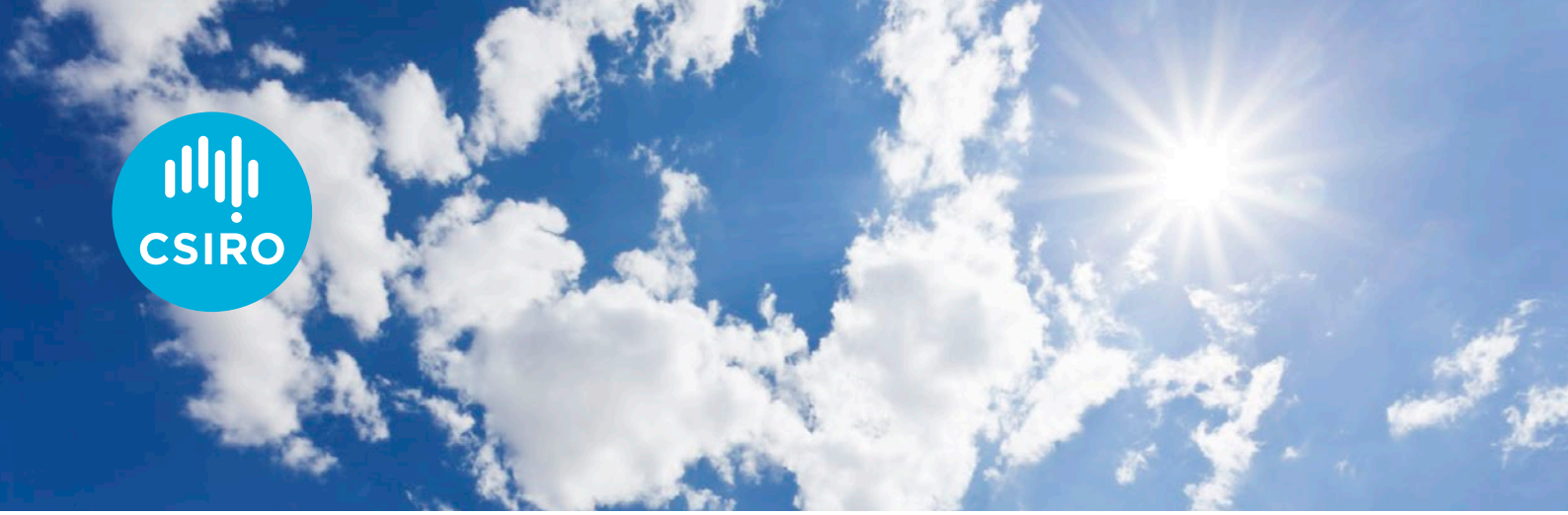

Addressing the energy transition challenge: Carbon capture use and storage

CSIRO actively researches the challenges associated with the transition of energy, industrial, manufacturing, agricultural and transport sectors to meet Australia's net zero emissions ambitions.

As Australia's national science agency, CSIRO is well positioned to support governments, industries and communities through the energy transition.

Science and innovation will be critical in supporting Australia's transition, which is being driven by new technologies, changing consumer preferences, and efforts to reduce greenhouse gas emissions.

As we move towards a net-zero emissions future the four key components of the energy sector – electricity, industry, transport and exports – are evolving rapidly. In this dynamic landscape, CSIRO provides reliable, actionable, evidence-based research.

Here we look at the role of carbon capture use and storage (CCUS).

What is CCUS and why do we need it?

The Australian Government has identified CCUS as a priority low-emissions technology that will play an important role in Australia's transition to a low emissions future.

CCUS is the process of directly capturing and then storing the CO_2 emissions that are a by-product of industrial processes and electricity generation. The aim is to reduce the amount of CO_2 reaching the atmosphere.

The captured CO_2 is compressed, transported to a well and injected into a deep underground reservoir. This is a porous rock such as sandstone, which is capped with an impermeable layer of rock that stops the gas from moving upwards. The CO_2 can then be stored for many thousands of years.

Many CCUS technologies are well developed, and have been used for decades by the petroleum industry. Experience with geological storage projects across the world has shown that CO_2 can be stored securely, with very low risk of leakage at progressively lower costs.

There is currently no single technology available that will reduce greenhouse gas emissions to the levels needed to meet emissions reduction commitments. But used as part of a suite of low-emissions tools, along with renewables, nuclear, fuel switching and electrification, CCUS can play an important role in a broad range of industries, including those that are difficult to decarbonise with renewable technologies alone.

There is also great potential for Australia to capitalise on the opportunities presented by emerging CCUS technologies. In this approach, rather than simply storing the captured CO_2 in an underground reservoir, it is converted into useful new products ranging from synthetic fuels, food and beverages, chemicals, carbon fibre and building materials.

What are the challenges?

In its first Low Emissions Technology Statement (2020), the Australian Government set a stretch target of under $20 per tonne for CO_2 compression, hub transport (in the vicinity of 100 km) and storage.

This would position CCUS to be competitive over the long term with other forms of abatement supported by the Emissions Reduction Fund.

Australia has a comparative advantage in CO_2 transport and storage, with a number of sources of CO_2 located close to suitable geological storage basins and with established pipeline easements between the two.

However, in order for CCUS to become more widely adopted, and a viable tool for large-scale decarbonisation, there is work to be done reducing costs and improving the efficiency of the technologies. Collaboration and partnerships between governments, industry and researchers continues to be essential.

Community engagement will also play an important role in improving understanding of CCUS technologies, addressing concerns around safety, and securing social licence for CCUS projects across Australia.

What is CSIRO doing to help make CCUS viable

CSIRO has over two decades of experience in CCUS research. We are currently undertaking a number of projects focused on reducing the cost and improving the efficiency of CCUS so it is a cost-effective and scalable option for Australia's energy future.

Our research is focused on deploying large-scale demonstration projects that enable substantial reductions in emissions and provide a pathway for industry to adopt the technologies at full scale.

We have broad capabilities in the science that underpins CCUS technology and a strong track record of working with government, industry and research organisations on demonstration projects.

CSIRO is also undertaking research into direct air capture to remove carbon dioxide from the atmosphere through chemical processes that capture carbon dioxide directly from the air. For example we developed Airthena™ that captures CO_2 from ambient air and recycles it for use onsite, on-the-spot, enabling companies to generate their own supply and alleviate transportation or steam costs.

We are involved in the development, commissioning and operation of Post Combustion Capture pilot plants in Australia and overseas. This program is supported by extensive laboratory research aimed at developing more cost-effective capture technologies that are applicable in Australia.

We have also developed a CO_2 Utilisation Roadmap to explore the opportunities presented by emerging CCUS technologies for Australia to support new industries and reduce carbon emissions.

The Roadmap identifies four opportunity areas for Australia to pursue:

- direct use of CO_2 in the food, beverage and agricultural industries
- mineral carbonation i.e., converting CO_2 into solid, carbonate-based products such as building materials
- conversion of CO_2 to create chemicals and fuels for use in industries like aviation and plastics
- biological conversion – using CO_2 to produce a range of niche, high value products in the food, pharmaceutical and agricultural sectors.

We believe that through a combination of robust science, broad collaboration and strategic investment, Australia can build on past successes and comparative advantages to position itself as a world leader in CCU.

Further reading

CO_2 Utilisation Roadmap
https://www.csiro.au/en/work-with-us/services/consultancy-strategic-advice-services/csiro-futures/futures-reports/co2-utilisation-roadmap

Understanding carbon dioxide behaviour in situ
https://www.csiro.au/en/research/environmental-impacts/emissions/Storage/In-situ-lab

The CSIRO In-situ laboratory
https://research.csiro.au/in-situ/

Global CCS Institute
https://www.globalccsinstitute.com/resources/

Scottish Carbon Capture and Storage research group
https://sccs.org.uk

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OCTOBER 2021 B&M | 21-00402