

CO2CRC Membership Benefits

CO2CRC
Building a low emissions future



Optimising
storage

Reducing
capture costs

Enhancing CO₂
utilisation

Technical
leadership

Who we are

CO2CRC is an Australian company and a world leader in research on carbon capture, utilisation and storage (CCUS). We have been in operation since 2003. CO2CRC owns and operates the Otway International Test Centre site at Nirranda South in Western Victoria.

As an incorporated not-for-profit research organisation (company limited by member guarantees), we are an organisation funded through government grants, membership fees and direct investments from industry and research organisations. Our investors and members recognize the strategic importance of having a collaborative R&D centre such as CO2CRC systematically progressing the science and engineering of CCUS to ensure an efficient and safe deployment of the technology.

What we do

CCUS is recognised as a key, proven technology in reducing greenhouse gas emissions around the world. Through collaborations with respected industry, academic and government partners, we conceptualise, design and project manage research and development of carbon capture, storage, utilisation and monitoring technologies with a focus on risk and cost reduction. From bench-scale to field demonstrations, CO2CRC seeks to advance the implementation of CCUS.

CO2CRC works with global industry and research partners to shape, support and undertake research.

Industry members directly benefit from:

preferential access to our Otway International Test Centre

priority access to our research findings, including proprietary databases data sets, models and methodologies combined with 20 years of specific research experience

license to use and deploy CO2CRC IP

opportunity to enter into bi-lateral consultancy or project agreements specific to the needs of individual members

being able to influence the direction of future research and access the outcomes with representation on the Board appointed Program Advisory Committee

access to specialised, worldwide technical and research expertise through our links to the international CCUS research community

opportunity to leverage government grant funding

assistance in establishing best practices relating to CCUS activities

our community engagement expertise

helping you maintain your social licence to operate

supporting CO2CRC's technical leadership and collaborative public policy work

invitation to and participation at the CO2CRC bi-annual research and technology conference / workshop

Vision

The world's leading CO₂ storage technology centre, globally recognised for innovative carbon capture & utilisation solutions

Mission

Add value to customers by testing, developing and demonstrating CCUS research, products and services as viable options for a lower emissions future

Values

Excellence
Integrity
Delivery

The opportunities

Companies who already have a plan in place to respond to the challenge of substantially reducing CO₂ emissions will have a significant advantage.

CCUS is the only mitigation technology able to decarbonise the fossil fuel industry and large industrial sectors, particularly steel, cement, fertiliser and petrochemical industries.

Clean hydrogen production at scale requires the use of fossil fuels combined with CCUS. To achieve the ambition of Australia becoming a hydrogen exporter CCUS will be essential.

CO2CRC brings together industry, research and governments to develop practical solutions to ensure CCUS can play its vital role in reducing greenhouse gas emissions.

A global leader in CCUS research

For more than a decade, CO2CRC has led the Australian effort in progressing the carbon capture, storage and monitoring knowledge base through laboratory and field research. In the field of CO₂ storage and monitoring, we have invested in a range of experiments, from desk-top and laboratory studies to field scale technology developments to optimise storage operations and minimise risk. Our efforts within CO₂ capture have led to further development of advanced capture materials, now being proven in both laboratory and in-field settings. We are currently extending our efforts into the field of CO₂ utilisation by investigating the potential for CO₂-EOR in Australia, investigating the potential for CO₂ integration into bio- and thermo-chemical processes for wastes to chemicals and value-added products, and investigating Direct Air Capture (DAC) and hydrogen storage.

We have a demonstrated capacity to collaborate with local and international scientific and project management experts, ensuring we are outWome-driven, nimble and have low fixed costs. We use our internal skills to tap into Australian and global industry leaders, universities and government agencies to provide results which are relevant to our members.

This ensures our member companies will be sufficiently prepared with technology and knowledge for capture and storage projects anywhere in the world.

CO2CRC:

has a large, international team of researchers who undertake projects benefiting a range of sectors

demonstrates the feasibility and address the challenges of carbon capture and storage to scientists and industry from around the world

connects with upcoming capture and storage projects globally and provides expert advice

conducts research in accordance with our strategic direction and is responsive to member needs by undertaking research specific to individual members

has deep experience in conducting appraisal and assessment work having completed studies on various reservoirs around the world

has almost two decades of experience in operating a research facility with strong community and regulatory support

contributes substantially in helping to train and educate a future workforce of scientists and engineers for the CCUS industry over the long term

CO2CRC's four strategic focus areas



Optimising storage

At the Otway International Test Centre we have:

- › injected, stored and monitored more than 65,000 tonnes of CO₂ in a depleted gas reservoir
- › injected, stored and monitored more than 30,000 tonnes of CO₂ into a saline aquifer.

Through three distinct phases of storage research, CO2CRC has:

- › tested and demonstrated the characterisation, appraisal, approval, operation and monitoring process required for the transport, injection and storage of CO₂ into a depleted gas reservoir. The **Otway Stage 1 Project** was a pathfinder for CCUS in Australia, developing a range of techniques for monitoring storage and setting an international example of transparency and accountability
- › developed and demonstrated the current technical capabilities and limits of characterisation and monitoring for CO₂ storage within saline formation. The **Otway Stage 2 Project** was an end to end field scale saline formation investigation to understand the effectiveness of various seismic techniques for monitoring CO₂ and demonstrating plume migration and stabilization
- › demonstrating and validating the application of cost-effective technologies for targeted, on-demand, permanent subsurface monitoring and verification (M&V) of a CO₂ storage site. The **Otway Stage 3 Project** is developing a suite of technologies that reduces the necessity for repeat plume monitoring seismic surveys in onshore and offshore settings in a way that minimises the environmental footprint of monitoring operations.

CO2CRC's wider storage R&D program is focussed on:

- › developing methods in effective site appraisal
- › optimising storage injection and M&V operations
- › effective site closure for commercial projects.

We aim to achieve significant cost reductions and streamlined project operation solutions.

Reducing capture costs

- › CO2CRC has been developing innovative carbon capture systems since 2003. Research and development of membrane, adsorbent, potassium carbonate-based solvent (precipitating and non-precipitating), cryogenic and hybrid capture technology has been undertaken at a range of scales from laboratory to demonstration scale.
- › Extensive field trials of membrane, adsorbent, hybrid (membrane-contactor), potassium carbonate-based solvent technologies have been completed for both pre-combustion and post-combustion capture, using real flue gas and syngas from Australian coal fired power plants. Membrane and Adsorbent have also been tested using high pressure natural gas to potentially develop cost-effective, compact natural gas processing technologies. This has put Australia at the forefront of testing carbon capture technology.
- › These trials are an important step in screening and developing effective technologies for industrial use. They also generate a significant volume of fundamental new knowledge about emerging CO₂ capture technologies.
- › CO2CRC is a member of the International Test Center Network (ITCN), a global coalition of facilities working to accelerate research and development of carbon capture technologies.

Enhancing CO₂ utilisation

- › CO2CRC is currently working with partners to examine the feasibility and potential of using CO₂ in enhanced oil recovery in Australia. The other area includes utilisation of CO₂ to produce carbon negative products from wastes, in the Australian circular economy. A key focus includes a feasibility stage study exploring the potential of a refinery valorising organic waste (bioorganic and plastics) and CO₂ feed-streams to produce carbon negative products of a platform chemical, biofuel and a biodegradable plastic.
- › CO2CRC also provides technical support to research and develop products and services along various aspects of the utilisation chain.

Technical leadership

- › CO2CRC accesses many of the world's best CCUS researchers across the fields of capture, storage and monitoring. The strength of this partnership has resulted in more than a decade of successful research outcomes from desktop and laboratory scale trials to field scale demonstrations. This, together with CO2CRC's established relationships with industry, government and regulators provides us with a platform to serve as a trusted technical focal point and knowledge hub for the CCUS community in Australia and internationally. Our biannual R&D symposiums offer the CCUS community the opportunity to communicate new research and technologies to stakeholders.



Benefits of membership

Access to the Otway International Test Centre

As owner and operator of the Otway International Test Centre (OITC), we have so far invested over A\$100 million to demonstrate real-world injection, storage and monitoring techniques. The OITC is one of the largest CO₂ storage demonstration laboratories in the world and is unique in terms of its variety in reservoir types, structures and seals, has a ready supply of CO₂ from an in-situ natural gas field, all necessary regulatory approvals and the full support of local communities to undertake CCUS investigations.

The field has been extensively characterised and is complemented by a high quality, comprehensive dataset. The Site has multiple reservoir-seal pairs within the 1 – 2 km depth range and is ideal for appraising storage and monitoring performance. Our permanent seismic sources are already validated from past experiments. With the implementation of sub-surface monitoring technologies in the next research phase, we offer one of the world's most comprehensive monitoring and verification (M&V) system for benchmarking tools as well as testing CO₂ storage capacities, modelling of CO₂ trapping and other dynamic processes. CCUS experts from the International Energy Agency's Greenhouse Gas Research and Development Programme have reviewed the OITC monitoring program annually since November 2006 and found it to be one of the most comprehensive in the world.

The facility operates to petroleum industry standards and has outstanding regulatory compliance. Members have the opportunity to test their own technologies at this comprehensive research facility.

Influence our research

Members participate in the Board appointed Program Advisory Committee and help guide and develop the CO2CRC R&D program. Each CO2CRC research program has a number of industry champions who ensure it addresses industry needs.

Access to a global community

Through CO2CRC's network of world leading researchers, members have access to internationally renowned CCUS experts. CO2CRC's global reach allows members to gain insights on CCUS R & D at an international level.

Advice on community engagement and maintaining your social licence to operate

CO2CRC works very closely with landowners and the local community at the OITC. We have a dedicated Community Liaison Officer and conduct Community Reference Groups to engage in two-way conversations, ensuring we listen and address community needs and concerns. Maintaining our social licence to operate the Otway International Test Centre is something we take seriously. Members have taken lessons from CO2CRC's highly successful and comprehensive approach to community engagement and applied them to their own settings.

Through partnering with Australia's leading CCUS research organisation, members demonstrate that they are committed to tackling climate change through reducing their CO₂ emissions.



Support technical leadership in CCUS

CO2CRC operations and projects have been designed to demonstrate the safe capture, transport and storage of CO₂. This work satisfies best practice methods for operators and demonstrates to regulators, government and the community that CCUS is safe, reliable and becoming a cost-effective mitigation option.

CO2CRC's safe demonstration of the CCUS chain has provided benchmarks to government and regulators. We have been active in ensuring CCUS is seen as an option for industry to meet Australian government agendas for secure, reliable and clean energy for Australia.

CO2CRC takes a leading role in coordinating the Australian CCUS Policy Forum – a collaborative effort between industry members to provide inputs to the development of a methodology to qualify CCS for Australian Carbon Credit Units (ACCU's) under ERF Act.

Major reports include:

- › Over 2800 technical publications including;
- › Submissions to all of the major Australian government energy and environment reviews,
- › CO2CRC Stage 2C final report demonstrating the detection of CO₂ plume, decreasing the detection threshold limit to 5,000t and demonstrating the plume stabilisation.
- › Exploring technologies and pathways to emission reduction in steel industry.

Tax

Qualifying organisations may be eligible for taxation benefits from direct investment in CO2CRC R&D projects.



Case study of member benefits

1999 – 2009, Otway Stage 1: CO₂ injection into a depleted gas field

Member-derived benefits from project:

- › Important proof-of-concept test for geological CO₂ sequestration in Australia, setting a useful precedent for state and federal regulators and providing assurance of safety to the local community.
- › Reservoir simulation tools and techniques – reservoir engineers of a member organization were able to directly discuss modelling approaches with CO2CRC engineers and researchers, gaining confidence that modelling processes can accurately predict the behaviour of CO₂ in a sub-surface environment.

2009 – 2019, Otway Stage 2: De-risking CO₂ storage and monitoring in a saline formation

Member derived benefits from project:

- › Otway Stage 2B (measurement of residual CO₂ saturation using multiple methods).
- › Schlumberger's RST tool was run in CRC-1 and CRC-2 wells (baseline and repeat).
- › Experiment demonstrated that default tool parameters were not appropriate for CO₂ in brine systems and that parameters needed to optimise data gathering.
- › Experience was directly applied for baseline logs run in Member's reservoir surveillance wells.
- › Value of residual CO₂ saturation measured using multiple techniques, validating assumptions used in Member's modelling.

- › Initial well behaviour during very early CO₂ injection into 100 per cent brine-saturated reservoir, invoking relative permeability effects, was measured, validating expectations.
- › Water produced using N₂ gas lift. Same method applied in member CO₂ project to clean up wells prior to CO₂ injection.
- › Otway stage 2C (longer term monitoring of CO₂ plume movement and stabilisation).
- › Reservoir characterisation and modelling approach during project development – many parallels with member CO₂ subsurface workflows.
- › 4D seismic is key technology for project, same as for member projects.
- › Trialling other seismic monitoring alternatives which may be considered for future use in commercial projects to complement 4D seismic.

Storage R&D activities relevant to member's commercial projects:

- › Validation of assurance monitoring technologies and near surface migration controls in performance and detection thresholds.
- › CO₂ storage in depleted reservoirs addressing four main elements:
 - Flow assurance issues
 - Well integrity assessment and mitigation
 - Geo mechanics and seal integrity
 - Potential for enhanced gas recovery.
- › Methodologies to reduce the uncertainty in fault seal characterisation through core to log transforms.
- › Application of micro and passive seismic monitoring as a cost-effective monitoring option.
- › Development of geochemical barrier fluids for managing CO₂ migration in the subsurface.

Otway Stage 3: Next generation CCUS monitoring

The challenge

CO₂ storage projects require monitoring and verification (M&V) to understand behaviour of the CO₂ plume and provide assurance of storage complex integrity.

The solution

CO2CRC's Otway Stage 3 M&V Project will develop and commercialise next generation subsurface M&V technologies.

These technologies provide on-demand, permanent monitoring solutions, enabling continuous plume data acquisition, transmission and analysis. They are expected to drive down costs by up to 75% while also decreasing environmental footprint of traditional monitoring techniques.

The proposed M&V techniques will provide regulators and communities with ongoing confidence that CO₂ injected deep underground is permanently stored within the bounds of the storage formation in large scale CCUS projects.

Members will derive the following benefits from the project:

- › A suite of technologies that reduces the necessity for repeat plume monitoring seismic surveys in onshore and offshore settings.
- › An on-demand, sub-surface and permanent monitoring solution incorporating current market-available technologies.
- › Faster acquisition and continuous transmission of plume monitoring data for immediate user access.
- › A subsurface-based acquisition system with significantly lower environmental footprint and associated benefits for community and landowner interaction.

- › A successful field validation of the various techniques utilising the Otway International Test Centre and in-situ Buttress gas supply.
- › Regulatory and community acceptance of the technologies utilised at the Otway Site.
- › A techno-economic assessment of the expected value of the proposed Otway Stage 3 M&V suite compared to a conventional M&V approach (onshore and offshore) across scales from demonstration to commercial projects.

The primary monitoring technologies to be evaluated are:

- › Subsurface seismic data acquisition – permanent surface orbital vibrators (SOV's) will be installed to send a seismic signal for acquisition by a distributed acoustic sensor (DAS) installed in each of the four monitoring wells (by means of fibre optics in the well-bore). The data will be processed on-site and the resulting seismic images will be transmitted securely offsite for effective 'on demand' access.
- › Pressure tomography imaging and the closely related technique of pressure inversion – A pressure pulse will be induced in the reservoir and the response will be measured accurately via downhole pressure sensors installed in the four monitoring wells in order create an image of the plume. This is a 'first of a kind' application of this technology to CO₂ sequestration.

The M&V technologies selected for the Stage 3 Project will be tested and compared under identical reservoir conditions and experimental parameters. This will ultimately assist companies to quickly and confidently select a fit-for-purpose M&V solution tailored to the needs of their large-scale storage projects.



Membership categories and fee structure



Industry membership

For major operators in the oil and gas, resources and utility sectors and government partners

- › Access and IP rights to utilise research outcomes, operational best practices and protocols, datasets, models and scientific publications, reports, workflows and presentations not available to the public.
- › Strong role in organisational governance and steering direction of CO2CRC.
- › Setting directions of research programs and projects with a seat on the Board appointed Program Advisory Committee.
- › Preferential access to CO2CRC owned R&D facilities – the Otway International Test Centre.
- › Opportunity to leverage government grant funding.
- › Free attendance and participation for up to three attendees at the CO2CRC biennial research and technology symposium. This premiere technical event provides cutting edge information, showcases new products and serves as a crash-course update on the state of the CCUS industry.
- › Free attendance on CO2CRC's CCUS Fundamentals Course for two participants a year.
- › Invitation to participate in cross-industry member forums.
- › Free subscription to CO2CRC's monthly e-newsletter 'CO2CRC Insights' providing a summary of CCUS industry news, technical developments and project updates.

Industry membership: \$250,000/year (5-year membership term)

Associate membership

For industrial users of CCUS, industry bodies, technology and equipment vendors, consulting firms

- › Opportunity to contribute and collaborate with multi-disciplined research teams within a wide network of local and international research organisations and industry.
- › Access to publicly available technical reports and publications as they are published.
- › Opportunity to tour the Otway International Test Centre with stakeholders/interest groups seeking an in-depth understanding of the practical applied science of CCUS.
- › Free attendance and participation for one attendee at the CO2CRC biennial research and technology symposium. This premiere technical event provides cutting edge information, showcases new products and serves as a crash-course update on the state of the CCUS industry.
- › Free attendance on CO2CRC's CCUS Fundamentals Course for two participants a year.
- › Invitation to participate in cross-industry member forums.
- › Free subscription to CO2CRC's monthly e-newsletter 'CO2CRC Insights' providing a summary of CCUS industry news, technical developments, regulatory developments and project updates.

Associate membership: \$25,000/year (minimum 2-year membership term)

Research membership

For research organisations

- › Access to research outcomes, datasets, models and scientific publications from projects in which the member has provided services. Access to IP is for the delivery of the project outcomes and teaching purposes.
- › Invitation to participate at the CO2CRC biennial research and technology symposium. This premiere technical event provides cutting edge information, showcases new products and serves as a crash-course update on the state of the CCUS industry.
- › Opportunity to leverage government grant funding.
- › Invitation to participate in cross-industry member forums.
- › Free subscription to CO2CRC's monthly e-newsletter 'CO2CRC Insights' providing a summary of CCUS industry news, technical developments, regulatory developments and project updates.

New research members seeking datasets, models, etc: \$100,000/year

Partners

CO2CRC acknowledges and appreciates the strong relationships it has with industry, community, government, research organisations, and agencies in Australia and around the world.

Industry

ANLEC R&D
(on behalf of LET Australia)
BHP
Chevron Australia
Eni
ExxonMobil
Global CCS Institute
J-POWER
Santos
Shell Australia
Total
Woodside Energy

Associate

National Energy Resources
Australia (NERA)

Government

Australian Government:
Department of Education, Skills
and Employment
Australian Government:
Department of Industry, Science,
Energy and Resources
CarbonNet Project
Coal Innovation NSW
NSW: Department of Planning
and Environment
Victoria: Department of Jobs,
Precincts and Regions

Research

Australian National University
CSIRO
Curtin University
Deakin University
Federation University Australia
Geoscience Australia
Helmholtz Centre Potsdam –
GFZ German Research Centre
for Geosciences
King Abdullah University of
Science and Technology
(KAUST)
Lawrence Berkeley National
Laboratory (LBNL)
Stanford University
University of Adelaide
University of Cambridge
University of Edinburgh
University of Melbourne
University of NSW
University of Western Australia
University of Wollongong



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