



CRC FOR GREENHOUSE GAS TECHNOLOGIES

RESEARCHING AND DEMONSTRATING CARBON CAPTURE AND STORAGE





REDUCING CO₂ EMISSIONS TO THE ATMOSPHERE

ABOUT CO2CRC

The Cooperative Research Centre for Greenhouse Gas Technologies (CO2CRC) is one of the world's leading collaborative research organisations focused on carbon capture and storage (CCS), a process for reducing emissions of the greenhouse gas carbon dioxide to the atmosphere.

CO2CRC is a joint venture of industry, government, universities and research bodies from Australia and overseas, who provide financial and in-kind support to the Centre.

CO2CRC:

- » researches and develops technologies for carbon dioxide capture and geological storage;
- » demonstrates practical applications of carbon dioxide capture and storage technologies;
- » contributes to the development and global uptake of carbon dioxide capture and storage technologies by participating in international programs, collaborating with leading researchers and research groups globally;
- » supports the uptake of carbon dioxide capture and storage through technology transfer and developing new commercial opportunities based on CO2CRC intellectual property;
- » communicates with the community on carbon capture and storage technologies and projects;
- » meets the needs of industry and government for highly skilled graduates and well-trained staff by providing quality education and training in CCS technologies.

WHAT IS CARBON CAPTURE AND STORAGE?

Carbon dioxide (CO₂) is the most common greenhouse gas after water vapour. Burning fossil fuels, land clearing and other activities of modern industrial society have caused the concentration of carbon dioxide in the atmosphere to climb from about 280 parts per million to over 380 parts per million, causing warming and other climate changes.

Carbon capture and storage (CCS) involves capturing and purifying carbon dioxide that would otherwise be emitted to the atmosphere, compressing it, transporting it to a suitable site and injecting it into deep geological formations where it will be trapped for millions of years.

While the concept of geological storage of carbon dioxide as a means of reducing greenhouse gas emissions is relatively new, CCS utilises technologies that have been widely practised in the oil and gas industry for many years.



CO₂ SOURCE

CO₂ CAPTURE

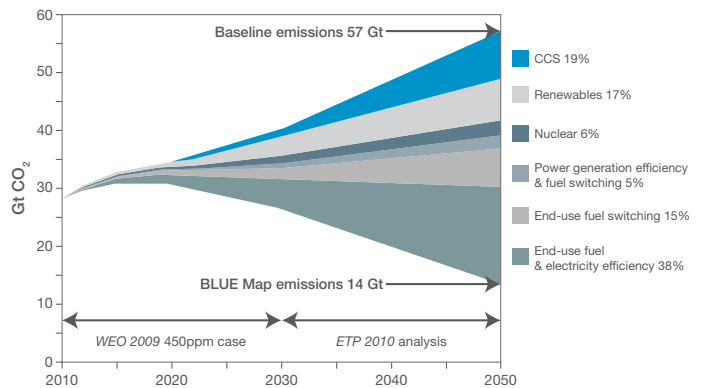
WHY DO WE NEED CARBON CAPTURE AND STORAGE?

Reducing greenhouse gas emissions to the atmosphere is a key environmental issue facing Australia and the world. Carbon dioxide, primarily from the combustion of fossil fuels for energy, is the most common greenhouse gas emitted by human activities and the one with the most significant impact on our climate.

Making reductions in greenhouse gas emissions to the atmosphere will require a range of responses: increased use of renewable energy, greater energy efficiency, fuel switching and biosequestration, as well as CCS.

Fossil fuels provide 80 per cent of all energy globally and more than a third of the total greenhouse gas emissions to the atmosphere. The International Energy Agency expects demand for energy to rise by more than 50 per cent by 2030, with almost three-quarters of the increased demand coming from developing countries such as China and India. Despite efforts to expand the use of renewable and other non-fossil fuels, the International Energy Agency expects the proportion of fossil fuels in the total energy mix to increase over this period.

Carbon capture and storage is the only technology currently available that can make deep cuts in greenhouse gas emissions to the atmosphere from the use of fossil fuels for industry and electricity generation.



CO2CRC RESEARCH

CO2CRC is focusing its efforts on the development and application of technologies to more efficiently capture carbon dioxide from large stationary sources and safely inject and store it geologically. Its work includes extensive research into technologies to:

- » cost-effectively capture carbon dioxide;
- » identifying and characterising geological formations with the potential to securely store carbon dioxide for millions of years;
- » demonstrating capture and storage technology, and;
- » addressing the non-technical barriers to deployment of CCS.

CAPTURE RESEARCH

The first step in CCS is separating the carbon dioxide from other gases at the emission source and, in the process, capturing it. Carbon dioxide capture can be applied to a variety of stationary sources of carbon dioxide, using a variety of capture technologies.

Capture of carbon dioxide is usually the most expensive part of a CCS system. CO2CRC is researching, developing and demonstrating capture technologies with the aim of reducing the costs of capturing carbon dioxide by up to 80 per cent.

CO2CRC has a research portfolio including solvent, membrane, adsorbent and cryogenic/hydrate separation technologies. CO2CRC is working in existing and new applications of capture – post-combustion, pre-combustion, oxyfuels, natural gas separation and other industries. By developing new systems and improving existing systems, CO2CRC research is producing significant cost reductions.

Carbon dioxide capture requires large amounts of heat and energy. Work by CO2CRC is developing power station/capture integration and engineering options to substantially reduce heat and energy costs.

CO2CRC is also working with and advising industry and government in a range of carbon dioxide capture studies and pilot projects.



STORAGE RESEARCH

CO2CRC researchers are actively researching and demonstrating safe and efficient long-term storage of carbon dioxide. This involves testing and modelling mechanisms such as residual saturation, dissolution in formation waters and precipitation as minerals. The CO2CRC Otway Project is a 'laboratory' for studying these aspects of carbon dioxide storage.

CO2CRC researchers have identified regions and sites in Australia and New Zealand that could be suitable for the safe geological storage of carbon dioxide. Research also includes studies into the behaviour of carbon dioxide in the deep sub-surface, developing and testing sophisticated technologies to monitor and verify carbon dioxide storage, detailed risk assessment, and modelling the behaviour of carbon dioxide in the sub-surface over thousands of years.

CO2CRC has undertaken studies of the Browse Basin, North West Shelf and Perth Basin in Western Australia, and the Gippsland Basin, Victoria, and found that they are likely to be able to store large quantities of carbon dioxide. A Review of Geological Storage Opportunities for Carbon Capture and Storage in Victoria found that the offshore Gippsland Basin had the best overall potential for geological storage in Victoria, followed by the onshore Otway Basin, the offshore Otway Basin, and the onshore Gippsland Basin.

The Centre has undertaken studies of the Aramac Trough in the Galilee Basin of western Queensland, the Bowen and Surat Basin regions of central Queensland, produced a review of potential storage throughout New Zealand and published The CCS Atlas of New South Wales Australia. It is also part of a consortium that has helped to determine Ireland's potential for geological storage of carbon dioxide and has assessed the storage integrity of potential sites.

CO2CRC contributed a report on the costs of carbon dioxide transport and injection to Australia's National Carbon Mapping and Infrastructure Plan.

DEMONSTRATING CCS

THE CO2CRC OTWAY PROJECT

CO2CRC is working with industry and government to demonstrate the safe injection and long-term geological storage of carbon dioxide in the Otway Basin at Nirranda in south-west Victoria – Australia's first carbon dioxide storage project.

The CO2CRC Otway Project provides technical information on geological storage processes, technologies and monitoring and verification regimes that will help inform public policy and industry decision-makers while also providing assurance to the community.

The project involves:

- » Operations - safe production, processing, transport and injection of a carbon dioxide-rich gas into deep geological formations;
- » Research - effective modelling of carbon dioxide behaviour in the sub-surface, demonstrating safe storage of the gas, verifying that the gas remains in the deep sub-surface, developing potential methodologies for assessment of CO₂ storage sites;
- » Regulation – testing the applicability of the existing regulatory environment in relation to transport, injection and geological storage of carbon dioxide and providing data and advice, as needed, toward development of Australia's regulatory regime; and
- » Community consultation – effective consultation with the community and other stakeholders to inform them of the nature, progress and outcomes of the project and build understanding and acceptance of carbon dioxide capture and geological storage.

The project brings together a large number of Australian, New Zealand and international researchers. It includes the most comprehensive monitoring and verification program undertaken in the world, and is the first to use a number of new sampling and monitoring techniques for the atmosphere, the surface, and sub-surface. Monitoring and verification will continue for several years.

CO2CRC CAPTURE DEMONSTRATIONS

CO2CRC has developed world-class capture demonstration projects. They are unique capture research facilities investigating a range of technologies at a range of scales, and provide an opportunity for real-world application of capture, economic, engineering and process integration research.

CO2CRC capture research facility at International Power GDF Suez Hazelwood Power Station in Victoria, is evaluating the performance of solvent, membrane and adsorbent technologies with Australian brown coal flue gases, and assessing them for larger scale capture.

In a three year \$4.2 million project, CO2CRC is using a dedicated capture plant at International Power GDF Suez Hazelwood Power Station to develop an innovative system for capturing carbon dioxide. The UNO Mk 3 system, developed by the CO2CRC solvent team at The University of Melbourne, uses potassium carbonate, an environmentally benign compound similar to baking soda, to capture CO₂ from large industrial sources for storage.

The research has been supported by the Victorian Government through their ETIS program, Brown Coal Innovation Australia (BCIA) and CO2CRC industry and government partners.



SUPPORTING CCS DEPLOYMENT

CO2CRC works in several cross-disciplinary projects that support the development of CCS.

- » Economics – monitoring the costs of building and running CCS systems in Australia, comparing these costs to other abatement technologies and developing cost modelling software
- » Risk assessment – developing CCS risk assessment methodologies and contributing to the regulatory process for Australian CCS projects
- » Providing technical advice to Australian governments on CCS issues
- » Developing education, training and skills for scientists, engineers, policy makers, insurers, financiers, lawyers and teachers.
- » Increasing awareness of CCS technologies by providing factual and unbiased information for the public and the media, and consulting with the local community on the CO2CRC Otway Project.

COMMERCIAL ACTIVITIES

CO2CRC Technologies Pty Ltd (CO2TECH) is the commercial arm of CO2CRC. CO2TECH commercialises carbon dioxide capture and storage technologies developed by CO2CRC, and provides consultancy services in the application of CCS technologies for government and industry in Australia and internationally.

COLLABORATION

A key feature of CO2CRC is its collaborative approach to research in Australia and overseas.

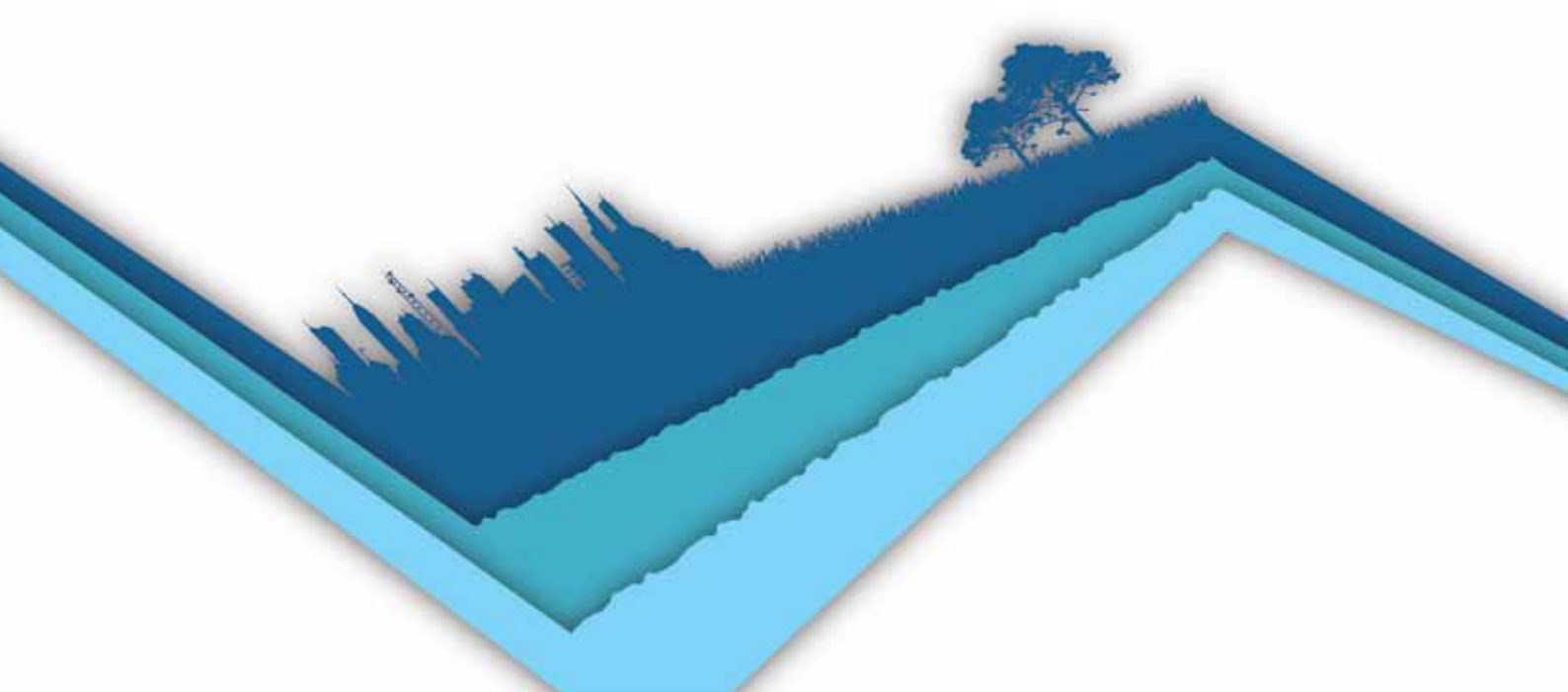
CO2CRC core expertise is drawn from participant research organisations and universities around Australia and the world, as well as through research links with the private sector.

The structure of CO2CRC facilitates collaboration between many of the world's leading carbon dioxide capture and storage researchers. Its work at the CO2CRC Otway Project enables close links with overseas researchers, in particular the Lawrence Berkeley National Laboratory in the US.

CO2CRC is actively involved in multinational research and policy organisations such as the International Energy Agency Greenhouse Gas R&D Programme, the Carbon Sequestration Leadership Forum, the International Panel on Climate Change, the Asia Pacific Partnership on Clean Climate and Development, the Australia-China Joint Coordination Group on Clean Coal Technology and the Global CCS Institute.

CO2CRC actively contributes to promoting CCS on the international stage by providing keynote presentations at many international conferences and specialist workshops, hosting many visitors and high level delegations from around the world and participating in a range of international research exchange programs.

Through these collaborations, and also through the global nature of many of our core participants, CO2CRC is widely connected and recognised internationally, and is able to learn from and contribute to the global CCS community.



CO2CRC PARTICIPANTS

RESEARCH PROVIDERS



CORE INDUSTRY AND GOVERNMENT PARTICIPANTS



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Established and supported under the
Australian Government's Cooperative
Research Centres Programme