPCC), the International Clean Energy Ministerial (CEM), the European Union, United States and UK Governments have unambiguously stated that CCS is essential to achieving climate change mitigation targets and must be considered as part of the portfolio of decarbonisation options if decarbonisation is to be achieved at the lowest cost. A snapshot of supporting statements includes:

- Faith Birol- International Energy Agency- Executive Director Nov 2018
  “Without CCS as part of the solution, reaching our climate goals is practically impossible”.

- UK Committee on Climate Change - May 2019
  “deploying CCS in the 2020s is a crucial enabler to putting the UK on track to meeting a net-zero target”.

- UK Committee on Climate Change – Net Zero Report - May 2019
“The evidence base is clear that UK deployment of CCS is required to unlock the greatest opportunities for cost reduction”

• Bloomberg New Energy Finance – Energy Outlook 2019
  “To keep an electrified energy sector on a 2-degree trajectory, we will need to deploy additional zero-carbon technologies that are dispatchable and economic running at low capacity factors, or technology that can capture and sequester emissions at scale”

• Clean Air Task Force (USA)
  “CCS is an essential technology in the climate solution toolbox”

• Natural Resource Defence Council (USA) Mar 2018
  “has long supported policies to advance a proven technology called carbon capture and storage”

• US EPA (Obama Administration) 2016
  “Current scientific and technical knowledge, coupled with ongoing project experience, confirms that well-selected, well-designed, and well-managed geologic sequestration sites provide a safe way to permanently sequester CO2."

• IPCC 1.5-degree report Chapter 4
  “removing BECCS and CCS from the portfolio of available options significantly raises modelled mitigation costs”

• Energy Transitions Commission (EU) - Mission Possible Nov 2018
  “Carbon capture will, however, have a crucial role to play in industrial decarbonization”

• Angela Merkel –German Chancellor May 2019
  “Nine countries want to be carbon neutral by 2050 – so on balance to emit no CO2. It is my firm belief that is only possible if one is prepared to capture and store carbon dioxide. The countries in question do not deny this."

• Lord Nicholas Stern – Economics of Climate Change for UK Government - GCCSI Status Report Nov 2018
  “CCS is absolutely essential”

The key findings from all these international agencies supports the role that CCS can play in facilitating Australia’s continued economic prosperity while meeting its international emissions reductions targets to 2030 and beyond:

1. **CCS is the only feasible technology that can deliver deep emissions reductions in many industrial processes that are vital to the global economy such as LNG, steel, cement and chemicals production.**

   Some of the Australia’s most carbon-intensive industries have no alternatives to CCS for deep emissions reduction since much of the CO2 is generated by their production processes rather than from fuel use.
CCS therefore supports Australia’s continued success as a global natural resource export leader. Emissions from these sectors are expected to grow because of increasing demand for consumer products and infrastructure and the importance of commodities such as steel, cement, liquid fuels and chemicals for the growth of modern economies. Materials like steel, carbon fibres and concrete are also fundamental to the supply chains of other low-carbon technologies – e.g. wind and nuclear power. According to a report from the IEA, efficiency measures and non-fossil energy options have the potential to reduce the specific emissions from the above sectors’ production by only around 30%. CO2CRC has invested significant effort in developing more cost-effective CCS solutions for deployment in trade-exposed sectors of the Australian economy including LNG, steel and the new hydrogen economy.

2. CCS can be cost-effectively applied to coal and gas fired power plants, providing dispatchable low emissions generation capacity to provide grid stability and security of supply to complement an increased deployment of intermittent renewables.

The Independent Expert Panel relies mainly on CSIRO’s GenCost 2018 report in advocating for a power sector that relies primarily on variable renewable energy (VRE) sources (with wind and solar photovoltaics representing the workhorses) supported by energy storage. The GenCost 2018 report concludes that rapidly falling costs of renewable energy make solar and wind the cheapest form of new energy generation even with additional costs included for energy storage.

However, this conclusions rests on a number of inaccurate assumptions which negatively impact on the relative competitiveness of CCS as an emissions reduction option. Primarily, CO2CRC would like to highlight four major shortcomings of the GenCost 2018 calculations:

- GenCost 2018 assumes a continued high decline in capital and operational cost for variable renewable energy sources through learnings and project experience. By contrast, cost reductions (capital and operational) achieved through ‘Learning by Doing’ are largely disregarded CCS in GenCost 2018 on the premise that CCS is less likely to be widely deployed and therefore offer few opportunities to ‘Learn by Doing’.

  In reality, it is widely accepted by the scientific, engineering and investment community that all ‘emerging technologies’ benefit from ‘Learning by Doing’. Further, there are a number of large-scale CCS facilities in commercial operation and policy refinement could see a significant increase in CCS activity in Australia and globally. World-wide, according to GCCSI’s 2018 Global Status of CCS report, there are 18 large-scale CCS facilities in commercial operation, 5 under construction and 20 in various stages of development, capturing almost 40 mtpa of CO2. This excludes projects where CO2 is primarily utilised for enhanced oil recovery.

- Retrofits of CCS on coal are not given consideration in GenCost 2019. In its report, Retrofitting CCS to coal: Enhancing Australia’s Energy Security (2017), CO2CRC concluded a coal fired power plant retrofitted with CCS was as competitive as renewables due to the lower cost of operating current power stations.

To reiterate the role of ‘Learning by Doing’, for retrofits, the 2018 Shand Power Station CCS Feasibility Study conducted by the International CCS Knowledge Centre showed that compared to
the Boundary Dam 3 CCS project (BD3) built in 2014, a CCS system at Shand could see capture capital cost reductions of 67% per tonne of CO₂ captured as well as 92% in potential savings to power plant integration capital cost. Based on the model, the levelized cost of captured CO₂ was calculated at $45US/tonne. The Boundary Dam Shand project projects a 67% reduction in CO₂ capture & compression costs. These costs, though unvalidated in practice, ought to have been considered in the modelling.

- The GenCost 2018 report acknowledges that the variability of wind and solar increases non-linearly as the share of energy from these sources rises. To compensate, it has considered a limited number of hours of firm power supply achieved using battery storage or pumped hydro energy storage. The authors note that this method, referred to as system balancing provides no guarantee that the system is balanced and the actual cost of providing storage over longer periods (days, weeks) of scarce wind or solar production.

- The GenCost 2018 report does not consider the inefficient utilisation (resulting in overcapacity) needed to support very high shares of wind and solar. This requires overbuilding total installed capacity to meet peak demand during periods when VRE output is below average. The need to overbuild increases non-linearly as VRE penetration rates increase.

3. The production of hydrogen with a low-carbon footprint (produced using fossil fuels with CCS or renewable energy) has the potential to significantly reduce energy related CO₂ emission domestically and position Australia to benefit from the growing demand for hydrogen globally.

Federal and state governments through the Government COAG Energy Council are developing a national strategy for hydrogen on the basis that clean hydrogen has a key role to play in an economically, socially and environmentally sustainable and prosperous future.

Wisely, the COAG Energy Council refers to ‘clean hydrogen,’ defined as being produced using renewable energy or using fossil fuels with carbon capture and storage (CCS). This definition reflects the principle of technology neutrality set by COAG Energy and Resources Ministers when they commissioned a comprehensive and ambitious strategy for the development of an Australian hydrogen industry.

It is widely acknowledged that based on current and projected future production costs, the production of clean hydrogen from fossil fuels with CCS is currently considerably more cost effective that the alternative production processes involving electrolysis powered by renewable energy sources (green hydrogen). This is acknowledged in the August 2018 briefing paper prepared for COAG Energy Council by the Hydrogen Strategy Group chaired by Chief Scientist, Dr Alan Finkel AO.²

In fact, clean hydrogen production from methane or coal is the lowest cost and most commercially

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mature method, accounting for just about all current hydrogen production globally. In terms of market share, according to a 2014 report by IEA-ETSAP titled Hydrogen Production and Distribution, currently 95% of hydrogen production worldwide is fossil fuel based and by 2030, it is projected that fossil fuels will still account for 70% of hydrogen production\(^2\).

Considering these facts, if Australia is to take advantage of the time-constrained opportunity to meet the global demand for hydrogen by 2030, continued development of CCS technologies at scale is vital to support the production of clean hydrogen.

The commitment from the Federal and Victorian governments to support the development of the Hydrogen Energy Supply Chain Project in the Latrobe Valley to demonstrate the feasibility of hydrogen production from coal gasification and transport to Japan has greatly enhanced Australia’s position in the international market as a potential technology-neutral producer of commercial scale clean hydrogen.

The CarbonNet Project (CarbonNet) is a critical CO\(_2\) storage link to the Hydrogen Energy Supply Chain (HESC) project. CarbonNet is investigating the potential for establishing a commercial-scale carbon capture and storage (CCS) network. CO2CRC is developing key technologies for long-term CO2 monitoring for CarbonNet.

4. CCS can protect and create skilled and high value jobs

As Australia reduces CO2 emissions, CCS can protect and create more skilled and high value jobs in communities and regions with strengths in production of traditional sources of energy. One example is the Latrobe Valley in Victoria which has the potential to host a new low emissions industrial hub, servicing an international market that will increasingly value low emissions products.

A nationally coordinated response is needed

Coordinated leadership from federal and state governments is needed for Australia to make an effective contribution towards the achievement of global emissions reduction goals.

Climate change policies set at the state level that are not integrated with policies at the national level are unlikely to create the regulatory and policy frameworks required to incentivise the significant investments in technologies and infrastructure needed to develop a sustainable domestic energy market or position Australia to benefit from global markets for new fuels such as hydrogen. A nation-wide approach to emissions reduction will provide for a systematic pathway to decarbonise that takes advantage of economies-of-scale and enables cross-sectoral benefits to be realised.

Conclusion

Given Victoria's exceptional hydrocarbon resources including massive brown coal deposits and offshore gas reserves, Victoria should plan for a clean energy future which supports a technology-neutral approach to reducing emissions. This would include an embrace of CCS as an appealing option for combining with traditional energy sources to meet domestic energy needs as well as supporting future fuels such as the opportunity presented by a new hydrogen export market.