GLOBAL CCS INSTITUTE

Interim Emissions Reduction Targets for Victoria (2021-2030)

Submission from the Global Carbon Capture & Storage Institute

30 APRIL 2018

Interim Targets Independent Expert Panel Secretariat
via email: climate.change@delwp.vic.gov.au

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Re: Interim Emissions Reduction Targets for Victoria (2021-2030)

Please find enclosed the Global Carbon Capture and Storage Institute's submission to the consultation on Interim Emissions Reduction Targets for Victoria (2021-2030).

The Global Carbon Capture and Storage Institute (the Institute) is the world authority on carbon capture and storage (CCS) and appreciates the opportunity to provide a submission on this important issue.

The Institute's mission is to accelerate the deployment of CCS globally to achieve the required permanent reductions in carbon dioxide (CO_2) emissions necessary to meet climate targets.

As a raft of pre-eminent climate change experts and analysis asserts, Paris climate change targets cannot be achieved, and energy security cannot be maintained, without the inclusion of CCS as a fundamental clean technology.

I would appreciate the opportunity to present to the Independent Expert Panel and expand on the detail contained within this submission.

Yours sincerely

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Key points

- To reach Paris climate change targets and avoid the deeply adverse socio-economic and environmental effects of climate change, we need all available solutions to be deployed, including CCS;
- CCS has been identified by pre-eminent research and analysis, including the International Energy Agency (IEA) and the Intergovernmental Panel on Climate Change (IPCC), as pivotal in meeting Paris climate change targets;
- CCS is a proven climate mitigation technology which has been in successful operation for more than 45 years;
- CCS is currently in commercial deployment across 17 large-scale sites, with five more facilities in development;
- CCS effectively complements intermittent renewables in the power sector;
- CCS is the conduit to a new energy economy of hydrogen production, bioenergy and CO_2 re-use applications;
- CCS is the only clean technology capable of decarbonising major industrial sectors (steel, cement, fertiliser, pulp and paper, petrochemicals, gas processing);
- CCS can play a significant and complementary role in a fully decarbonised Australian electricity market.
- In forming its advice to the Minister on interim targets for reducing greenhouse gas emissions, the Independent Expert Panel should consider the role of CCS, an essential climate mitigation technology.

Background

The Global Carbon Capture and Storage Institute (the Institute) is the world authority on carbon capture and storage (CCS) and appreciates the opportunity to provide a submission regarding Interim Emissions Reduction Targets for Victoria (2021-2030).

The Institute's mission is to accelerate the deployment of CCS globally to achieve the required permanent reductions in carbon dioxide (CO_2) emissions necessary to meet climate targets.

CCS represents a range of technologies that directly reduce emissions from a variety of industries involving the combustion of fossil fuel (e.g. power generation and steel manufacture) and others where CO_2 is a by-product (e.g. steel, chemical and cement production, natural gas processing).

What is Carbon Capture and Storage?

Carbon capture and storage (CCS) captures CO_2 and permanently stores it in meticulously characterised storage formations deep below the earth. CCS technology has been in safe commercial operation for more than 45 years, and is endorsed by international climate change experts including the Intergovernmental Panel on Climate Change (IPCC) and the International Energy Agency (IEA) which maintain that it is pivotal to reach climate change targets.

The IPCC and the IEA have developed exhaustive mitigation scenarios which address how Paris targets can be reached and how the disastrous consequences of climate change can be avoided. Both organisations maintain that CCS has a critical and unparalleled role to play in building a new, decarbonised energy system. In fact, in the IEA's 2°C scenario, CCS accounts for 14% of cumulative emissions reductions. Under this scenario, a total of 2,732 CCS facilities are needed by 2040 to meet Paris goals – equivalent to present-day annual CO_2 emissions in the United States.

CCS is proven, safe, reliable and operating at commercial scale today.

Operations undertaken over almost half a century demonstrate that CO_2 can be permanently stored deep below ground. Oil, gas and naturally occurring CO_2 reservoirs have proven that fluids can be safely sealed underground for millions of years. CCS facilities access the same geology.

Globally, CCS technology is verifiably well tested. The Institute's projects database currently tracks 38 large-scale CCS facilities either operating, under construction, or in development, around the world. Some of these facilities have been operational for more than 20 years. The Institute also tracks 72 individual smaller pilot and demonstration facilities. Current, large scale facility developments globally are illustrated in Figure 1.

Figure 1: Key CCS facility developments globally

Source: Global CCS Institute

CCS is already curbing greenhouse gas emissions around the globe, with more than 220 million tonnes of anthropogenic carbon dioxide safely and permanently injected deep underground.

There are currently 17 large-scale CCS facilities operating globally, with five more in development. These facilities are capturing and storing 37million tonnes of CO_2 per annum, the equivalent of removing eight million cars from the road each year.

However, this is not enough. To make deep, rapid reductions in greenhouse gas emissions and meet Paris climate change targets at least cost, CCS must be deployed swiftly and at scale.

In December 2015, at COP21 in Paris, 195 countries adopted the Paris Agreement. The Agreement's longer-term climate goals are defined as:

- Limit average global warming to well below 2°C above pre-industrial times, with the aspiration of limiting warming to 1.5°C;

- In the second half of this century, achieve a balance between emissions sources and sinks (often referred to as net-zero emissions). There simply cannot be a cost-effective mitigation response to climate change without CCS.

Modelling of least-cost emission pathways consistently identifies the need to deploy CCS in large volumes if Paris emission targets are to be achieved. The importance of CCS in these results is in direct contrast to spurious claims that CCS is either 'too costly' or 'cannot compete with renewables'.

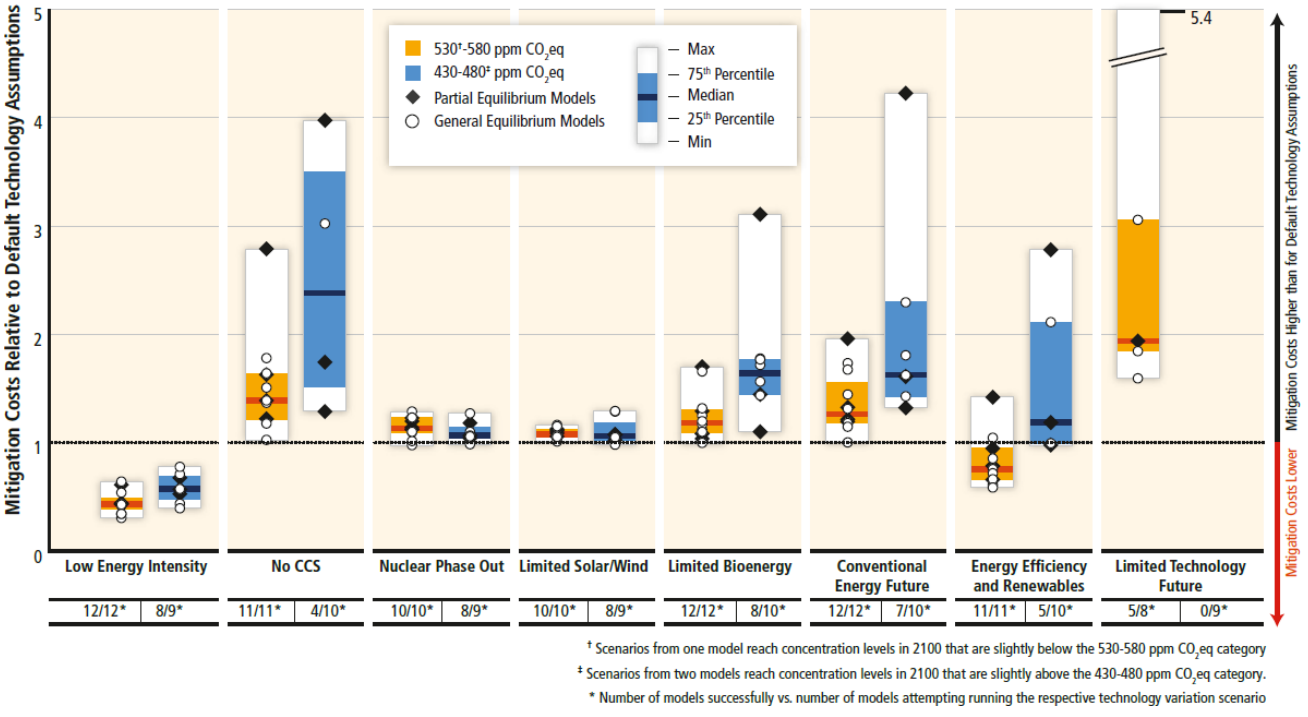
To the contrary, on a like-for-like basis, CCS economically complements renewables. Similarly, it is important to underscore that CCS is not a competitor to renewables, but a supportive adjunct. It is part of a flotilla of clean technologies needed to turn the tide on climate change.

This is well supported across climate change science. The father of the phrase 'global warming', Columbia University Professor, Wallace Smith Broecker, has said:

"Eventually, the dependence on fossil fuels will come to an end and the world will be powered by renewables. But as this energy utopia lies many decades in the future, by the time we arrive there we will be saddled with an atmosphere laden with excess CO_2 . CO_2 threatens to change our climate. Hence we must learn how to capture and bury it."

The Intergovernmental Panel on Climate Change's (IPCC) Fifth Assessment Report commented on a range of modelling which examined the impact of mitigation technologies on the cost and likelihood of limiting global temperature increases. The results of this are shown in Figure 2, where the median cost of achieving 450 parts per million CO_2 concentration was 138% higher in scenarios that excluded CCS compared to default scenarios where CCS was included.

Figure 2: Mitigation costs 2015 to 2100, with varied technology availability



† Scenarios from one model reach concentration levels in 2100 that are slightly below the 530-580 ppm CO_2eq category

‡ Scenarios from two models reach concentration levels in 2100 that are slightly above the 430-480 ppm CO_2eq category.

* Number of models successfully vs. number of models attempting running the respective technology variation scenario

Source: IPCC, 5th Assessment Report, Figure 6.24.

CCS complements intermittent renewables in the power sector.

The Renewable Energy Target and state-based renewable energy policies have been effective in supporting deployment of wind and solar PV capacity, but unfortunately not in creating investment in CCS and other technologies to support the low-emission power system required to achieve Australia's global climate targets. Nor have these policies addressed the challenges created by intermittent renewables across system planning, resilience and operation as penetration increases.

Safe, reliable and affordable electricity is reliant on a suite of technologies to meet changing supply and demand patterns. Intermittent renewable energy with energy storage will be an important part of the future global energy mix but renewable energy alone cannot provide reliable electricity at acceptable cost and risk. An electricity system with a high penetration of intermittent renewable generation requires back-up and augmentation systems to ensure reliability and resilience. Dispatchable fossil-based generation with CCS requires no additional grid integration costs or risks, making it affordable and reliable, and reducing the total cost of a true low emissions electricity system.

Therefore, CCS is a key component in reconciling the so-called "energy trilemma" – the challenges associated with meeting international climate change commitments, keeping the lights on, and ensuring energy affordability, all concurrently.

Inclusion of CCS within an agnostic, "all-of-the-above" portfolio of low-carbon technologies is not just the most cost-effective route to global decarbonisation, it also delivers energy reliability at lower total system costs.

CCS is the conduit to a new energy economy utilizing clean hydrogen.

As the energy matrix continues to evolve, CCS also facilitates the creation of new low emission energy economies, which are yet to reach their apex. A good example is the work Kawasaki Heavy Industries is undertaking with Iwatani, J-Power and Shell Japan to develop the Hydrogen Energy Supply Chain project in the Latrobe Valley. The opportunity to turn Victoria's brown coal into clean hydrogen is just one example of the new opportunities CCS can create. Clean hydrogen, produced from brown coal with CCS, provides a pathway for the decarbonization of transport (particularly heavy transport where hydrogen fuel cells can provide the range that battery energy storage cannot) and electricity production, the sectors with the largest emissions in Victoria.

Clean hydrogen can also be used to decarbonize industrial and residential heat. Hydrogen can be introduced into the domestic natural gas reticulation system at concentrations below approximately 10-15% without any modifications to the reticulation system or end-use domestic appliances, delivering emission reductions. Concentrations higher than this would require modifications to parts of the reticulation system and to end-use appliances, however such changes have been undertaken before where natural gas replaced town gas. (Town gas was a mixture of hydrogen and carbon monoxide manufactured from coal and/or oil).

Full decarbonization of the reticulated gas system would occur in a 100% clean hydrogen system. The full conversion of the Northern Gas Network in the United Kingdom from natural gas to 100% clean hydrogen produced from natural gas with CCS has been studied in detail by the *Leeds City Gate H21 Project*.[1] The project concluded that:

- the gas network has the correct capacity for such a conversion
- the existing gas network can be converted incrementally with minimal disruption to customers
- minimal new energy infrastructure will be required compared to alternatives
- the existing heat demand for Leeds can be met via steam methane reforming …

[1] https://www.northerngasnetworks.co.uk/wp-content/uploads/2017/04/H21-Report-Interactive-PDF-July-2016.compressed.pdf

Victoria is extremely fortunate to have enormous brown coal reserves located adjacent to one of the world's largest carbon dioxide storage reservoirs in the Gippsland Basin. This unique juxtaposition of world class natural resources enables the creation of a new low emissions energy and industry hub in the Latrobe Valley. This hub would epitomize the necessary transition from old high-emissions industry to the new low-emissions economy of the future, enabling the continued monetization of Victoria's enormous brown coal reserves, for the benefit of all Victorians, without the carbon dioxide emissions, preserving and creating high-value employment opportunities in the Latrobe Valley, and generating export revenue for Australia. In addition to enabling the production of clean hydrogen and clean electricity, this hub could store carbon dioxide produced from other nearby industries such as natural gas processing at the Longford gas plant which currently emits approximately 1 million tonnes of carbon dioxide per year.

The Victorian government has already established its credentials as a leader in the commercialisation of carbon capture and storage through the CarbonNet project which is expected to complete the characterization of a commercial scale carbon dioxide storage reservoir in the Gippsland Basin by 2020. The next step is the utilisation of this storage resource to deliver material carbon dioxide emission reductions.

CCS is the only clean technology capable of decarbonising major industrial sectors.

One of the greatest challenges facing the global effort to achieve Paris climate change targets is the decarbonisation of large-scale, emission intense industry which contribute 21% of global CO_2 emissions.

International climate change experts including the IPCC and IEA confirm that CCS is the only mitigation technology capable of reducing large-scale emissions from major industrial sectors such as steel, cement, fertiliser, refining, pulp and paper and petrochemicals.

Successful examples of CCS technology being utilised to reduce industrial emissions can be found in multiple locations around the world such as the Al Reyadah CCUS facility in UAE (the world's first CCUS installation in the steel industry) and the Al Uthmaniyah CCS facility in Saudi Arabia. The Gorgon project in Western Australia will become the world's largest dedicated carbon dioxide storage project when injection commences in the next year or so. It will store 3-4 million tonnes of carbon dioxide each year.

If Australia is to meet its commitments under the Paris agreement, the task decarbonising major, unabated industry cannot be ignored. Through stimulating investment in the development and deployment of CCS technologies, we will in turn keep communities alive and create new sustainable economies.

CCS can play a significant and complementary role in a fully decarbonised Australian electricity market.

Australia continues to grapple with its energy mix, and what, exactly, is right for its complex and numerous requirements. However, some things are certain. The pressures on the electricity system are heavy. As we look to the future, it is clear we need a fully decarbonised electricity sector. It is also apparent that gas will continue to be a major energy provider and need to play a significant role in smoothing intermittency. Attaining a zero-carbon electricity system will place a greater burden on hydro and still developing battery technology.

The story that is rapidly emerging is one in which CCS acts as the catalyst for new energy economies including hydrogen, bioenergy and CO_2 re-use applications. Particularly, hydrogen sourced from CCS-fitted gas or coal technologies is more cost-effective than using renewables and hydrolysis. And by applying CCS to gas and coal, renewables can underpin other energy needs where it is best deployed.

Presently in Australia, too little attention is being paid to the prospect of CCS-equipped fossil fuel generators playing a role in a fully decarbonised electricity market. This contrasts to other countries such as Canada, the United States and the United Kingdom where large-scale CCS facilities in power generation are operational or have been actively pursued by governments.

Recent developments from across the globe indicate a positive policy shift towards incentivisation, development and deployment of CCS technologies. These include:

- In February, the United Kingdom established a carbon capture and utilisation (CCUS Council) to speed deployment of CCS technologies;

- The European Parliament has voted into law measures to reduce CO_2 emissions across Europe, including the establishment of a multi-billion-euro fund supporting CCS innovation and other low-carbon projects;

- Canada, and, more recently China, have placed a value on avoided carbon as they move towards a low emission future;

- The United States of America (US) recently introduced a tax credit for CO_2 storage, better known as the 45Q legislation.

The recent legislative amendment in the US is prodigious. It represents an historic move by an Administration proven to be reluctant in acknowledging climate change and addressing CO_2 emissions. The tax credit has been lauded as providing the impetus for essential investment in the research, development and deployment of CCS.

Allowing for investment in CCS technologies under the Bill is in-step with international best practice and will enable Australia to establish our position at the forefront of the global fight against climate change.

Concluding comments

We are fervent in our resolve that there is no single silver bullet in the fight to reduce greenhouse gas emissions, and meet Paris climate change targets. We need everything and CCS is a pivotal part of that ‘everything’.

Carbon capture and storage is a proven and essential climate mitigation technology with the potential to materially reduce Victoria’s CO_2 emissions whilst maintaining and growing its industrial base. All of the ingredients needed to transition from the high emissions industry of the past to the new low emissions industry of the future exist in the Latrobe Valley and the Gippsland Basin. This opportunity for Victoria is enabled by the juxtaposition of its world-class endowment of brown coal, gas processing and other industries, and massive accessible CO_2 storage reservoirs. The CarbonNet project will deliver the first storage reservoir in the Gippsland Basin available for commercial utilization within the next couple of years.

Given the right policy environment, CCS could be deployed at industrial scale in Victoria within a decade, delivering multi-million tonne per annum emission reductions. The Institute recommends that the Independent Expert Panel consider;

- the potential material emissions reductions that CCS can deliver in Victoria within a decade, and;
- the economic benefit to all Victorians of growing a new low emissions industrial base in the Latrobe Valley and Gippsland utilizing CCS

when forming its advice on interim targets for reducing greenhouse gas emissions.

Any questions on this submission should be directed in the first instance to:
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