

IS IT TIME FOR AN AUSTRALIAN CARBON CAPTURE & UTILISATION POLICY?

EXECUTIVE SUMMARY

In September 2020 the [Australian Government along with governments of other G20 countries endorsed the G20 Circular Carbon Economy](#) (CCE) approach to energy. A key part of that approach is converting GHG emissions into value added materials through Carbon Capture and Utilisation (CCU) technology. Most of the elements of a competitive Australian CCU policy are now in place. If the Australian Government wishes to adopt formally a CCU policy it could do so by bringing together recent and existing initiatives with no additional cost.

CCU in Australia is defined by [CO₂ Value Australia](#) (CVA) as the transformation of captured CO₂ into valuable products. These are typically building materials, synthetic fuels and chemical building blocks.

Australian CCU technologies are now coming out of the laboratory into demonstration and have the potential to be commercially viable without a carbon tax. Major Australian companies are now engaging with Australian technology developers to bring CCU technologies to market so creating value out of CO₂ while reducing national GHG emissions.

International studies estimate that the CCU industry will be worth [almost US\\$6 Trillion pa](#) and could lock away about [10% of current annual global GHG emissions per year by 2030](#).

Australia has two large comparative advantages in CCU development: 1) the existing resources industries and related technologies and human capacity and 2) potential renewable energy capacity. Practical, Australian-developed low emissions technology could combine these advantages to create greater sustainable resources processing and advanced manufacturing in Australia instead of exporting so much unprocessed raw materials. CCU technology should be a key part of that transformation in industrial capabilities.

CCU technology aligns with the Australian Government policy of reducing emissions through technology. It also aligns with the need to create new jobs in regional areas, particularly jobs to assist transition away from traditional resource extraction. It further aligns with the Government's intention to develop low emissions technology exports. This paper suggests why and how the Australian Government should consider adopting a CCU policy.

CO₂ Value Australia (CVA) represents CO₂ utilisation stakeholders in Australia which work together to promote the development and deployment of sustainable industrial processes that transform CO₂ into valuable products - see www.co2value.org.au

IS IT TIME FOR AN AUSTRALIAN CARBON CAPTURE & UTILISATION POLICY?

The Australian Government has most of the elements of a credible Carbon Capture and Utilisation (CCU) policy, strategy or plan already in place following recent announcements on energy, low emissions and modernising manufacturing. If it wishes to announce a CCU policy, strategy or plan it could bring together already existing initiatives without additional cost using programs now in place or in the process of being implemented.

Given that the emerging international acceptance of the Circular Carbon Economy (CCE) is likely to accelerate with a Biden Presidency in the USA it may now be time for the Government to adopt a CCU policy which combines low emissions action with new industry development and to communicate that policy to stakeholders in Australia and internationally.

This paper proposes what CO₂ Value Australia (CVA) considers should be included in an Australian CCU industry policy along with suggested next steps. But first it provides the context for what is happening in CCU in Australia and internationally.

CCU INDUSTRY POLICY CONTEXT

This context includes a brief definition of CCU, an update on the status of CCU development in Australia, Australia's real comparative advantages in CCU industry and recent relevant international developments.

Definition of CCU

CCU in Australia is defined by CVA as *the transformation into valuable products of CO₂ captured from emissions sources or from the atmosphere*. These products typically are building materials, synthetic fuels and chemical feedstocks. CCU technologies can also transform CO₂ into stable bulk materials for land reclamation or mining rehabilitation.

CVA's definition of CCU does not include Enhanced Oil Recovery (EOR) in which captured CO₂ is pumped deep underground to recover hydrocarbons and then stored geologically. CVA considers EOR is more appropriately regarded as part of Carbon Capture and Storage (CCS).

International studies of the emerging CCU industry estimate that it is worth some [US\\$5.9 Trillion pa](#). CCU activities are estimated to be able to lock away about [10% of current annual emissions by 2030](#).

CCU technology alone will not be sufficient to achieve global low emissions targets but CCU will be part of the growing portfolio of low emissions technologies and practices which together can help achieve the Paris Agreement goals.

Australian CCU Update

While CCU has been under active development in the USA and particularly the EU for the last decade, activities in Australia are only recently starting to emerge from R&D and planning into the demonstration of feasibility at scale and then commercialisation.

The following projects are thought by CVA to be the current leaders in Australian CCU technology development.

APA Group/Southern Green Gas

Australia's major gas pipeline operator APA Group and its technology development partner Southern Green Gas in May 2020 received ARENA funding to help demonstrate the technical and commercial benefits of an integrated hydrogen electrolysis and renewable methane production system. The project will produce cost and technical data to enable assessment of larger, commercial scale renewable methane production. It will extract water from the atmosphere for electrolysis powered by solar energy with the hydrogen produced combined with CO₂ from the atmosphere to produce renewable methane which can then be fed into the East Coast gas grid. There will be a demonstration plant at the Wallumbilla Gas Hub in Queensland operational by late 2021 see www.southernreengas.com.au.

Mineral Carbonation International

Mineral Carbonation International (MCI) started commercialisation of its carbon engineering technology in 2019 following seven years of research at its Newcastle, NSW reference pilot plant funded by the Australian and NSW Governments and industry partners including chemicals giant Orica. MCI technology transforms captured CO₂ emissions from most industrial sources into stable solids which become raw materials in the manufacture of a range of low carbon emissions building and construction products. MCI is currently negotiating with major corporate emitters to build a mobile industrial scale demonstration plant which can be deployed in different locations and applications – see www.mineralcarbonation.com.

Abel Energy

Abel Energy (AE) has partnered with German engineering group thyssenkrupp to convert low cost hydroelectricity to green hydrogen, e-methanol and dimethyl ether in Tasmania in the Bell Bay Powerfuels Project (BBPP). AE proposes to use thyssenkrupp alkaline water electrolyzers to produce green hydrogen and combine that with CO₂ from forest biomass to produce e-methanol for export. AE is finalizing feasibility work prior to building an initial production train for demonstration in 2021. AE's priority is renewable methanol, a liquid chemical and fuel for which it sees a large global seaborne market already – see www.abelenergy.com.au. AE's Bell Bay project was one of four projects supported in November 2020 by the Tasmanian Government's Renewable Hydrogen Action Plan.

Australia's CCU Advantage

Australia has two real comparative advantages which will shape a new CCU industry sector here. There is Australia's resources industry where we have world leading technology and services as well as the resources themselves. Add to that the potential for renewables in our large and sunburnt country and we have a powerful and potentially profitable combination.

As Professor Ross Garnaut said in *Superpower*, Australia will be able to use renewable energy to enable low carbon resource processing and advanced manufacturing at scale. The combination of resources and renewables with related expertise should see Australia turn much of what it now exports as raw materials into value added products. CCU could be an integral part of that.

Australia should also be able to develop a new export services industry around establishing and operating CCU or CCU-enabled industry just as we export mining and resources expertise now.

If Australian CCU technology can minimise emissions while adding value to resources in Australia it could do likewise for overseas buyers of Australian resources ie address Scope 3 emissions (embedded emissions). This possible potential to mitigate Scope 3 emissions could soon become important as the US and EU and probably also Japan and South Korea proceed to form 'carbon customs unions' which impose 'carbon adjustment fees' or 'carbon border adjustment mechanisms' on emissions intensive exports.

International Developments

Australia participates in international arrangements such as Mission Innovation where CCU is starting to feature. Australia could become a leader in CCU in such fora in the fields of mineral carbonation and synthetic fuels.

The potential industrial scale use of captured CO₂ for industry development and emissions mitigation had for many years been dismissed as technically or economically not feasible. The conventional energy industry and government policy response has been to promote CCS as the only realistic means by which to lock away CO₂ emissions.

In the last decade public demand for action on climate change and the recognition of potential business opportunities by industry have seen emergence of CCU as a potential complementary technology to CCS. To illustrate in Europe there are now more than 50 CCU projects at demonstration stage and several already in commercial operation.

CVA is well-placed to assist with international co-operation on CCU matters in the US and EU through its MoU signed in December 2019 with the world leading authority [CO₂ Value Europe](#) (CVE), the first such MoU CVE signed with any country outside Europe.

The most recent international recognition of CCU has been by G20 Energy Ministers who in September 2020 endorsed the Circular Carbon Economy (CCE) approach. Energy Ministers are reported as saying ‘We acknowledge that the CCE approach is a holistic, integrated, inclusive and pragmatic approach to managing emissions’ that also aims to provide new pathways towards economic growth. Energy Ministers endorsed the CCE platform’s ‘4Rs’ framework (Reduce, Reuse, Recycle and Remove) in which CCU is part of Reuse – see <https://www.intellasia.net/g20-promotes-the-circular-carbon-economy-cce-826914>.

An Australian CCU Industry Policy

Industry policy is usually regarded as government interventions to promote or accelerate *Research & Development (R&D)* being the creation of new IP or processes often in research institutions; *Demonstration* being proving up at small industrial scale the commercial feasibility of these new technologies; and *Deployment* being their commercial implementation.

Recent Australian Government policy measures which apply to CCU together with pre-existing programs have created the elements of a competitive CCU industry policy. Energy initiatives announced by the Prime Minister and Minister for Energy and Low Emissions in September 2020 are particularly relevant to CCU. While we do not yet have details of all measures, if these are implemented in a technology neutral way, Australia will have a CCU industry policy framework which will also contribute significantly to climate response policies. CCU policy measures should generally be capable of delivery within current appropriations.

Research & Development

The reforms to the R&D Tax Incentive in the 2020/21 Budget mean CCU technology researchers and developers will continue to be supported at the pre-commercial stage. MCI is one such beneficiary of the R&D Tax Incentive and its carbon engineering technology is now moving out of the laboratory into commercialisation.

Monash University has lodged a bid to become an ARC Research Hub for Carbon Reuse and Transforming Emissions in which CVA is a partner. If successful the Monash Hub will focus on CCU scientific research and CVA on policy and regulatory research.

The present enabling legislation for the Australian Renewable Energy Agency (ARENA) could arguably allow that agency to support CCU R&D where it is related to renewable energy but that legislation is not as clear as it could be in respect of CCU.

Demonstration

While Australia’s industry policy framework has effective measures in R&D and Deployment there is a gap in Demonstration. Demonstration measures showcase the commercial feasibility of promising ideas which R&D has turned into technologies or processes not yet deployed.

Typically Australian investors and institutions have been reluctant to finance such demonstration activities preferring to wait until first-mover risks are funded by someone else - this is one of the causes of the notorious 'valley of death' for innovation in this country.

Depending on how they are implemented, measures announced by the Prime Minister and Minister for Energy and Low Emissions in September 2020 in the *Investment in new energy technologies statement* could help bridge that Demonstration gap. These include the new \$95.4 Million Technology Co-Investment Fund recommended by the King Review and the \$50 Million Carbon Capture Use and Storage Development Fund. Implementation details are not yet released but the language of their announcement suggests these initiatives could demonstrate promising pre-commercial technologies at least in respect of those which are energy related. Strangely, by the time the CCUS demonstration fund was included in the *First Technology Roadmap Statement 2020* released later in September 2020 the CCUS demonstration fund had shrunk down to only a CCS demonstration fund.

Deployment

Deployment or the commercial rollout of CCU technology developments which survive the Demonstration 'valley of death' can already be supported by Clean Energy Finance Corporation (CEFC). Supporting deployment of CCU technologies involving clean energy is acknowledged by CEFC as within the scope of its current enabling legislation.

As with the energy initiatives of September 2020, the *Modern Manufacturing Strategy* announced by the Prime Minister and Industry Minister in October could support CCU applications. Again, while implementation details are not yet released, CCU technologies could fit well within the \$1.3 Billion Modern Manufacturing Initiative's (MMI) Resources technology and critical minerals processing priority stream. The MMI will focus on scaling up emerging industries and for CCU these will most often be located in regions close to and employing infrastructure and skills presently engaged in resources industries.

Next Steps

If the *R&D*, *Demonstration* and *Deployment* measures detailed above are implemented appropriately Australia could have a CCU industry policy which is balanced and competitive internationally, albeit on a more modest scale than in the EU and US.

CVA suggests the following additional CCU initiatives also be considered.

CSIRO

CSIRO is talking with industry about conducting a six month study to produce a *Commoditisation of CO₂ Roadmap* to follow its *National Hydrogen Roadmap*. On completion

this would be the first independent study of CCU potential for industry development, exports and regional employment in Australia.

CVA hopes such a CSIRO initiative will provide an independent and rigorous basis for consideration of possible elevation of CCU from Emerging to Priority technology status in the *Second Technology Roadmap Statement*.

Emissions Reduction Fund

The Australian Government has approved development of method/s for CCS/CCUS for the Emissions Reduction Fund (ERF) as recommended by the King Review. Implementation of the King Review decisions has since passed from DISER to the Clean Energy Regulator (CER). CER has started work on a CCS method and one for Soil Carbon.

Again strangely it appears the Utilisation component from CCUS was lost with the transfer of responsibility from DISER to CER. CVA is working with CER on the CCS method while CVA and CER seek to clarify that the Government's approval of CCUS included an ERF method for CCU.

The Australian Government should now confirm its King Review decision included Utilisation as part of CCUS and commit publicly to a timetable for work on a CCU method to assist planning for CCU projects which are starting commercialisation. This would also facilitate the flow on of method development work from the CCS method to CCU.

Policy Neutrality

Australian Government low emissions policy has in recent years been focused in particular on fossil fuel energy. Consequently policy and program responsibilities have generally resided in departments responsible for energy and government action has naturally had an energy emphasis.

While energy is critical to the Australian economy and power generation might be the largest single source of GHG emissions there are other industry sources which collectively contribute more emissions including agriculture, manufacturing, mining and transport. These should all be included in a technology neutral approach to low emissions policy and programs.

Further, CVA suggests the Australian Government should adopt separately the terms CCU and CCS instead of CCUS. While this might seem like semantics it reflects the reality that CCUS is the term used to describe a specific technology used in the oil and gas industry while Australian Government policy seeks to be technology neutral. Government policy intended for the whole economy should not adopt the terminology of just one sector, important though that sector is.

Recognition by the Australian Government that CCU and CCS are complementary but different technologies would also avoid the confusion in terminology evident in respect to the ERF detailed above.

Demonstration Gap

CVA suggests the Australian Government consider how all or some of the recently announced Technology Co-Investment Fund, the Carbon Capture Use and Storage Development Fund and the Modern Manufacturing Initiative could address the remaining gap in industry programs, namely Demonstration of commercial feasibility of technologies including CCU.

Given the rapidly growing market demand for green technology solutions once a low emissions technology is de-risked or risk-reduced it will likely be adopted by industry readily, particularly when supported by an expanded ERF. The current pressing need is to accelerate demonstration of commercial feasibility so markets can then take over commercial implementation of the successful technologies.

Regional Leadership

Australia has an opportunity in our own region to lead cooperation on CCU with the Government having recently agreed memoranda of cooperation with Singapore on CCUS and Japan on Carbon Recycling. As yet we are not aware of much work being done on carbon recycling. Similarly potential CCU products such as seawalls or land reclamation bulk materials could become important elements in climate change initiatives with South Pacific nations.

John Beever

Chair, CVA

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