Drilled a 1,667 metre well as part of a subsurface CO₂ monitoring and verification project aimed at saving industry 10s to 100s of millions of dollars over the life of a commercial program.

Produced two costed and detailed reports demonstrating that retrofitting CCS to coal and gas power stations is more cost effective than generating equivalent solar PV.

Opened eight laboratories as part of an Australian Government funded $51.6m national network of CCS centres to create efficiencies in research.

Experimental permanent surface orbital vibroseis sources have higher repeatability, significantly lower cost, and comparable data quality to using conventional vibroseis.

After 10 years of successful operation we safely decommissioned our first monitoring well Naylor-1.
Energy prices and security continue to stand out in the Australian political and policy landscape. The Finkel Report, released in June 2017, highlighted the need for a stable and reliable electricity system. The report's 50 recommendations are founded on four key outcomes for the National Energy Market: increased security, future reliability, rewarding consumers and lowering emissions. Carbon Capture and Storage (CCS) ticks these four boxes. 49 of the report's recommendations have been accepted and will be implemented by a newly formed Energy Security Board.

In March 2017, the Australian Government announced the intention to amend the Clean Energy Finance Corporation legislation to include CCS. While parliamentary approval is still required, the proposed change provides the technology neutral approach to funding emissions reduction technologies that CO2CRC has long advocated.

The Finkel Review and the CEFC decision advocate a level-playing field for CCS to compete openly with other clean energy technologies on their merits, but there is still work to be done to give confidence to investors to commit capital.

While energy policy considerations in Australia are beginning to reflect investment decisions in CCS around the world, CCS is rapidly gathering momentum internationally with 17 projects operational and a further five scheduled for completion by the end of 2018. In 2007, our international CCS goal was to have 20 large scale projects operational by 2020, and we are on track to surpass that. Globally, CCS is storing 40 million tonnes of CO₂ per annum, and key to further success will be the next pipeline of large scale investments. The United States, Canada, Japan, Norway, and Australia, along with our own Gorgon project, have led the way in large scale projects. China with its major focus on clean energy is expected to be the next major economy to invest in CCS.

CO2CRC has evolved as the challenges of CCS have changed. With that in mind, the Board endorsed new Vision, Mission and Values statements in 2016. The statements reflect with clarity our current and future journey with our partners and dedicated staff. New values of teamwork, operational excellence, transparency, integrity and courage will guide the team to continue a growing commercial focus.

I would like to acknowledge the strong relationships we have with governments, industry and research partners, without them we could not contribute strongly to the deployment of CCS. I would also like to thank the Otway community which has hosted our research facility for more than a decade.

Mr Greg Lewin AM, and Dr Alex Wonhas who left the Board this year after years of dedicated service will be greatly missed. Their expertise and insights were invaluable and I thank them for their contributions.

I am happy to welcome Ms Fiona Hick from Woodside Petroleum who brings a wealth of environmental experience, and Mr Brian Kitney as an independent Board member with 25 years’ commercial experience in oil and gas in Australia and Asia, who both joined us in March.

Finally, I would like to thank CO2CRC’s staff who continue to perform over and above, and have established the benchmark for CCS in Australia.

CO2CRC CHAIRMAN’S REPORT

Martin Ferguson AM
Chairman
2017 will be marked as a year of achievement for CO2CRC and CCS. It was the year we began our largest CCS project to date. Our capture projects flourished, we opened a national suite of CCS labs, and policy discussions actively turned towards making reliable baseload power generation low carbon.

Officially our $49.3 million Stage 3 storage monitoring and verification project began in April 2017 when drilling commenced at our Otway National Research Facility, but the steps taken to bring us to this point date back to the first day of CO2CRC operations. The 1,677 metre appraisal well, one of five we will drill in the next 18 months, will allow real-time monitoring of subsurface activity.

Previous storage research proved CCS was possible, safe and that we could detect minimum levels of CO2 in the subsurface. Stage 3 will provide us with tools that make CO2 monitoring cost-effective, and an essential contributor to a low-carbon economy.

We conservatively estimate the suite of technologies and learnings from Stage 3 will reduce the cost of CCS by tens to hundreds of millions of dollars over a commercial project’s life. This development is crucial because reduced costs anywhere in the CCS value chain makes the technology attractive to not only large but smaller scale emitters in a range of industries. While there has been a focus on power generation, industrial emitters such as steel, cement and fertiliser producers will also reap the benefits of reduced storage costs.

The Stage 3, 30-day 24/7 drilling program operated with no incidents to personnel or the environment which is testament to our operations team and our commitment to leading industry standards. CRC-3, as the appraisal well is known, yielded 130 metres of quality core samples to deliver exceptional data of the subsurface before we commence the next stages of the project.

While it has been a big year for our storage team, our capture research has also made progress on several fronts. CO2CRC won a competitive $1.2 million grant from the NSW government’s Coal Innovation Fund to develop cost-effective carbon capture technology at the Vales Point power station in NSW. The plant has been relocated from the closed Hazelwood power station in Victoria to Vales Point and is currently being modified to use both solvent and membrane technologies. The funding enables us to combine the advantages of both solvent absorption and membrane gas separation methods of capturing CO2, while overcoming the drawbacks of both technologies.

Capture projects were also significantly enhanced in October when we installed our proprietary capture skid at the Otway National Research Facility. The capture plant has been designed for use in offshore natural gas applications, with varying percentages of CO2 content. It has been made to be robust, small and efficient, and will also applicable to different capture requirements in the future.

These developments are the result of our deep commitment to cutting-edge research. In 2016-17 we extended our research base through the opening of several new Australian CCS Research Laboratories Network (CCSNet) facilities. In September 2016, we opened new capture, CCS modelling, and storage laboratories at The University of Melbourne. The $7.56 million facility was opened just 12 days after the Minister for Infrastructure and Transport, the Hon Darren Chester MP, opened CCSNet’s $2.3 million analytical laboratory at Federation University. And, in November, the Minister for Education and Training, Senator the Hon Simon Birmingham, opened our $5.04 million storage research facilities at the Australian National University.

As CCS research gains momentum, we also remain focussed on ensuring government and key decision makers understand the value that CCS has to Australian emissions reduction, our economic prosperity and our national energy security.

As CCS research gains momentum, we also remain focussed on ensuring government and key decision makers understand the value that CCS has to Australian emissions reduction and national energy security. Our detailed and costed retrofit studies, submissions to government and presentations to senior decision makers were well received by governments.

With the commitment from staff, the collaboration of our research partners and the support of our members and the community, CO2CRC has reached a pivotal point where the investment in research programs will yield industry applicable technologies and methodologies in the near term.

Thank you for sharing our vision for CCS.

Tania Constable PSM
Chief Executive Officer
Work started in January 2017 when we conducted a seismic survey to establish a baseline measurement for Stage 3. The images were of the 15,000 tonnes of carbon dioxide stored and settling deep underground as part of the ongoing Stage 2C research project. This survey covered a greater area of land than in previous years, extending for the first time to the Western side of the Great Ocean Road, requiring access permission from more landholders to conduct seismic surveys.

Through March and April works continued with a 30-day, 24-hour drilling period to establish the CRC-3 appraisal and injection well. The well delivered 130 metres of quality core samples to further enrich our understanding of the subsurface. Importantly, the well demonstrated pressure communication through to the CRC-2 well which is a vital component to our Stage 3 pressure topography research.

Economic benefits to the region from our Stage 3 work includes increased demand for bulk water, fuel and food as well as use of the regional airport, and earthmoving and waste disposal contractors.

CO2CRC’s global success could not have been achieved without the support of the Nirranda South community. This support is more important than ever as we undertake expanded works at the Otway National Research Facility.

STAGE 3 RESEARCH PROGRAM AT THE OTWAY

The $49.3 million Stage 3 research project at the Otway National Research Facility is a landmark in the advancement of CCS. To ensure the smooth progress of the project, CO2CRC is working closely with the residents of Nirranda South to explain the scope of our work and its global contribution to the development of emissions reduction technologies. The response from community members to Stage 3 has been overwhelmingly positive.

DECOMMISSIONING NAYLOR-1

Our first CCS well has had a major role at the Otway Research Facility for more than a decade, providing vital monitoring access to the subsurface. Originally drilled by Santos in 2001, the well produced methane before being closed due to excessive water production.

Naylor-1 enabled us to regularly sample the 65,000 tonnes of carbon dioxide that has been safely stored in the depleted gas reservoir for almost 10 years. The well has provided the most detailed information ever collected on CO₂ stored in this manner globally.

To coincide with the timing of the arrival of a rig for CRC-3 drilling, we decommissioned the Naylor-1 well. It was earlier determined that the well had reached its useful lifespan and would be plugged and abandoned. Plugging and abandoning Naylor-1, and removing monitoring equipment from the heavily instrumented, three-and-a-half inch well was challenging but successful. Rehabilitation of Naylor-1 has demonstrated to the community and regulators that CO2CRC is committed to rehabilitating facilities when they are no longer needed.

Economic benefits to the region from our Stage 3 work includes increased demand for bulk water, fuel and food as well as use of the regional airport, and earthmoving and waste disposal contractors.
OTWAY VISITORS CENTRE

The refurbished Visitors Centre proved to be a comfortable and suitable venue to host the increased number of meetings and visitors received during the year. Feedback from community members in response to the building has been very positive and it has successfully accommodated large groups required during the drilling program. The provision of adequate shelter outside and the need to redesign the landscaping surrounding the building to reduce the required maintenance, are works planned for the coming year with the financial assistance of the Global Carbon Capture and Storage Institute (GCCSI).

PROFESSIONAL AND LOCAL ENGAGEMENT

Throughout the year the Otway National Research Facility hosted visits from groups and individuals representing academia, industry and government.

Visitors included members of the CSIRO hosted Australia-Japan Carbon Resource Utilisation Symposium; the Taiwanese Bureau of Energy; Dr Julio Freidman, Senior Advisor at the Lawrence Livermore Laboratories in the United States; Korea University; a China Australia Geological Storage of CO2 delegation; Nobel Laureate and climate scientist Dr Russell Schnell; participants in the Global Carbon Capture and Storage Institute Symposium; and a representative of the South African Government.

Increased activity levels on site and the higher level of media coverage of CCS may have been the reason behind the unprecedented number of visitors to our Open Day in November 2016. More than 50 locals attended this event which included discussions about CCS and staff-led facility tours. This was a fantastic outcome despite the inclement weather. Open Day was promoted on local radio, and included a barbecue lunch, ice-cream, and a barrista.

The year saw a total of 314 people visit the Otway National Research Facility to learn about our carbon capture and storage activities. Many came on trips we organised from Melbourne on special visitors’ days during the drilling of the CRC-3 well. The composition of many of the visiting groups reflects the increase of interest in establishing viable CCS projects throughout Asia.

Keeping the local community informed of CO2CRC’s research activities is a key organisational objective, as is maintaining positive working relationships with the landholders surrounding our research facility. In the past year we have held two Community Reference Group Meetings where we provided detailed information on site operations, research outcomes and planned activities. These were well attended by local residents and regulators.

COMMUNITY SUPPORT

CO2CRC isn’t simply judged on what we say; we’re judged on what we do. For the community, it means we work to have a positive impact within the community.

In 2017, we supported Nullawarre Primary School’s science, technology, engineering and mathematics (STEM) program, sponsoring the purchase of scientific LEGO kits. We believe that getting children excited about STEM subjects is part of the remit of a science and engineering-based organisation.

CO2CRC also continued its long-term sponsorship of the Nirranda netball and football teams, both vital sporting institutions in the community.

CO2CRC and Origin Energy sponsored an important community event discussing mental health, specifically depression in men. The forum was organised by Alan Ripon, a Nirranda South landholder and an active member of the Nirranda Football Club. Alan arranged for AFL legend Wayne Schwass, originally from the area, to address a capacity crowd at the Nirranda Football Netball Club rooms where he shared his personal battles with mental illness. The large attendance speaks volumes about communities hard-hit by this condition. We were happy to support the function so that he could bring his message to the Nirranda community.

The 2016-17 year has been exceptionally productive for CO2CRC at the Otway National Research Facility and we would like to thank the land owners and local community for their ongoing support.
OTWAY CAPTURE FACILITY
Successful delivery, installation, commissioning and operation of the capture facility at the Otway National Research Facility has been a significant milestone for CO2CRC capture research. The rig closes the loop at the Otway with a wide range of in-field experiments possible at the same site as our storage research.

The capture rig is designed to be compact, efficient and robust enough for use in off-shore environments. The technologies we have chosen to pioneer have potential in natural gas processing and separation, where future fields have high CO₂ concentrations. Concrete foundations were laid in July 2016 and the Melbourne fabricated rig followed shortly after.

The facility is flexible enough to provide a range of feed compositions ranging from 10 to 80 percent CO₂ in the natural gas, thereby mimicking various gas field compositions. The facility will also accommodate testing the effects of impurities within the gas, and will test advanced adsorbent and membrane materials developed by researchers at the Universities of Melbourne and NSW. Information and understanding obtained from the capture skid will be used in scale-up engineering work and applied to commercial-scale natural gas facilities. The capture rig itself has been designed to not only test our materials and solvents, but provides the basis for putting a range of capture technologies through a wide battery of tests.

PILOT CCS PLANT AT VALES POINT
Coal Innovation New South Wales (CINSW) has provided CO2CRC with $1.22 million in funding to test new capture technologies at the Vales Point power station in New South Wales. After successful completion of the design of the pilot plant, it is currently under construction with delivery expected in late 2017. In this collaborative project, researchers from The University of Melbourne with CO2CRC will test advanced liquid-membrane contactors to capture CO₂ from power plant flue gas. It aims to get the best of both membrane and solvent technologies. Combining the two technologies has the promise to dramatically reduce the plant’s footprint compared to conventional solvent-based systems thereby reducing both capital and operational costs.

COAL TO HYDROGEN WITH CCS STUDY
This year CO2CRC has undertaken two feasibility study projects with Japanese industrial partners focusing on the conversion of brown coal to hydrogen as a clean fuel for motor vehicles and power generation. CO2CRC leads the gas cleaning for H₂ production and carbon capture and storage components of the study project. A local process engineering company was contracted to help in conducting the study. The initial aim of this program is to transport H₂ to Japan to power the sizable vehicle fleet for the 2020 Tokyo Olympics with the possibility that the learnings will be taken to a commercial scale. The pilot plant implementation initiative is underway, and CO2CRC is expected to play a vital role.

CAPTURE TO COAL & STEEL RETROFIT STUDIES
A visionary LaTrobe Valley Capture Retrofit Study was launched in June 2017. When complete, the study will provide an indicative outline of technical specifications, construction requirements and performance for potential post-combustion capture (PCC) retrofits at a brown coal power station. The principal purpose is to establish the technical feasibility for a number of fullscale, solvent-based capture systems to be installed on the specific site with an acceptable impact on the existing plant. Order of magnitude costs and construction and operation procedures will also be estimated. A steering committee has been formed involving international experts to guide the project. This study report will be a valuable tool in Australia’s future emissions-reduced energy policy.

The capture program is undertaking additional initiatives to expand our focus beyond the energy sector. We are working with the steel industry to examine how emissions can be cut in steel production through CCS. This works is being funded by the Australian Government.
NEW LABORATORIES SUPPORT NATIONAL NETWORK

CO2CRC opened capture laboratories at The University of Melbourne which were funded by the Australian government’s Education Investment Fund (EIF). These new laboratories will provide CO2CRC, through its close collaboration with The Peter Cook Centre for CCS at the University of Melbourne, with a solid, fundamental scientific basis which underpins our work on CO₂ capture technology development.

Under the EIF funding arrangement, CO2CRC also invested in capture laboratory facilities at Federation University. The laboratories examine the effects of CO₂ capture solvents on the metals within an experimental capture skid. The samples are taken from a power plant within a short distance of the university.

As an outcome of our expanding capture facilities, we plan to develop a strong in-house process modelling capability. This capability would underpin the engineering scale-up needed from data obtained from our capture facilities.

TAKING A LEAD INTERNATIONALLY

CO2CRC is a member of the International Test Centre Network (ITCN), participating in international meetings to share knowledge regarding technological developments, construction and operational experience, the establishment of generic performance indicators, and to promote technology standardisation for carbon capture. Current members include the National Carbon Capture Centre (NCCC) Facility in the US; the TCM test facility in Mogstad, Norway; CSIRO test facilities in Australia; the UKCCSRC test facilities in the UK, The CCS Knowledge Centre in Canada, SINTEF in Norway, CERI in China and KIER in Korea. Invitation to the network confirms CO2CRC’s place as a global CCS research and development leader.

Researchers involved in the capture work of the CO2CRC include CO₂ capture researchers at The University of Melbourne, the University of New South Wales, Federation University, as well as collaborators across the globe such as membrane and adsorbent groups in USA and Europe. We would like to thank them for their ongoing involvement through our substantial growth phase.

The technologies we are pioneering have potential in natural gas processing and separation, where future fields have high CO₂ concentrations.
OTWAY CAPTURE FACILITY
The facility was made in Australia to a CO2CRC design and specifications and has already begun testing advanced membrane adsorption technologies.

CO2 separation is performed in a harsh coastal environment, with high pressure natural gas, on a 24/7 cycle and without need for human intervention.

The use of two innovative technologies in a parallel in a common field testing platform is unique in the world.

The Otway Capture Facility provides the Otway National Research Facility with unmatched in-field capture and storage research possibilities for CO2CRC and its partners.

The rig’s performance is both monitored and controlled remotely, which is vital for off-shore, or even underwater operation.

The facility is flexible enough to provide a range of feed compositions ranging from 10 to 80 percent CO2 in the natural gas, thereby mimicking various gas field compositions.
Detailed engineering techniques to maximise our understanding of how geological features can be best used as CO₂ storage sites are a critical part of CO₂CRC’s research. Enhancing the value of the storage site while reducing the cost of monitoring is crucial to the competitiveness of CCS.

The storage program has four clear areas of research priority: Geological Integrity, Engineering Storage, Fit-for-Purpose Monitoring and Verification, and Geochemical Engineering. The storage team, collaborating with our operations team, also oversees the execution, operation and post-operation phases of storage projects at our Otway National Research Facility.

In 2016 – 17 we expanded our storage program portfolio to 12 distinct desktop and in-field research projects at our Otway National Research Facility.

In 2017 CO₂CRC successfully drilled the CRC-3 well, an appraisal well used to increase knowledge of the subsurface for the Otway Stage 3 project. CRC-3 was safely and successfully drilled, logged, and tested over a 30-day period to a total depth of 1,667 metres with no hurts to personnel, equipment or environment. The drilling operation also enabled CO₂CRC to undertake maintenance at the Otway National Research Facility, including the decommissioning of Naylor-1, a monitoring well used for the Otway Stage 1 project, and replacement of the well head for CO₂-source well Buttress-1.

The CRC-3 appraisal well effectively demonstrated clear pressure communication between itself and the CRC-2 well, providing strong evidence to the success of demonstrating pressure tomography in future Stage 3 operations. Subsequent formation evaluation work stemming from the CRC-3 well has also led to the selection of the injection interval for the Stage 3 project, and provided the necessary key data for modelling the future distribution of CO₂, providing a pathway to the design of the future injection and monitoring operation.

Evaluation of the Otway Stage 3 project will be completed in November 2017 and a decision will be made by the Board on whether to proceed to operations.

OTWAY STAGE 3 – CO₂ STORAGE MANAGEMENT AND SUBSURFACE M&V

Project Lead: Steve Marshall, CO₂CRC Ltd. Science Lead: Charles Jenkins, CO₂CRC Ltd. / CSIRO

CO₂CRC is developing fit-for-purpose monitoring technologies that aim to provide on-demand information of the CO₂ storage site with minimal surface impact. This technology will deliver substantial cost savings in future storage site monitoring design. The Otway Stage 3 project is the next major undertaking at the Otway National Research Facility, where up to five new wells will be installed and equipped with cutting-edge downhole seismic and pressure monitoring equipment. A trial injection of CO₂ will be used to validate these subsurface monitoring approaches on the resulting CO₂ plume. Primary monitoring methods being evaluated are pressure tomography and downhole seismic, with other monitoring modalities and techniques also being investigated as added components to the base design where possible.
MULTISCALE FLOODING DYNAMICS OF THE OTWAY USING DIGITAL CORE ANALYSIS

**Science Lead:** Mark Knackstedt, CO2CRC Ltd / Australian National University

During the feasibility phases, CO2CRC Otway Stage 3 requires accurate predictions of plume movement within the storage formation. A new project on multiscale flooding dynamics of the Otway, using digital core analysis, commenced in April 2017 to improve predictions by better understanding small scale geological features and heterogeneities, which can have a significant impact on plume movement within the subsurface.

The effects of these small scale heterogeneities can be modelled by digitally scanning core from the CRC-3 well and applying known rock properties to the core images. From this, reservoir flow and residual trapping properties can be applied to the whole core. In situ imaging of CO₂ behaviour within the core samples can also take place to understand potential brine/ fluid distribution. This data at the core scale will then be up-scaled and used to calibrate the Otway Stage 3 model to well log data.

The project will illustrate the value of incorporating realistic geological structures at multiple scales to offer greater confidence in storage models. Successful completion of the project will offer the Otway Stage 3 project and future Otway activities improved confidence in predicting the extent and behaviour of injected CO₂.

GEOCHEMICAL BARRIERS FOR ENHANCING CONTAINMENT

**Science Lead:** Ralf Haese, CO2CRC Ltd / The University of Melbourne

The Enhanced Containment through Barrier Formation project is developing reaction mechanisms to create a flow barrier as a mitigation strategy to ensure and enhance CO₂ containment in the reservoir.

Preliminary results from small-scale flow-through experiments in the laboratories at The University of Melbourne have shown first evidence of the formation of precipitates. The laboratory experiments offer insight into the reactive barrier formation mechanism; however, it is important to note that these results are only the first step as complexities such as heterogeneity under reservoir conditions will need to be accounted for.

Initially, the need to understand the applicability of these laboratory experiments under reservoir conditions is being addressed by numerical simulation. The reactive transport program, TOUGHREACT has been adopted for the simulation. This work includes a 1D radial model to reproduce geochemical changes observed in the laboratory, and then undertake sensitivity analysis to assess the impact variations such as pH conditions, ions concentrations, reaction time and flow rate have on the geochemical barrier’s performance.

The project will illustrate the value of incorporating realistic geological structures at multiple scales to offer greater confidence in storage models. Successful completion of the project will offer the Otway Stage 3 project and future Otway activities improved confidence in predicting the extent and behaviour of injected CO₂.
The Stage 2C project successfully demonstrated the technical limits of seismic technologies to detect and monitor the evolution of CO$_2$ at the Otway. Results from this project will be used to inform stakeholders of minimum detection limits for seismic technologies monitoring CO$_2$ in the subsurface. Newly developed Surface Orbital Vibrosis sources (SOVs) have demonstrated to have compatible data quality, higher repeatability and significantly lower cost, compared to conventional vibroseis trucks.

Burying geophones underground reduces the time to obtain information about stored CO$_2$ behaviour. The geophones also create less impact on landowners over the longer-term.

The quality data from the buried geophone array was enough to observe as little as 5,000 tonnes of CO$_2$ as it moved through the subsurface.
The CRC-3 drilling program:

- Operated 24/7 for 30 days and drilled to 1,667 meters in depth
- Extracted 130 meters of core with a 90 percent recovery rate
- Reported zero health, safety, environmental or regulatory incidents
- Delivered a well and data that will reduce uncertainty in reservoir dip, continuity, and heterogeneity

The Stage 3 program will deliver real-time monitoring capabilities of the CO₂ plume, and will provide risk targeted subsurface monitoring options to industry.

Drilling up-to five injection and monitoring wells, and introducing new subsurface monitoring technologies, the Stage 3 program will reduce the cost of a commercial CCS project by tens to hundreds of millions of dollars.

Practices and technologies developed from the Stage 3 program will shape policy settings and provide operators the means to reduce the cost of achieving regulatory compliance and manage risk.

Subsurface solutions reduce the frequency of land/sea based monitoring and inconvenience to communities.

The drilling of the CRC-3 appraisal well is the first step in the $49.3 million Stage 3 CO₂ Storage Management and Subsurface M&V project.
PREDICTION AND VERIFICATION OF SHALLOW CO₂ MIGRATION

Project Lead: Andrew Feitz, CO2CRC Ltd / Geoscience Australia

CO2CRC is completing phase one of a study for monitoring injected CO₂ flow along a shallow fault at the Otway National Research Facility. The general aim of this project is to understand our ability to detect and quantify fault-controlled CO₂ migration in the near surface, and from this develop improved assurance monitoring approaches.

In 2016-17, a 3D geological model for the upper 195 metres of the Otway Basin sequence was developed, along with simulations of CO₂ injection and migration in the Port Campbell limestone. This dynamic modelling exercise is the first step in the planned CO₂ injection experiment and identified key properties that influence migration behaviour.

Only general trends can be inferred from this initial modelling, and the models now require validation against core and logging near the fault. Nevertheless, the modelling suggests CO₂ should migrate along the fault as expected, when injected at a depth of around 30 metres. Drilling of an inclined appraisal bore to the base of the Port Campbell limestone is now planned for 2017-18 to provide essential information for the planned experiment. Opportunistically, future work in this project will employ the new geomechanical workflow that has been developed in the Fault Seal Characterisation project.

Fault Seal Integrity Characterisation

Science Lead: Eric Tenthorey, CO2CRC Ltd / Geoscience Australia

The Fault Seal Integrity Characterisation project is refining a technical workflow that provides a mechanical understanding of fault zone properties when little or no observational fault data is available. This petrophysical and rock mechanical workflow uses various measured mechanical properties of rock to understand the potential behaviour of faults during CO₂ injection and storage, and predict key fault properties to reduce risk and uncertainty at a given CO₂ storage site.

The Fault Seal Integrity Characterisation project has undertaken geomechanical studies of core and logs from our Otway Project, resulting in the development of a correlation that allows us to interpret geomechanical fault seal properties. Core from the CRC-2 well has been characterised in terms of the rock’s strength and frictional forces. This core data has been successfully transformed to log scale. For wells that cut through faults, yet don’t have core of the fault, this project’s predictive work can provide the necessary fault properties to understand safe injection and operating conditions.
OTWAY STAGE 2C – CO₂ STORAGE MIGRATION IN SALINE FORMATIONS

Science Lead: Roman Pevzner, CO2CRC Ltd / Curtin University

Saline formations offer the highest capacity storage resource for CO₂ storage globally, many times greater than depleted oil or gas fields, with the potential for hundreds of years’ worth of CO₂ to be stored in a variety of locations, including excellent opportunities in Australia. The Otway Stage 2C project continues to provide important information towards understanding capabilities to predict and monitor the behaviour of CO₂ in a saline formation as a key enabler for future large scale use of this type of storage solution.

The 15,000 tonne CO₂ plume, injected in 2015-16, has been observed in multiple monitoring campaigns. The plume is migrating in a south-east direction, and slowing, as expected due to residual trapping processes. Four active seismic surveys have been taken to date, as well as monitoring data acquisition using a pair of permanent seismic sources and semi-continuous passive seismic receivers.

Seismic signals were received using both fibre-optics and geophones within a 1km² buried seismic array and using downhole sensors. The seismic quality from the buried seismic array and downhole equipment has exceeded expectations. The high quality of the data is producing excellent images of the plume, helping the project team achieve the project’s core objectives, which are to:

› Detect injected CO₂ in the subsurface: ascertain minimum seismic detection limit
› Observe the gas plume development using time-lapse seismic
› Verify stabilization of the plume in the saline formation using time-lapse seismic

Curtin University, CSIRO and Lawrence Berkley National Laboratories continue to work closely together to interpret the monitoring data. The results allow us to understand the distribution of CO₂ injected into the subsurface. With the final active seismic acquisitions planned for 2018-19, as well as continual pressure monitoring, this project is well on track to demonstrate stabilisation of a CO₂ plume in an open saline formation, the first of its kind internationally. This work will provide a validated workflow for verifying plume behaviour in saline formations.

Otway Stage 2C: Root Mean Square (RMS) amplitudes of the 4 seismic acquisition differences at the Otway site (M1: after 5,000 t injected; M2: after 10,000 t injected; M3 after 15,000 t ‘end injection’; M4: 1 year after injection).
Since the granting of $51.6 million from the Australian Government’s Education Investment Fund (EIF) in 2013, CO2CRC has distributed the funding on a competitive tender basis to establish a national network of research assets across the CCS value chain. The research assets were selected to work collaboratively to reduce the cost of CCS and drive innovation. Three of the assets are also key research providers to Victoria’s flagship CCS CarbonNet project. In 2016-17 CO2CRC opened five laboratories around the country, including at the Australian National University, The University of Melbourne and Federation University. The significance of these assets to the Australian Government and the institutions was reflected in the participation of Federal Ministers and Vice-Chancellors at the launches.

**CARBON CAPTURE AND STORAGE NETWORK (CCSNET)**

Laboratories launched and operating in 2016-17:

The assets comprising the CT Lab (computed tomography) are conceived and managed by the Department of Applied Mathematics at the Australian National University. The assets comprise two X-ray computed tomography (XCT) scanners for 3D imaging of rock samples; an electron microscope, ‘QEMScan’, capable of automatically imaging the mineralogy of core materials or cuttings; a suite of special core analysis (SCAL) analytical equipment; and the refurbishment of two laboratories including one for core preparation. The lab is extending its multiscale imaging and analytical technologies to X-ray micro tomography which will produce extremely detailed 3D maps of rock microstructure, offering great potential for improved interpretation of laboratory core analysis through a better understanding of how rock structure affects petrophysical properties. Many reservoir rocks are sufficiently complex that they cannot be represented in a single 3D image, consequently the group has developed methods to correlate and integrate other imaging and measurement modalities, such as ‘QEMScan’, and CT at multiple length and time scales to improve interpretation.

Through the Bioreactor & Geomicrobiology Laboratory at The University of Melbourne, CO2CRC has established Australia’s only purpose-built laboratory for studying the effects of supercritical CO₂ on subsurface microorganisms under realistic conditions, enabling a new and complementary research direction for Australia that parallels international research efforts. The project will advance general research into CO₂ storage optimisation strategies with the bioreactor able to examine the microbial and biogeochemical processes that can affect aquifer porosity, mineralogy and chemistry, and investigate direct and indirect microbial responses to elevated CO₂ in geological formations. Industry will benefit from being able to understand the microbial environment of a storage site, how the injection of CO₂ may impact microbial activity on the formation or dissolution of minerals, and the effects of co-injected SOx and NOx.

The High-Resolution Display-Wall Modelling Room at The University of Melbourne will deliver visualisation equipment with a focus on high-power computing capable of handling large and varied data sets. Approved by the CO2CRC Board in November 2016, project planning and procurement by the School of Earth Science is well advanced. This asset will provide a high-impact medium for engaging with the Dynamic CCS Modelling Platform. Users will be able to undertake simulations that model the full CarbonNet pipeline network while at the same time visualising the power generation, capture, transport and storage infrastructure in 3D, along with constraining geological and geophysical datasets. The facility will also provide an environment in which to interact with 3D micro-CT scanning data generated by the Fluid Flow and Geochemistry Laboratory, also located at The University of Melbourne. The Seismology Monitoring Network will also produce a significant 3D dataset including earthquake locations and velocity models. Finally, this asset will provide a medium in which to visualise the earthquake hypocentres recorded by the GipNet seismometer array and will provide a workspace in which to derive 3D interpretations from that data including potential fault locations and orientations.

Launched in September 2016 at The University of Melbourne the Fluid Flow Equipment and Geochemistry Laboratory will enable a large range of CO₂ storage research projects on the impact of contaminants and trials of various corrosion-resistant materials. Trials of injected CO₂ with impurities is of interest to better understand the potential role of impurities for long-term CO₂ storage.

The provision of a contemporary Mercury Injection Capillary Porosimeter (MICP) is vital to the Australian School of Petroleum at the University of Adelaide, which is the primary location to conduct seal evaluation for research and industry projects in Australia. Seal analysis
and behaviour are key geological parameters that require further investigation and are vital to future storage projects. The MICP is to be used to undertake seal studies on CO₂ containment, oil or gas cap rock studies, and fault zone evaluations.

**Capture Analytic Equipment and the associated laboratory** at The University of Melbourne is now capable of handling the corrosive solvents and the dangerous gases that are fundamental to safe, best practice carbon capture research. In March 2016, renovations were completed to complement this new infrastructure to create a world-class facility. The renovation will house the CO2CRC solvent capture and membrane technology research groups. The Capture Analytic Equipment and Laboratory is responsible for six specific research projects with clear objectives around cost reduction, technical optimisation and scale-up.

The **Dynamic CCS Modelling Platform** will be a comprehensive system-wide modelling platform built to study the full CCS value chain, allowing for analysis and decision-making by multiple stakeholders in a capture project, including the emissions producer. The capture plant, the compression system, the transport network and the storage site are all examined as part of this model. The platform will seek to prove technical efficiencies which can be applied at post-combustion sites in Australia and around the world. The result will be will cost savings embedded in the design and construction of the CCS plant.

At Federation University, the **Capture Analytic Equipment and Laboratory** focuses on reducing capture system degradation and plant corrosion by examining samples of chemicals built up in an experimental capture plant attached to an electricity power plant in the Latrobe Valley. The laboratory is uniquely positioned given its location only a few kilometers from the capture site. This in-field research provides a unique opportunity to recommend how different materials may be used to reduce or halt corrosion of capture plant components.

**OTWAY SUBSURFACE LABORATORY (OSL)**

The **Otway Subsurface Laboratory (OSL)**, which accounts for 40 percent of the EIF grant, will provide the infrastructure with which to undertake the research activities associated with CO2CRC’s Otway Stage 3 Monitoring and Verification project. Significant progress on the OSL took place during this period, including technical and operational planning and design, and the drilling of field appraisal well CRC-3 in February 2017. The current focus for the OSL is interpretation of the formation evaluation results of CRC-3, and detailed planning and design for the future injection and monitoring wells.
Scientific Objectives

The GipNet research priorities are:

Marine

1. Distinguishing CO₂ release signatures from similar naturally occurring variability to reduce detection false alarm rates in future baseline monitoring design.

2. Determining the level of CO₂ release associated with environmental impacts at a range of scales.

3. Distinguishing changes associated with other drivers and pressures in multiple-use zones from the activities of CCS operations.

4. Investigating the nature, origin and biological significance of identified seabed channels offshore Gippsland.

Seismology

5. Gaining a benchmark from earthquake data for seismic activity in the region, for both natural and induced earthquakes, to inform accurate attribution.

Atmospheric

6. Determining the extent to which the newly developed atmospheric monitoring instrumentation and software can detect anomalous CO₂ in a near-shore CO₂ storage site, and determining optimal instrument combination and location in this environment.

Resourcing

Foundation work undertaken by CO2CRC on GipNet includes providing a business case to CarbonNet to procure a funding contribution, development of a stakeholder engagement strategy, public land access facilitation, and commencement of risk assessment, regulatory review and securing of stakeholder engagement resources.

With four research projects comprising GipNet resulting in multiple interfaces (illustrated below) between the research teams required to meet objectives, effective stakeholder engagement will be essential. For this reason, a dedicated Gippsland-based stakeholder engagement officer will be employed for the duration of the project. GipNet research projects (except one) utilise assets funded by the Australian Government under the EIF. The operational costs of GipNet research projects are majority funded by ANLEC R&D with substantial in-kind contributions by CSIRO, The University of Melbourne, the University of Wollongong and CO2CRC. The total value associated with delivering the GipNet research projects is $20.3 million.

The Seismology Monitoring Network will provide cost-effective and more accurate seismic monitoring of CO₂ in complex, ‘noisy’ ocean settings such as the Gippsland Basin. The network will allow a detailed understanding of the background seismicity, and coastal and ocean noise levels within the entire basin with a level of fidelity that is currently not possible in either the Gippsland or Otway Basins. The technology is designed to deliver monitoring at lower cost and, owing to improved signal to noise reception, at higher accuracy than technology used to date.
The Atmospheric Monitoring Network is allowing researchers to develop an open-path measurement system for atmospheric trace gases including CO₂ and CH₄ by using two instruments at a single site along with a series of reflectors, all deployed within the Gippsland Basin. The project leaders are pioneers of open-path techniques which uses beams invisible to the naked eye that detect gases as they pass through them. These assets will establish regional baseline CO₂ levels and inform the design and installation of the optimal network for monitoring sources and sinks of CO₂ in the proposed storage area.

The Marine Monitoring Network will allow for validation of monitoring and verification technologies in the marine environment. This is an important consideration when developing offshore storage projects. Marine monitoring research assets will be operated by the world-leading marine monitoring expertise within the Oceans and Atmosphere division of CSIRO. The Marine Monitoring Network will provide certainty to regulators and the community that CCS is safe to the environment in which it operates – specifically marine environments where many storage sites are viable – and ensure that changes in CO₂ levels resulting from other drivers and pressures in multiple-use nearshore marine zones can be accurately distinguished from the activities of CCS operations.

<table>
<thead>
<tr>
<th>EIF ASSET</th>
<th>KEY DEVELOPMENTS IN 2016-17</th>
</tr>
</thead>
<tbody>
<tr>
<td>Otway Subsurface Laboratory</td>
<td>Appraisal Well CRC-3 drilled and formation evaluation data acquired</td>
</tr>
<tr>
<td>Seismology Monitoring Network (Part of GipNet)</td>
<td>Subcontract with The University of Melbourne executed in September 2016. Local network onshore seismometers: Stage 1 delivered; Stage 2 ordered, equipment validation, installation site evaluation in progress.</td>
</tr>
<tr>
<td>CT Lab</td>
<td>Launched at Australian National University in November 2016. QEMScan in use according to research plan endorsed by CCSNet governance committees, procurement and building of balance of assets in progress.</td>
</tr>
<tr>
<td>Bioreactor &amp; Geomicrobiology Laboratory</td>
<td>Launched at The University of Melbourne in September 2016, assets in use according to research plan endorsed by CCSNet governance committees.</td>
</tr>
<tr>
<td>High-Resolution Display-Wall Modelling Room</td>
<td>Proposal approved by CO2CRC Board in September 2016. Subcontract between CO2CRC and The University of Melbourne drafted.</td>
</tr>
<tr>
<td>Fluid Flow Equipment and Geochemistry Laboratory</td>
<td>Launched at The University of Melbourne in September 2016, assets in use according to research plan endorsed by CCSNet governance committees.</td>
</tr>
<tr>
<td>Mercury Injection Capillary Porosimeter</td>
<td>Commissioned at the University of Adelaide in February 2017, now in use according to research plan endorsed by CCSNet governance committees.</td>
</tr>
<tr>
<td>Capture Analytic Equipment and Laboratory</td>
<td>Launched at The University of Melbourne in September 2016, assets in use according to research plan endorsed by CCSNet governance committees.</td>
</tr>
<tr>
<td>Dynamic CCS Modelling Platform</td>
<td>Subcontract with The University of Melbourne executed in September 2016. Appointment of PhD candidate and IT consultant.</td>
</tr>
<tr>
<td>Capture Analytic Equipment and Laboratory</td>
<td>Launched at Federation University in September 2016, assets in use according to research plan endorsed by CCSNet governance committees.</td>
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RETROFITTING CCS TO COAL OR GAS POWER STATIONS

ELECTRICITY SUPPLY DIVERSITY

Electricity generation accounts for a third of Australia’s emissions, and as a sector is the largest contributor to the national greenhouse gas inventory. Today, the sector remains heavily reliant on gas and coal based power plants, together accounting for more than 80 percent of electricity generated. Retrofitting CCS has the potential to make rapid and large-scale contributions to decarbonising the Australian electricity sector.

At present, coal is the majority generator in baseload power, while natural gas often takes a supplementary role. However, retrofitting natural gas combined cycle plants added to brown and black coal plants with CCS will provide additional baseload power that is available 24/7 with very low carbon emissions.

In 2017 CO2CRC developed two vital reports on the costs of retrofitting selected black and brown coal, and gas fuelled power stations with carbon capture and storage. The aim of the reports was to determine whether the retrofit option would be cost-competitive in the production of stable, reliable electricity.

The reports, Retrofitting CCS to Coal: Enhancing Australia’s Energy Security and Retrofitting Australian Gas Power Plants with Post Combustion Capture are the direct follow on from the Australian Power Generation Technology Report of 2015, which is the most comprehensive Levelised Cost of Electricity (LCOE) report to date.

Broad deployment of CCS must commence by 2030 to achieve net zero emissions in Australia beyond 2050

Reliable, 24/7, baseload energy that is low emissions can be secured through CCS

All forms of electricity production are essential to optimise consistency and security of supply, lowest possible cost, and environmental outcomes for Australia.
The figure above shows the Levelised Cost of Electricity (LCOE) range for differing capacity factors, fuel costs and capture rates for both a new build NGCC PCC plant and a retrofit.

The base case of a new build NGCC plant delivers electricity at an average LCOE of $78/MWh, which increases to $136/MWh with PCC added. The retrofit of an existing NGCC results in an average LCOE of $115/MWh at a 65% capacity factor and the Australian Power Generation Technology Report (APGT) gas price range. The increase in capacity factor decreases the LCOE, as there is more generation to amortize costs. However, the largest factor is gas price sensitivity. Recently there has been an increase in average prices in Australia, so an $8 – 13/GJ range is also modelled, with an approximately $30/MWh increase in the average LCOE.

A retrofit of an existing NGCC plant at the $9-13/GJ, 85% capacity factor and a 90% capture rate results in an average LCOE of $108/MWh. The gas price range of $8 – 13/GJ used in this study reflects a ‘very strong’ gas price outlook compared to the Australian Energy Market Operator’s 2016 National Planning and Forecasting review’s strong case at $8.50/GJ.

**RETROFITTING CCS TO BROWN AND BLACK COAL POWER GENERATION**

The capital costs for post combustion capture retrofit for brown coal and solar PV are similar. Retrofitting 2,100MW of an existing efficient brown coal power station would achieve 1,500MW of low carbon electricity and cost just over $10 billion. This would power just under 2 million households per annum and would be equivalent to 4,800 megawatts of solar PV at the same cost.

Retrofitting a single boiler on a brown coal power plant would cost less than a fully retrofitted brown coal power station. For a single boiler the cost is conservatively $2.45 billion. In application, there are avenues to lower costs further, due to the reduced need for SOx and NOx controls due to quality brown coal (low ash, low sulphur) in the Latrobe Valley.

The capital costs for post combustion capture retrofit for black coal are lower than the comparable scale of solar PV. Since black coal is cheaper per kilowatt than brown coal per kilowatt, a total retrofit of a black coal power station will cost less than the equivalent in solar PV. A single boiler retrofit on 450MW on an average black coal power station would cost $1.8 billion powering 430,000 households and would be equivalent to 1,050MW of solar PV.

The optimistic scenario on a single boiler retrofit, taking into account use of advanced solvent capture technologies and learning by doing at a capital rate of 20 percent, would cost $1.48 billion. This would power 460,000 households. Using the non-optimistic case for brown coal the levelised cost of electricity is 14% cheaper than new build coal and 18% cheaper for black coal.

The LCOE range for full brown coal retrofit with CCS is $122 - $164 and $103 - $154 for full black coal retrofit with CCS. Utility 1 PV axis tracking shows a range of $95 to $121, as is shown in the figure below.
NEW BUSINESS

Substantial inroads have been made during the year to identify and approach prospective new members. The appointment of a dedicated Business Development Manager during the year has bolstered the Company’s capacity in this area. Revenue derived from members is integral in providing a strong foundation for growth, and this is an area of continued focus for the next twelve months.

In the latter part of the year, we pursued investment in the Stage 3 CO₂ Storage Management and Subsurface M&V program, with a thorough prospectus and accompanying proposals produced for a number of Australian and international organisations. We are confident that we will meet our investment goal of $20m required for this project.

HUMAN RESOURCES

During the year the Company increased its capacity with the appointment of a number of new roles including Chief Financial Officer, Business Development Manager, Project Co-ordinator, Capture Program Engineer and Well Completions Engineer.

Training and workplace improvements have been a focus in 2017 with staff undertaking Prince 2 project management training. Prince 2 provides our project managers, and their internal and external stakeholders, a uniform method of developing and managing particularly complex multi-million-dollar research programs. With all staff undertaking the training, independent of position or involvement in projects, it has provided a common knowledge base to the group.

Additionally, all staff have been taken through the Birkman Method assessment tool, assisting them with their career development, understanding their strengths in the workplace and highlighting their preferred working styles. The Birkman Method has aided staff and management to create a relationship that focuses on needs and capabilities.

Continued focus on the company’s 2021 Strategy Plan has seen the 2017/18 milestones being developed by the whole team. Board, Executive and Staff were pleased with the performance in achieving the 2016 milestones with only three of the nine milestones being carried over to 2017.

FINANCE

The Company remains in sound financial health, receiving an unqualified audit opinion from external auditors HLB Mann Judd. The statutory financial statements were signed by the Directors on 26 September 2017.

The Company reported a net surplus of $1.2M for the year ended 30 June 2017, and a net asset position of $4.13M. The Company aims to continue to grow its balance sheet to underpin its future growth plans.

Membership revenue contributed $2.17M to the overall gross revenue of $26.9M, the majority of revenue sourced from Government and other grants received for specific projects.

LEGAL & COMPLIANCE

The company remains in good legal standing in relation to all commitments.
GOVERNANCE

Every year there is improvement in the governance of CO2CRC. This has led to an improvement in the effectiveness of the organisation and has led to new memberships.

The company is privileged to have a Board of Directors who each contribute valuable and complementary skills, and exercise critical oversight of the company’s strategy. These contributions are made through Board and Committee meetings and processes. Much of this important work is done with the assistance of four Board sub-committees which deal with specialist issues and provide recommendations to management, and to the Board as required:

› The Finance, Risk and Audit Committee
› The Operations, Safety and Environment Committee
› The Program Advisory Committee, and
› The Appointments and Remuneration Committee.

The Finance, Risk and Audit Committee is strengthened by the addition of two independent experts that bring technical skills and key relationships that support and appropriately challenge the capability brought by company employees and Directors.

BOARD APPOINTMENTS & DEPARTURES

While the company can no longer call on the exceptional services of Greg Lewin AM, who resigned as a Director on 8 March 2017, or Dr Alex Wonhas who resigned on 22 November 2016, it has made two new appointments during the 2017 year:

› Brian Kitney
  (appointed on 1 March 2017)
› Fiona Hick
  (appointed on 8 March 2017)

CO2CRC once again thanks Greg and Alex for their dedicated and outstanding service.

ADMINISTRATION

Due to the closure of the ‘Lab 14’ office site at 30 June 2017 for redevelopment, the company secured a new office space in Carlton, continuing to sub-let from The University of Melbourne. The company’s head office relocated at the start of July 2017 to a stand-alone premises at Argyle Place South. The office provides additional meeting space and capacity for growth.
Tania Constable PSM
MInt Law, MBA, Grad Cert Econ
Ms Constable was chief advisor in the Personal and Retirement Income Division of Treasury, working on tax-related matters. Prior to her work at Treasury, she held various senior resources and energy roles in the Department of Industry. Ms Constable was the Head of Resources for more than four years. She had responsibility for policy advice to the Minister for Industry on oil and gas regulation, exploration and development, and mining activities. During her time Ms Constable also had the privilege of being the Australian Joint Commissioner and Sunrise Commissioner for Australia and Timor Leste leading joint activities on the development of the Joint Petroleum Development Area and Greater Sunrise Project. She was awarded the Public Service Medal in 2014 for outstanding public service in the development of Australia’s Liquefied National Gas and other resource and energy industries.

Special responsibilities:
Chief Executive Officer

Martin Ferguson AM
BEc (Hons)
Mr Ferguson joined the Company as Chairman in September 2014, bringing decades of experience working with the resource sector from a government and private sector perspective.

Mr Ferguson served as the Member for Batman from 1996 to 2013 and held a variety of Shadow Ministerial portfolios including Resources and Energy.

Upon the Rudd Government’s election in December 2007, Mr Ferguson was appointed Minister for Resources and Energy, and Minister for Tourism, positions he held until March 2013.

During his time as Minister, he oversaw the larges ever investments in the oil and gas sector, and the rapid expansion of the mining sector. Post politics, Mr Ferguson has accepted a number of positions in the oil and gas industry, including Group Executive in Natural Resources at Seven Group Holdings, Non-Executive Director of the BG Board, and Chairman to the APPEA Advisory Board.

Special responsibilities: Chairman of the Board, Chairman of Appointments and Remuneration Committee

Tania Constable PSM
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Special responsibilities:
Chief Executive Officer

Greg Lewin AM
Resigned 8 March 2017
BE (Chem), MBA, FREng, FIChemE, FIEAust
Mr Lewin has extensive international business experience and many key industry relationships developed during a distinguished 35 year career with Royal Dutch Shell, culminating in the position of President Shell Global Solutions International.

He is a member of the Order of Australia, Fellow of the Royal Academy of Engineering, a past President of the Institute of Chemical Engineers, and is the current President of the World Chemical Engineering Council. He is also Chairman of WAWA Foundation and Leofwine, non-executive Director of Alinta Energy and Executive Director of Sapphire Global.

Special responsibilities: Member of Finance, Risk and Audit Committee
Tim Walton  
BA, MBA, GAICD  
Mr Walton joined the Company board in November 2014 as a research sector representative. He is currently the Director, Energy Research Initiatives, in Curtin University’s Office of Research and Development in Perth, WA.  

With a professional background in corporate communications, government policy and strategy, Mr Walton has worked in science administration and resources development within the Western Australian Government’s minerals and petroleum, and science and innovation portfolios.  

Previously he has worked in a diverse range of areas including conservation education, natural resources management, policy and regulation, heavy industry and port logistics. Mr Walton is a board member of the Western Australian Energy Research Alliance which oversees a joint venture in offshore oil and gas research engagement between CSIRO, Curtin and the University of Western Australia. The National Geosequestration Laboratory is also managed by the Alliance. He has been a board member of the Centre of Renewable Energy in Sustainable Transport (CREST), the Parker Centre CRC for Hydrometallurgy and the Australian Centre for Natural Gas Management.  

Special responsibilities: Chairman of Operations, Safety and Environment Committee, Member of Appointments and Remuneration Committee

Dr Alex Wonhas  
Resigned 22 November 2016  
Physik Diplom (equiv BSc and MSc), PhD, GAICD  
Dr Wonhas is Executive Director, Energy and Resources at CSIRO with responsibility for a $200 million a year research and development portfolio which aims to provide science and technology solutions that will enhance the value Australia derives from its vast energy and mineral resources while enabling the transition to a lower emissions economy.  

In addition to a strong research and development management background, Dr Wonhas also possesses a deep understanding of the private sector, especially in resources and energy. In his former position as a consultant at McKinsey & Company, Dr Wonhas spent several years advising national and international energy and resources companies on questions of strategy and operations.  

He also currently serves on a range of energy-related advisory committees and boards including the Australian National Low Emissions Coal Council, the Energy and Minerals Institute of the University of Western Australia, and the Federal Government’s Energy White Paper Reference Group.  

Special responsibilities: Chairman of the Program Advisory Committee

Dr James Johnson  
BSc (Hons), PhD  
Dr Johnson is a geologist with 30 years’ experience in mining and mineral exploration, including nine years as a Division Chief at Geoscience Australia. He managed exploration programs for gold and copper from 1997 to 2005. At Geoscience Australia, he managed the five-year $59 million Onshore Energy Security Program from submission through program design and successful implementation. The program stimulated considerable industry investment in exploration and was instrumental in mineral discoveries.  

From 2011 to early 2014, Dr Johnson managed the Australian Government’s Petroleum Precompetitive Geoscience Australia programs. He now has carriage of both the Minerals and Energy Resources programs at Geoscience Australia.  

Dr Johnson was appointed as CEO of Geoscience Australia in 2017.  

Special responsibilities: Member of Program Advisory Committee
Dr Fiona Wild
Bachelor and PhD degrees in Chemistry

Dr Wild has over 20 years’ experience in the oil and gas industry, working in both frontline and corporate roles. During that time she has worked with BP in both the United Kingdom and Australia before moving to BHP Billiton in 2010. In her current role as Vice President, Climate Change and Stability, she leads the design and implementation of BHP Billiton’s climate change strategy and is also accountable for the company’s public policies on sustainability issues.

Special responsibilities:
Member of Appointments and Remuneration Committee

Bill McKenzie
BE (Chem) Hons, FIChemE, CEng, RPEQ, MAICD

Mr McKenzie is a chartered chemical engineer with significant experience in concept development, process engineering, operations management and process safety across oil refining, coal bed methane developments and conventional oil & gas developments.

After a 16 year international career in BP in refining, he joined Origin Energy in 2008 where he led their Oil & Gas Division’s safety, engineering and operations functions before becoming General Manager Technical in 2010. In 2011 he became accountable for APLNG’s Upstream CSG operations as General Manager Qld CSG. In 2013 he joined QGC becoming Vice President Developments in 2015. With the Shell acquisition of BG Group in 2016, Mr McKenzie joined Shell as General Manager QGC Development and is accountable for Shell’s exploration, appraisal and development activities in eastern Australia.

Mr McKenzie is passionate about the contribution engineering can make to improving society and more specifically in how engineering contributes to safety in industry. He has previously served a member of the editorial panel of the Institute of Chemical Engineer’s Loss Prevention Bulletin and has been appointed as a Fellow of the Institute of Chemical Engineers.

Special responsibilities:
Deputy Chairman of the Operations, Safety & Environment Committee

Mick Buffier
BE (Civil) Hons, MBA

Mr Buffier is responsible for Sustainable Development and Industry Relations for Glencore’s coal assets, a role he took on following Xstrata’s merger with Glencore in May 2013.

Mr Buffier has more than 30 years’ experience in the coal mining industry. Appointed Group Executive, Xstrata Coal in March 2009, he was responsible for Corporate Affairs, Government Relations and Sustainable Development across Xstrata’s global coal operations.

From 2002-09, he was Chief Operating Officer of Xstrata’s NSW coal mining operation and, prior to joining Xstrata, held various positions including Mining Engineer, Senior Mining Engineer, Production Manager, Mine Manager and General Manager.

Mr Buffier is the former Chairman and a current Director and member of the NSW Minerals Council (NSWMC), a Ministerial appointee to the NSW Coal Innovation Council, and a Director of the Australian Coal Association Low Emission Technologies Pty Ltd (ACALET).

On an international level, he is an Alternate Director of the World Coal Association (WCA) and an Associate of the International Energy Agency (IEA) Coal Industry Advisory Board (CIAB).

Special responsibilities: Member of Finance, Risk and Audit Committee
Mr Brian Kitney has over 25 years industry experience in oil and gas in Australia and Asia. He has held senior industry positions including Vice President Commercial at Osaka Gas Australia, having spent nine years in the company. As head of the Commercial team, based in Perth, his primary responsibilities included managing the company’s upstream investments in Australia and Papua New Guinea, as well as evaluating new investment opportunities. Prior to joining Osaka Gas Australia, he held the position of Vice President Commodities at JPMorgan Securities Japan, based in Tokyo. Mr Kitney has also held senior positions at Apache Energy Ltd and Mitsui & Co (Australia) Ltd. He was previously a Director of a number of Osaka Gas subsidiaries.

Special responsibilities: Member of the Finance, Risk and Audit Committee

Ms Hick has over 20 years’ experience in the oil, gas and mining industries. Ms Hick is Vice President Health, Safety, Environment and Quality at Woodside Energy. Fiona has been with Woodside for more than 15 years through a range of senior engineering and operations roles including Senior VP Engineering and Australia Business Unit Strategy and Governance Manager. Prior to joining Woodside, she worked for a number of years with Rio Tinto. Fiona has a passion for building high performing teams and regular and open engagement with stakeholders.

Special responsibilities: Member of the Finance, Risk and Audit Committee
MILESTONES
2017/18

1. Successful Stage 3 funding commitment of $20M by Dec 2017

2. Developed evidence-based messaging where CCS is critical to Australia’s future prosperity

3. Industrial sectors have adopted technology neutral position for reducing emissions

4. Stage 3 contracted and technically ready to execute

5. Developed business case for an industrial CCS project

6. Developed successful 10 year rolling R&D plan

7. Secured minimum of one new industrial sector member

8. Approved a high-value R&D project for capture in the industrial sector

9. Developed a Quality Management System

10. Grown capability of the team and organisation to deliver strategic objectives
In 2016 CO2CRC adopted new vision, mission and values statements reflecting the evolving nature of our business.

**OUR MISSION**
Develop carbon capture, utilisation and storage as a socially, technically and commercially viable option for net zero emissions.

**OUR VISION**
To be the safest and most innovative carbon capture, utilisation and storage company in the world.

**OUR VALUES**
Teamwork, Operational Excellence, Integrity, Courage, Transparency.
CO2CRC acknowledges and appreciates the strong relationships it has with industry, community, government, research organisations, and agencies in Australia and around the world.