CO2CRC BUILDING A LOW EMISSIONS FUTURE

**CO2CRC is Australia's leading carbon capture, utilisation and storage (CCS) research organisation**

# CO2CRC INSIGHTS | AUGUST 2019



## WELCOME: A Note from the Chief Executive

Forty years ago, oil, gas and coal supplied 80 per cent of the world's energy.

Forty years later, hydrocarbons still supply 80 per cent of the world's energy.

Despite wishful thinking by some, the global energy mix is unlikely to shift easily or quickly from the hydrocarbon energy sources that dominate, given their huge scale, performance and cost advantages.

But there is a path forward to meeting global climate goals while playing to our national economic strengths. While few Australians would nominate carbon capture and storage as a crucial part of shaping our future, it's time we woke up to the strengths of this proven and reliable technology.

Carbon capture and storage (CCS) prevents carbon dioxide from use of hydrocarbons being released into the atmosphere. $CO_2$ produced by large industrial plants is captured, compressed for transport and then injected deep into a rock formation at a carefully selected site, where it is permanently stored.

It is clear that public awareness and understanding of CCS is low, at a time when there is a strong community acceptance of wind power, solar power and battery storage as a quick fix for what increasingly is being characterised by some as a climate emergency.

But replacing fossil fuels with renewables for energy can only ever be part of the solution.

There is no 'magic bullet' to reducing emissions.

CCS has enormous potential in other parts of the economy – manufacturing and industry – not just energy.

This monthly bulletin is designed to help business, policymakers and the general public understand that the development of CCS can mean lower-cost emissions reductions across all sectors and a stronger domestic economy.

Thank you,

**David Byers**

**Chief Executive of Australia's leading CCS researcher CO2CRC**

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## POLICY: Santos Calls for Changes to Support CCS

Santos, one of the country's largest LNG producers and exporters, has called for greater incentives to CCS in Australia.

Santos chief executive Kevin Gallagher has asked for CCS to be recognised by and receive credit from Federal Government's Emissions Reduction Fund.

"Proving up and deploying [CCS] is vital to achieving the world's long-term aspirations for zero emissions and I want Santos to be a leader in this endeavour.

"At the moment the technology does not qualify for generating Australian Carbon Credit Units and this is something that needs to change."

Australian Carbon Credit Units (ACCUs) are issued by the Clean Energy Regulator. They are issued when emissions of carbon are avoided or sequestered. They are currently available for approved projects, which includes energy efficiency, waste management, revegetation, livestock management and savanna fire management.

Santos is currently investing heavily in CCS. Gallagher stated that "$10 million is being invested to test the potential for carbon capture, utilisation and storage in the Cooper Basin and use carbon dioxide reinjection to enhance oil recovery."

The Cooper Basin project is currently assessing two wells that have been drilled for CCS from the group's Moomba project.

Gallagher also called for greater tax incentives for the Australian industry, following the lead of US regulators.

Last year, the US Federal Government issued a new tax credit for CCS technologies for $CO_2$ stored underground. The credit effectively operates in the same manner as credits for renewable energy providers, such as wind farms, where operators are credited for avoided emissions. The credit commenced at USD10/tonne last year, and will ramp up to $35/tonne towards 2024.

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## COOPERATION: BHP and Mitsubishi Sign Agreement On CCS

BHP and Mitsubishi Development have signed a memorandum of understanding (MOU) to collaborate on emissions reduction projects in the future.

CCUS will likely form a major part of the strategy; both companies are seeking to reduce emissions from their coking coal operations and the steel industry more broadly.

BHP and Mitsubishi have joint venture operations in Australia, such as the Blackwater mine in Queensland's Bowen Basin, with coking coal going to steelmaking operations in Japan.

In the region, BHP is working with Peking University to identify barriers to CCUS for the steel industry.

Japanese policymakers have been assisting the Japanese steelmaking and other industries on CCS for more than a decade. The Ministry of Environment, Trade and Industry has been providing subsidies and commissions for industry demonstration projects, with a particular focus on the steel industry.

Around 40 per cent of Japan's industrial emissions come from steelmaking, even though Japan is the world's most efficient steelmakers.

The industry has taken it upon itself to seek ways of cutting their emissions via efficiency and CCS, as it is simply not a matter of replacing the industry's energy supply.

The Japan Iron and Steel Foundation has set itself a target of reducing its $CO_2$ emissions by 5 million tons by 2020 against its 2005 baseline.

Reducing emissions from steelmaking has become a critical target for operators in industrialised countries that have made emissions reduction commitments. ArcelorMittal, the world's largest steelmaker, is advocating for greater investment and support from governments for CCS in the European Union.

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## TECHNOLOGY: Joint Australia-Canada Enzyme Project Shows Promise

Australia's Coal21 Fund and Canada's $CO_2$ Solutions have demonstrated progress on capturing $CO_2$ after combustion.

The $CO_2$ Solutions process relies on enzymatic technology. In this process, effluents from an industrial process (e.g. energy production) are bubbled through a cylinder that contains enzyme-storing material and a water solution. The cylinder can be fitted to a smokestack or similar.

The carbon dioxide is separated from the effluent and into the solution as bicarbonate. The solution is then extracted, and can be converted into pure $CO_2$ for storage, or can be turned into limestone in combination with calcium.

$CO_2$ Solutions have developed their own proprietary enzyme based on the naturally occurring carbonic anhydrase enzyme. This has dramatically boosted the performance of the carbon capture process – and reduced the costs involved.

Peer-reviewed research on the process was first published in 2017. The new update published last month shows the validity of the work, its lower energy requirements, and also that it will be well suited to steel and cement production. Cement is the largest source of global $CO_2$ emissions, which takes place when limestone is converted into lime.

The research estimates the cost of removing and capturing the $CO_2$ at around USD28/tonne, including total capital requirements and operational requirements. This is at the lower end of general CCS cost estimates.

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## INTERNATIONAL: G20 Boosts CCS, UK puts £196 million into investment

G20 Energy Ministers have officially recognised the significance of CCS in their annual communique , which was released at the G20 Summit in Japan at the end of June. The communique states that G20 ministers “recognize the potential of developing and deploying Carbon Capture, Utilization and Storage (CCUS) technologies, including through international cooperation and multilateral innovation initiatives”.

Japan CCS, an industry body in Japan that leads CCS research, also held a side-event at the G20 meeting.

Although this has been heralded as the first recognition within the G20, the body has supported CCS for some time. In 2017, with Germany as chair, there was a clear encouragement for the uptake of CCS, with a specific push for research and development efforts. They stated that they “encourage countries that opt to use carbon capture, use and storage (CCUS) to continue to undertake RD&D and to collaborate on large-scale demonstration projects.”

Last month the UK Government has awarded UKP26 million to nine CCS projects across the UK that will capture more than 40,000 tonnes of $CO_2$. The grants are part of the UK’s CCUS Action Plan . The centrepiece of the announcement is UKP17 million grant to Tata Chemicals’ Carbon Capture and Utilisation Demonstration project at its soda ash and sodium bicarbonate facility.

UK politicians have called for ‘greater ambition’ in CCS projects in the UK. The CCUS Action Plan called for at least three large-scale projects to be up and running by 2025.

In addition to the latest round of CCS funding, the UK Government has also set aside UKP170 million for carbon capture projects as part of the Action Plan and its broader Clean Growth Strategy .

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## IN BRIEF: Mackenzie says CCS "the only short- to medium-term solution" for industry

BHP, the world's largest diversified miner, has announced that it will set aside $400 million for carbon reduction projects, which will include carbon capture projects.

The commitment was made at a speech in London on July 23 by CEO Andrew Mackenzie. Mackenzie described CCS as "the only short- to medium-term solution that can materially reduce these emissions [from industrial processes]".

Mackenzie's speech was notable in that he supports a flexible approach to emissions reductions, regardless of where those reductions come from. He stated: that "Renewables, nuclear, hydrogen, long-term storage of electricity, coal and gas with carbon capture and storage (CCS), negative emissions technologies like re-forestation and biomass with CCS, and other approaches will all contribute to lower carbon outcomes."

BHP has already undertaken a number of investments in CCS, including partnerships with Peking University, Stanford University, Cambridge University, University of Melbourne, and Canada's SaskPower.

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## CCS BASICS: Capture

Carbon dioxide ($CO_2$) is emitted as part of the exhaust gases that go up the smokestacks of power plants and factories during many industrial processes. The largest of these include cement manufacturing, steel manufacturing and energy generation.

The idea behind 'capture' is to capture the $CO_2$ before it is released to the atmosphere as a greenhouse gas.

This can be done by separating the 'CO2 stream' from other parts of the flue (waste) gas. This is generally done by passing the gas through

- A liquid solution that absorbs $CO_2$
- A membrane that filters out the $CO_2$
- A solid sorbent bed that adsorbs the $CO_2$
- A cooled environment that turns gaseous $CO_2$ into a liquid.

The capture technologies can be fitted to greenfield industrial projects, or retrofitted to existing facilities.

Once the $CO_2$ is captured, it can then be compressed, transported and injected underground for permanent storage or the $CO_2$ can be used as a feedstock in other processes such as mineral carbonation, carbonation of beverages and the manufacture of plastics.

While the logistical and technological challenges can be dealt with, there are cost challenges. All of these processes require additional energy inputs, for example. Lowering these costs – and therefore the costs of abatement of $CO_2$ – is one of the key challenges facing the industry.

A number of industry commentators dismiss CCS seeing it as a vehicle for the fossil fuel industry to continue with 'business as usual'.

This is far from true. If the primary goal is to reduce greenhouse emissions, CCS must be a vital part of any viable climate mitigation policy. But it is also true that cement manufacturing, steelmaking, and many other processes are high $CO_2$ emitters from their chemical processes rather than their energy requirements. These processes cannot simply switch to different energy sources.