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CSIRO has world-class laboratories and equipment for experimental and theoretical research on hydraulic fracturing. Image courtesy of CSIRO.
INTRODUCTION

MINING

OIL AND GAS

AUSTRALIAN RESEARCH INSTITUTES, CENTRES & UNIVERSITIES

FURTHER INFORMATION

Australia’s harsh climate, remotely located resources and infrastructure challenges have long tested the nation’s natural resource extractors.

However, these difficulties have led to a unique culture of innovation that has been the hallmark of Australia’s resources industry for more than 100 years, giving rise to research and development (R&D) which is now in demand all over the world.

The nation’s resources sector is massive by any measure. In 2015-16, Australia’s resources and energy-related export earnings exceeded $175 billion.¹

Australia is endowed with an abundant supply of mineral resources, including the world’s largest reserves of lead, nickel, uranium and zinc.

The country also has abundant supplies of conventional and unconventional sources of oil and gas – and only a small proportion has been extracted.

Australian universities and other Government-funded research institutions have developed expertise across mineral, coal, oil and gas exploration, geophysics and geoscience, drilling technologies, surface and underground mining, coal and mineral processing, material handling, transport and logistics, pipeline construction materials and methods, engineering and design, and geotechnical engineering and assessment.

As a result, R&D efforts undertaken on behalf of Australia’s minerals sector and its oil and gas sector have underpinned much of the resources industry’s success.

The nation’s R&D is intertwined with Australia’s culture of collaboration between government, academia and big industry. Of the eight global public resources companies listed in the top 100 global companies in 2016, seven operate in Australia.² In many cases, they partner with local institutions, resulting in world-leading developments which go swiftly to market.

Australia’s resources industry is a unique mix of traditional skills, cutting-edge R&D and environmental sensibilities. The nation’s mining and oil and gas industries are at the forefront of sustainable extraction, recognising that environmental and commercial success is inseparable and embedding this approach from a project’s inception.

This industry capability statement provides an overview of Australian capability in the resources R&D sector, including examples of some of the many Australian research centres and institutions with specialist expertise.

Talk to your local Austrade representative for more tailored advice and information about connecting and partnering with the Australian resources R&D sector.
A large open-cut iron ore mine in Australia’s remote Pilbara region.
INNOVATION ACROSS THE SUPPLY CHAIN

A major strength of Australia’s natural resources R&D sector is the depth and breadth of innovation across the industry value chain. Australian mineral and hydrocarbon explorers and developers work in all parts of the globe, and the profile and reputation of the country’s natural resources R&D sector continues to expand worldwide, largely due to the innovative advances being made across Australia.

Australia’s mining-related research and education infrastructure is a key factor in the continuing competitiveness of the nation’s minerals and metals industry. The infrastructure has been successfully extended to other parts of the world by the University of Queensland, Julius Kruttschnitt Mineral Research Centre (JKMRC), CSIRO, CRCMining (now trading as Mining 3), CRC ORE, Curtin University’s Western Australia School of Mines (WASM), the University of Western Australia, the University of Adelaide, the University of Tasmania (CODES) and Victoria’s RMIT University.

Moreover, cutting-edge R&D by these and other bodies has produced technologies and products that have been commercialised and sold internationally for the past two or more decades. These include the ISA, Albion and Jamieson range of mineral processing and refining technologies developed by MIM Process Technologies (Xstrata Technology, now part of Glencore), Ausmelt (now part of Outotec) smelting and converting technologies, and patented state-of-the-art MillMapper technology and software.

In the private arena, Charles Warman’s unique mineral slurry pump, Ludowici’s revolutionary coal cleaning classifier, Gekko Systems’ equally ground-breaking leach reactor, the Arnall rock bolt, Remote Control Technologies’ machine control and guidance systems, and MICROMINE software represent the historic and contemporary vanguard of innovative Australian mining R&D effectively translated into hundreds of millions of dollars a year of international product sales.

Other names that have taken Australian public-private R&D collaborative outcomes and inserted them commercially into the world’s mineral value chains include Mine Site Technologies, Intellection, GroundProbe, MineWare, Maptek, Mincom (now part of ABB) and Scantech.

Oil and gas sector R&D in Australia also continues to grow its reputation. Internationally recognised publicly and privately funded facilities and institutions are staffed by some of the world’s leading geoscience, engineering and process design experts. Research and development breakthroughs are benefiting the industry across exploration, development, production, processing and transport.

The transfer of deep Western Australian North West Shelf geotechnical engineering expertise to the Gulf of Mexico and North Sea, and creation of the world’s first centre of advanced floating Liquefied Natural Gas technology and engineering knowledge, are examples of the way in which Australian oil and gas R&D has demonstrated leadership in the sector.
RungePincockMinarco’s financial modeling software links individual mine with corporate reporting systems. Image courtesy of RungePincockMinarco.
Australia is a world leader in the production of a number of key mineral commodities. The industry's R&D breakthroughs across mineral and coal exploration, geophysics and geoscience, surface and underground mining, coal and mineral processing, material handling and transport and logistics, are well known and have had significant impact across the globe. Intensive research is in progress at a number of centres of excellence in next generation exploration, mining, ore concentration and pit-to-port systems and processes.

MINING RESEARCH & DEVELOPMENT

Australia is a world leader in the production of a number of key mineral commodities. A strong commitment to R&D underpins this production success. According to the Australian Bureau of Statistics, the country's annual business expenditure on mining-related R&D more than doubled between 2006 and 2012 from $1.8 billion to more than $4.1 billion.3 Natural resources R&D in Australia has directly fostered commercial enterprises that today generate hundreds of millions of dollars of domestic and international sales and employ thousands of workers. This success was largely due to the Commonwealth Scientific and Industrial Research Organisation (CSIRO) – its impact across the country's mining, minerals processing, and oil and gas industries has been pronounced. This influence has spread throughout the world via direct representation in other countries, world leading technologies and products and partnerships with many of the world's mining and energy companies.

Other resource research organisations that have made substantial contributions to the industry include university-based bodies, specialised federally (and industry) funded groups such as Cooperative Research Centres (CRCs), and other centres of excellence established to pursue ambitious goals in increasingly niche areas of the research spectrum.

In mining, Australia's key differentiator is the capability to research the whole mining process, where unit process research is typical elsewhere. The mining value chain is complex and segmented by technical discipline, function and market. Process integration across a mining operation from resource to product, whether the final product is bulk material, concentrate or metal, offers complete optimisation and considerable value enhancement.

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MINING TECHNOLOGY ADVANCES

Automation and robotics

Australia is a world leader in mine automation research and development. The field of automation is drawing increased attention within the global mining industry and for good reason. Automation has the potential to provide a mine with technology advances that impact the four big issues of productivity improvement, maximising plant and equipment utilisation, cost reduction and increased mine worker safety.

In practice, the emerging science of field robotics and intelligent systems is becoming increasingly vital to advances in mine mobile fleet autonomy and semi-autonomous operation in leading mines across the country.

Technology to maximise fleet utilisation is now being merged with breakthroughs in the field of vehicle-to-vehicle (V2V) communications, perception, navigation and vehicle state prediction, to move past increasing operator information systems and into the field of interactive automated operation.

Head of the School of Mechanical and Mining Engineering at the University of Queensland, Professor Ross McAree, explains that understanding how to achieve interactive automated operation is arguably the most important and significant technical barrier to the further development of mining automation technologies.4

The Australian mining equipment, technology and services (METS) industry is well advanced in new and emerging vehicle safety technologies that estimate ‘time to collision’ and other measurable quantities. These cutting-edge technologies can determine unsafe scenarios based on established risk metrics. They are able to minimise mining vehicle related accidents and near misses via detection and response in real time to unsafe behaviour.

Numerous research centres, university departments and collaborative industry partnerships within Australia are investing millions of dollars into the significant potential automation holds.
Case study

Robotics centre advances mining mobile fleets

The Australian Centre for Field Robotics (ACFR) has been instrumental in developing breakthrough technologies and conducting world-leading R&D on the principles and systems of field robotics.

The ACFR is based in Australia at the University of Sydney’s School of Aerospace, Mechanical and Mechatronic Engineering. The centre is dedicated to the research, development, application and dissemination of autonomous and intelligent robots and systems for outdoor operation.

The centre has partnered with major national and international agencies in academia, government and industry and has established a number of leading research centres funded by the Australian Research Council, mining, security and defence, and environmental agencies.

The ACFR focuses on four core research areas – perception, control, learning and complex system management, or what is termed ‘system of systems’. These core areas define the science of field robotics and intelligent systems and are vital to advances in mine mobile fleet autonomy and semi-autonomous operation.

In 2007, Rio Tinto partnered with ACFR to establish a centre for mine automation, expanding the robotics centre’s mining-related research.

acfr.usyd.edu.au

The ACFR is dedicated to the research and development of autonomous and intelligent robots and systems for operation in outdoor environments.
When the Australian Centre for Field Robotics, in collaboration with Rio Tinto, established the Rio Tinto Centre for Mine Automation (RTCMA), the vision was to develop and implement a fully autonomous, remotely operated mine.

RTCMA’s work so far has resulted in a number of major research advancements targeted at improving the safety and productivity of autonomous operated mining sites. One project has created autonomous mining drill rigs that can bore holes into the ore body efficiently and reliably. This autonomous capability also allows the operator of the rig to be located in a much safer area of the mine site - or indeed anywhere on the planet. This increases the safety of the operator, and also greatly improves drilling precision in operations.5

With more mining taking place in remote parts of the world, tomorrow’s mines will increasingly rely on remote monitoring and control, with employees running the mines from cities thousands of kilometres away.

acfr.usyd.edu.au/rtcma/index.shtml
Australian companies are at the forefront of major advances in technology that are expected to improve discovery rates, make resource modelling more efficient, and enhance resource estimation workflows.

Australian software developers are leveraging modern computer power to better visualise exploration data, as well as manipulate, analyse and fully utilise the data from an array of state-of-the-art exploration tools.

Miners have access to technologies that use simulation to assess a range of scenarios on the mining environment both before and during mining. With this information, they can create auto-generated designs, use simulation engines to assess any number of economic and physical parameters, and create multiple production schedules.

During the feasibility and planning phase, companies are successfully using cycle analysis to obtain risk profiles and choose the best option for their particular financial requirements. Increased R&D investment has taken this same sophisticated analysis technology and migrated it into the production environment, creating significant potential for improved efficiency and profitability.

GeoMole’s cross-border collaboration leads to underground imaging

An electromagnetic imaging technique could have a big impact on brownfields underground minerals exploration and production. The GeoMole Borehole Radar provides highly detailed orebody and structural delineation information for exploration, mine planning and geotechnical applications.

GeoMole has patent coverage for its unique monostatic ‘single stick’ radar, as well as its fixed-wing time domain electromagnetic survey technique and OTR survey process. These patents grew out of research and development work linking the Sydney University Geophysical Imaging Lab, CRCMining (now trading as Mining3) and the Stellenbosch University Electronic Engineering Electromagnetic Group in South Africa. The GeoMole Borehole Radar is a means of ‘seeing’ through solid rock mass for up to 50 metres around a borehole. It can allow hard-rock mining engineers to gain an accurate view of the location of an orebody to increase the accuracy of mine planning and ultimately improve safety and productivity.

The technology has been proven around the world and is being used in hard rock diamond, platinum, gold and nickel mines in Canada, South Africa and Australia.

g geomole.com
mining3.com
Modelling of thickener technology has delivered ongoing benefit to mining operations. Image courtesy of CSIRO Mineral Resources Flagship.
MINERAL PROCESSING

Australian companies and research organisations are responsible for many of the industry innovations and advances being adopted across the mineral processing technology industry globally. Remoteness of mine sites, plus the scarcity of some resources, have contributed to Australia’s enormous advances in mineral processing technology and services.

AMIRA, formerly the Australian Mineral Industries Research Association, recorded that a total research commitment of about $13 million went into mineral processing in 2016.6

A global leader and partner of choice for innovation in mineral processing and geometallurgy research, the Julius Krutschnitt Mineral Research Centre (JKMRC) has been operating for the last 50 years, pursuing the development of practical technical solutions for large-scale mining and minerals industry challenges. It is the largest Australian research centre in its field and collaborates with mining and mineral processing research groups worldwide through projects sponsored by most of the major mining companies as well as equipment and technology providers.

Mineral-processing research creates commercial success story

Technology created by an Australian Government initiative at Perth’s Curtin University is one of the country’s great R&D success stories. The Government’s Cooperative Research Centre for Spatial Information (CRCSI) in collaboration with scientists at Curtin University, developed technology that uses laser-scanners to analyse wear and tear on heavy mineral-processing equipment.

The research began in 2004 and collaborators founded a company, Scanalyse, to commercialise their technology. Conventional methods of measuring equipment wear involve considerable downtime, generate a limited number of single-point data measurements and are relatively inaccurate. They also require site personnel to enter a hazardous environment for maintenance.

Scanalyse’s MillMapper and CrusherMapper, which measure wear in grinding mills and gyratory crushers, provide fast, safe, highly accurate methods of detecting wear and predicting optimum replacement rates of liners and mantles. These products are now in demand across the globe and as a result Scanalyse has expanded into Brazil, Chile and the United States.

In 2013, minerals and metals processing company Outotec bought Scanalyse. The global reach of Finnish company Outotec signals further rapid growth for the mineral-processing technology developed by Scanalyse.

outotec.com/services/maintenance-services/condition-monitoring
A 3D model of the grinding mill liners enables operators to identify high-wearing zones which can cause equipment failure. Image courtesy of Outotec.
More than 80 per cent of Australia’s oil and gas resources exist in deep, remote, offshore areas. Realising the full potential of these remote resources has relied – and continues to rely – on advances in exploration, infrastructure and project development, transportation and maintenance.

Australia’s oil and gas industry has a reputation worldwide for overcoming challenges related to the remote location of its resources, inherent technical challenges and risks, and mounting environmental and social pressures.

These difficulties have driven a unique culture of innovation that has been the hallmark of Australia’s oil and gas industry, from drilling the first offshore well in the Bass Strait in 1965 to the nation’s modern-day coal seam gas (CSG) boom.

Australia has abundant supplies of conventional and unconventional sources of oil and gas and only a small proportion has been extracted.

Australia’s supplies of petroleum and other types of conventional gas remain rich sources of opportunity. However, unconventional sources, such as coal seam gas (CSG), tight gas and shale oil, also offer great opportunities for growth, expanding the scope for R&D partnership opportunities.

Oil and gas R&D scientists in Australia focus on exploration, development, production, processing and transport and sustainability through internationally recognised publicly and privately funded facilities and institutions staffed by some of the world’s leading geoscience, engineering and process design experts.

The need to maintain the structural integrity of offshore pipelines running across hundreds of kilometres of seabed has driven cutting-edge R&D and technical solutions now being applied around the world. These same solutions for Australia’s offshore pipelines are seen as integral to achieving a vision of ‘platform-free fields’, where subsea technologies replace traditional oil and gas platforms in the production of gas from resources up to 300 kilometres offshore at depths exceeding one kilometre.

A similar focus in Western Australia on advancing floating LNG (FLNG) and floating production, supply and operation (FPSO) technologies and knowledge is expected to establish Perth as an international centre of excellence in research and development in offshore oil and gas production and processing using floating systems. Particular emphasis will be put on developing technology that supports floating systems design and improves productivity. These advances will be required as Australian projects move into deeper water to recover previously stranded gas reserves.

Perth is the Australian hub for oil and gas activity, with a special focus on offshore developments, hosting Australian head offices for four of the top seven international oil companies, more than 350 international companies, and a growing number of smaller companies servicing the oil and gas sector.

As a global hub for FLNG systems design and research, Perth has established clusters of offshore engineering expertise in such areas as:

- metocean conditions, offshore structures, offshore hydrodynamics, offshore geotechnics, offloading;
- offshore production engineering, including gas processing of floating structures, flow assurance at subsea, subsea processing, water and waste management; and
- offshore asset management and operations research, such as remote operations and communications, asset integrity, operations optimisation, risk management, as well as knowledge and testing facilities.
Seismic exploration on Australia’s North West Shelf. Image courtesy of Woodside Energy Ltd.
OIL AND GAS TECHNOLOGY ADVANCES

Within the Australian oil and gas industry, centres of excellence and clusters of suppliers, researchers and tier one industry players are working together to provide an environment which is conducive to innovation and commercialisation of bespoke solutions and technologies. The Australian Government, industry and universities are fostering oil and gas industry centres of excellence across Australia, and particularly within Western Australia where Perth is a natural whub for deep offshore and FLNG operations and maintenance.

High Speed Drilling Simulator

In Western Australia, Curtin University's petroleum engineering researchers are using a high-speed drilling simulator to replicate the increasingly popular industry method of drilling deep boreholes in tight gas formations and shales.

The research is being undertaken with the aim of improving efficiency in hard rock drilling but could be extended for shale gas drilling and fracturing. The simulator is capable of performing normal, over-balanced and under-balanced drilling, as well as simulating the use of different mud types and drilling through hard rock using diamond-impregnated bits.

The drilling simulator has been designed with a drilling lid mounted on a True Triaxial Stress Cell (TTSC), which is capable of simulating drilling at typical bottom hole conditions. The TTSC has been successfully used in hydraulic fracturing experiments on samples as small as 50mm to understand the response of tight sandstones and gas shale formations to drilling. The TTSC can monitor the magnitude of stress and strains on the sample and measure torque and drag systems, two important drilling operation parameters.

Subsea Pipelines Collaboration Cluster

Six Australian universities (The University of Western Australia, Curtin University of Technology, The University of Queensland, Monash University, The University of Sydney and Flinders University) and CSIRO’s Oceans and Atmosphere Flagship came together in 2008 to establish the Subsea Pipelines Collaboration Cluster. Based in Western Australia, its aim has been to provide engineering solutions for safe and economic design and operation of subsea pipelines in Australia’s offshore frontiers. The work has already resulted in significant advances in the understanding of subsea pipeline technology. Key achievements include establishing new numerical models and software for analysing the stability of offshore pipelines, novel methodologies for economic and safe pipeline design, and the commissioning of world-class experimental and pipeline testing facilities. These have spawned specialist testing and consultancy services for the offshore pipeline industry.

Results from the cluster’s research have been incorporated into new generation subsea natural gas projects such as the $43 billion Gorgon project in north-west Western Australia, while new methods used to test pipeline attributes have underpinned designs and technologies used elsewhere in Australia and the world.

Case Study

High-speed simulator may improve O&G recovery

In Western Australia, Curtin University’s petroleum engineering researchers are using a high-speed drilling simulator to replicate the increasingly popular industry method of drilling deep boreholes in tight gas formations and shales.

Professor Vamegh Rasouli, of Curtin’s Department of Petroleum Engineering, says the research aims to make hard rock drilling more efficient but could be extended to shale gas drilling and fracturing.

The simulator has been designed with a drilling lid mounted on a True Triaxial Stress Cell (TTSC), which is capable of simulating drilling at typical bottom hole conditions.

‘During testing, three independent stresses can be applied to the sample to simulate real in-situ field stress conditions,’ Professor Rasouli says.

‘A significant feature of the rig is its ultra-high speed rotation which can move at up to 10,000 rpm to simulate hard rock drilling in tight sandstone.

‘A drilling fluid of any type can be circulated in the simulated borehole, similar to a field situation, to study its effect on drilling performance.’

Meanwhile, work at Perth’s Centre for Offshore Foundation Systems (COFS) is equipping both geoscientists and offshore engineers with a better understanding of changing subsea conditions. The centre, which has become the largest international subsea research organisation of its kind, was originally established to investigate the unique composition of seabeds on the North West Shelf and address the shallow water challenges then faced by the subsea industry.

Its sophisticated modelling and applied research has improved the way offshore infrastructure is designed and has influenced the design of subsea pipelines around the world.

COFS, established by the University of Western Australia (UWA) with support from the oil and gas industry, has one of the world’s largest teams of internationally recognised researchers and consulting engineers in offshore geomechanics. The centre won the 2014 AIRG Medal for Australasian Major Industry Technological Innovation for development of the O-Tube program, a world-first facility which rapidly circulates 60 tonnes of water to simulate underwater conditions during tropical cyclones. The Australasian Industrial Research Group (AIRG) said the cutting edge O-Tube program had allowed for significantly improved designs of offshore oil and gas pipelines while ensuring cost savings for the Australian offshore oil and gas industry.9

A UWA in-house technical team led by Winthrop Professor Liang Cheng, of the School of Civil, Environmental and Mining Engineering, and Winthrop Professor David White of COFS, designed and built the program’s large and mini O-Tubes – oval recirculating flumes through which water is rapidly circulated, simulating extreme underwater wave and current conditions.

‘The O-Tube program uses engineering solutions to optimise the competitiveness of industry while ensuring the safety of our offshore infrastructure,’ said Professor John Dell, Pro Vice-Chancellor and Executive Dean of UWA Faculty of Engineering and Mathematics Sciences. ‘It is not only a great example of how UWA’s research innovation changes how companies globally do engineering, but also of our work for the wider community and the environment. These are the kinds of partnerships that benefit everyone.’

Former AIRG President and current AIRG Government Liaison and Strategy Officer, Leonie Walsh said the JIP project and O-tube program provided significant economic benefits to Woodside and its partners in the project. ‘It is a great demonstration of industry-academia collaboration with successful translation of the research outcomes,’ she said.10

Woodside has said the project is a practical example of how embracing technology can generate real cost savings for oil and gas companies. Gerry Flaherty, asset development manager for the Australian operations of another industry partner, Chevron, said the project helped give the industry a better understanding of pipeline reliability and helped reduce stabilisation costs for subsea pipeline owners.11 The O-Tube had been used for studies to optimise pipeline design for Chevron’s Wheatstone Project, providing significant savings.

The world’s largest offshore foundation systems research organisation

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O-Tube technology revolutionises offshore pipeline design

The Centre for Offshore Foundation Systems (COFS) in Perth has made offshore oil pipelines safer and cheaper by equipping engineers with a better understanding of changing subsea conditions.

COFS is a collaboration between the University of Western Australia (UWA) and Australian oil and gas industry partners including Woodside and Chevron Australia.

Its O-Tube program is a world-first facility which rapidly circulates 60 tonnes of water to simulate underwater conditions during tropical cyclones. The development helps industry participants keep offshore infrastructure safe and, as a result, realise significant cost savings.

‘These are the kinds of partnerships that benefit everyone’

Professor John Dell, Pro Vice-Chancellor and Executive Dean of UWA Faculty of Engineering and Mathematics Sciences

cofs.uwa.edu.au

The centre won the 2014 Australasian Industrial Research Group’s (AIRG) Medal for Australasian Major Industry Technological Innovation for its O-Tube program. The AIRG said the program had significantly improved designs of offshore oil and gas pipelines while ensuring cost savings for the Australian offshore oil and gas industry.
Floating Systems
A focus in WA on advancing floating LNG (FLNG) and floating production, supply and operation (FPSO) technologies and knowledge is expected to establish Perth as an international centre of excellence in R&D in offshore oil and gas production and processing using floating systems. Particular emphasis will be put on developing the technology that enables floating systems and enhances productivity improvements that will be required as Australian projects move into deeper water, recover previously stranded gas reserves and increase reliance on FLNG technology.

A new centre of FLNG excellence will help the state capture world-class expertise, build further high-value capability and skills in the Australian workforce, leverage Australia’s investments in FLNG and enhance future LNG export competitiveness. It will deliver expertise on projects and in research areas including offshore engineering and production engineering, offshore asset management and operations research, and socio-economic and health, safety and environmental impact. Integrated research will also address the optimisation of offshore systems’ operations, productivity, logistics and maintenance outcomes.

Coal Seam Gas Alliance
In Queensland in 2011, industry and the science community came together to launch a groundbreaking research alliance to support sustainable development of the coal seam gas industry. Founded by CSIRO and Australia Pacific LNG (a CSG to LNG joint venture between Origin, ConocoPhillips and Sinopec) the Gas Industry, Social and Environmental Research Alliance (GISERA) has been hailed as an industry first. Co-venturers now include QCL, AGL, Origin and Santos, with funding also provided from the federal and New South Wales governments.

GISERA’s focus is research in five key social and environmental areas: groundwater and surface water, biodiversity, land management, the marine environment and socio-economic impacts. The $24 million venture was initially aimed at Queensland’s CSG-LNG industry but has expanded its scope to benefit other gas sector developments in Australia and offshore.

CSIRO is also leading industry research into new ways to liquify or transform natural gas so it is easier to use and transport. New generation gas-to-liquid processes are being targeted, with potentially significant implications for global use of the fuel.

Natural Gas Research
Working with Australia’s biggest gas producers, CSIRO research projects are aimed at developing, testing and demonstrating new catalysts to improve the efficiency of natural gas processing; making the conversion of natural gas to synthetic fuels and chemicals more economically feasible by developing processes that reduce plant size and cost; improving gas separation technologies for oxygen, hydrocarbons and carbon dioxide for process efficiency improvements and greenhouse gas mitigation; developing a concentrated hydrogen supply from gas-to-liquids processes for fuel cell and hydrogen economy applications; and researching plastics production from biologically-derived materials such as eucalyptus oil.

The work is also targeting new purification steps to produce cleaner LNG, potentially lowering processing costs.

CSIRO gas processing and conversion research facilities and laboratories are regarded as being unique in the Southeast Asian region. The organisation has also built Australia’s first synthetic fuels research facility.
Case Study

CSIRO collaboration results in pipeline protection technology

Subsea oil and gas pipelines deteriorate over time due to a range of structural and operational issues including manufacturing defects or degradation caused by exposure to harsh marine environments.

Researching corrosion on pipelines, a CSIRO-PETRONAS team developed an adhesive composite wrap, named ProAssure™ Wrap Extreme, a revolutionary technology for the repair, rehabilitation and maintenance of subsea oil and gas pipelines, which functions as an overwrap to protect and repair damaged sections of pipelines and is able to restore them to their original design specification for pressure containment. This means minimal interruption to production and increased lifespan for compromised pipelines.


ProAssure™ Wrap Extreme technology. Image © Petronas Nasional Berhad (PETRONAS) 2012
Curtin University’s high-speed drill and simulator signal lower drilling costs

Curtin University’s Geomechanics Research Group has developed a high-speed drill which has the potential to significantly lower the cost of drilling into hard rock deep below the Earth’s surface.

The drill, used in conjunction with the True Triaxial Stress Cell simulator also developed at Curtin, signals an advance in economic hard-rock drilling, according to Professor Brian Evans, Pro Vice-Chancellor of Curtin’s Faculty of Science and Engineering.

Scientists at Curtin have also developed a new high-speed flow loop for experiments on the transport of drill cuttings up the gas pipeline.

The high-speed drilling and cuttings transport research for the Deep Exploration Technologies Cooperative Research Group is complemented on the petroleum side by a project for Chevron.

‘If we can quantify the cuttings in any fluids such as water or gas, then we have a more precise prediction of what solids need to be filtered from the flow stream and when to predict changes to operations as a result of unexpected solids arriving at the gas-processing terminal’

Professor Brian Evans, Pro Vice-Chancellor of Curtin University’s Faculty of Science and Engineering
Gas liquids lab at CSIRO Synthetic Fuels and Catalysis Research Facility, Australia’s first fully automated, around-the-clock, synthetic fuels research centre. Image courtesy of CSIRO
GOVERNMENT
Commonwealth Scientific and Industrial Research Organisation (CSIRO)

Applied research into solutions for the exploration, mining, minerals processing, metal production and oil and gas industries.

CSIRO, the Commonwealth Scientific and Industrial Research Organisation, is Australia’s national science agency. It is one of the largest and most diverse scientific institutions in the world with more than 55 sites throughout Australia and overseas. CSIRO works with leading scientific organisations around the world, and is recognised internationally for the quality of its research. It is ranked in the top 1 per cent of scientific institutions worldwide in 15 of 22 research fields.14

csiro.au

CSIRO Business Units
CSIRO Business Units mission is to create benefit for Australia through impactful science and innovation. It is through these Business Units that CSIRO invests in an evolving portfolio of businesses.

The Mineral Resources Business Unit delivers science and technology options for the discovery and efficient development of Australia’s $1 trillion mineral resource endowment.

The Energy Business Unit delivers solutions that will enhance Australia’s economic competitiveness and regional security while enabling the transition to a lower emission energy future.

The Oceans and Atmosphere Business Unit aims to boost Australia’s prosperity and wellbeing through solutions that enable the sustainable economic, social and environmental use of Australia’s marine estate.

csiro.au/strategy

csiro.au

COOPERATIVE RESEARCH CENTRES
The Cooperative Research Centre (CRC) program provides businesses with an opportunity to pursue public–private research collaborations which aim to achieve commercial outcomes. CRCs linked to the resources and energy sector have undertaken collaborations across the world and have involved leading Australian and international commercial players and Australia’s best research institutions. CRC’s active in 2016-17 include:

Energy Pipelines CRC
The major challenge to be tackled by the Energy Pipelines CRC is to provide the Australian energy pipeline industry with the technology necessary to extend the life of the existing ageing natural gas transmission network, and to build the new networks necessary to support increased demand for natural gas and the transmission of the new energy cycle fluid hydrogen and carbon dioxide.

epcrc.com.au
CRC for Optimising Resource Extraction

Over the last 30 years, the average grade of mined Australian ore bodies has halved, while the waste removed to access the minerals has more than doubled. This in turn has led to an 80 per cent increase in energy consumption across mining operations. The CRC for Optimising Resource Extraction (CRC ORE) is addressing this challenge by facilitating a transformation of the methods used by Australia’s mining and minerals industry to evaluate and extract mineral deposits. This research includes the capability to comprehensively characterise, model and evaluate the economic and environmental impact of improved mineral-extraction methods.

crcore.org.au

Deep Exploration Technologies CRC

The Deep Exploration Technologies CRC (DET CRC) was established to address the most significant challenge to the future of the minerals industry in Australia, i.e. the reduction in the mineral resources inventory due to high production rates and low mineral exploration success. Mineral resources constitute around 50 per cent of the nation’s exports. However 80 per cent of the nation’s mineral production is from mines discovered over 30 years ago. The vast majority of Australia’s existing mines are located where prospective basement rocks outcrop.

To ensure the future of the minerals industry, new technologies are being developed to explore to greater depths in the vast areas of Australia’s deep, covered prospective basement.

detcrc.com.au

CRC for Contamination Assessment and Remediation of the Environment

The CRC for Contamination Assessment and Remediation of the Environment (CRC CARE) conducts research on the remediation of soil, surface and ground water and air at industrial sites. The research focuses on environmental contamination assessment and radiation of mining and oil and gas industries.

crccare.com

UNIVERSITY PARTNERSHIP R&D FACILITIES IN AUSTRALIA

Australia has a number of public facilities that focus on resources and energy R&D, including:

ARC Centre of Excellence in Ore Deposits (CODES)

Formed in 1989 at the University of Tasmania, the Centre has grown substantially over the years and is now widely regarded as a global leader in ore deposit research. It is home to 51 highly qualified research staff and 120 postgraduate students, further cementing its position as the largest university-based team of ore deposit researchers in the world.

CODES undertakes multidisciplinary research, in close association with industry, on ore deposit location, formation, discovery and recovery including: igneous petrology, geochemistry, melt/fluid inclusions and magma genesis, hydrothermal systems, volcanology, structure, tectonics geophysics and geometallurgy.

utas.edu.au/codes

Australian Centre for Geomechanics

The Australian Centre for Geomechanics (ACG) was established in 1992 to promote research and education in the field of geomechanics for Australia’s extractive resource industries. The aim is to ensure safer working environments for all resources (human and capital) and to add value to this most important of Australian industries.

acg.uwa.edu.au

Australian Geophysical Observing System

AuScope’s Australian Geophysical Observing System has built the integrated infrastructure that facilitates maximum scientific return from the massive geo-engineering projects that are now being considered, such as deep geothermal drilling. In effect this builds a platform for treating these as mega geophysical science experiments.

AuScope AGOS infrastructure enables collection of new baseline data including surface geospatial and subsurface imaging and monitoring data, thereby providing for better long-term management of crustal services, particularly in Australia’s energy-rich sedimentary basins.

auscope.org.au/Australian-geophysical-observing-system-agos
Australian Resources Research Centre

The Australian Resources Research Centre (ARRC) was opened in November 2001, when nearly 200 research and support staff from CSIRO and Curtin University of Technology came together with the vision of creating a petroleum and minerals centre of expertise for the Southeast Asian region.

ARRC was established to:

• enhance petroleum and mining exploration and extraction research and development in Western Australia
• partner and work with industry
• respond to changing industry requirements
• enable significant activities to be carried out with Cooperative Research Centres
• recruit research staff.

arrc.net.au

Centre for Exploration Targeting

The CET is a unique research institution focusing on a wide range of economic geology-related studies, which successfully combines pure science and applied research from an industry point of view.

cet.edu.au

Centre for High Definition Geophysics (CHDG)

The CHDG is investigating how seismic technologies can detect mineral resources such as gold, base metals and coal and also locate underground water reserves. The overall aim is to combine a range of geophysical techniques to characterise and map the earth’s properties and near surface resources in general as well as delineate ore bodies at greater depths to increase the effectiveness of exploration and assist the geotechnical sector for large infrastructure developments. CHDG applies geophysical techniques to imaging hard and mineralised terrain mainly using seismic techniques.

geophysics.curtin.edu.au/research/chdg.cfm

Melbourne Energy Institute

Melbourne Energy Institute is an access point for industry, government and community groups seeking to work with leading researchers in the following areas: new energy resources; developing new ways to harness renewable energy; more efficient ways to use energy; securing energy waste and framing optimal laws and regulation to achieve energy outcomes.

energy.unimelb.edu.au

Minerals Research Institute of Western Australia (MRIWA)

WA Government funded agency that provides funding for mineral research.

The Minerals Research Institute of Western Australia is a statutory body established by the WA government to encourage development of the mineral industry within the State.

mriwa.wa.gov.au

Energy & Minerals Partnership

University of Western Australia (UWA) partners with Curtin University on a range of projects including the National Geosequestration Laboratory (NGL) Project, the Australian Centre for Natural Gas Management, WA Energy Research Alliance, and the Ten Korean Universities collaboration.

Research themes include:

• Natural gas: developing a global transition fuel
• Remote operations: technology and innovation driving productivity
• In The Zone: international and regional development

emi.uwa.edu.au/partners/curtin-university

waera.com.au

Significant Private R&D Investors

Mining

There has been significant industry investment into mining R&D facilities in Australia focused on exploration, mining technologies and training. A few of these leading facilities are included here:

Rio Tinto Centre for Mine Automation

The Australian Centre for Field Robotics (ACFR) at the University of Sydney has established a major new Centre for Mine Automation. Rio Tinto, a global mining company, has committed $21m of funding for an initial period of five years for this new Centre. The aim of the Rio Tinto Centre for Mine Automation (RTCMA) is to develop and implement the vision of a fully autonomous, remotely operated mine.

The Centre was commissioned in August 2007. Since its launch, a world-class research and technical team of more than 20 talented engineers have joined the Centre. These individuals, from locations spanning six continents, are involved in the research, development and deployment of technology for a fully autonomous, remotely operated mine.

acfr.usyd.edu.au/rtcma
Anglo American investment into the Centre for Sustainable Comminution

Anglo American has invested $10 million over five years in the Centre for Sustainable Comminution at The University of Queensland, managed and run by the Julius Kruttschnitt Mineral Research Centre (JKMRC) in Brisbane. The centre is among five Anglo American funded centres of excellence all managed and run under the miner’s Global Comminution Collaborative (GCC) banner, from JKMRC.


BHP Global Technology Centre

Located within the Australian Resources Research Centre at Technology Park, the Perth Technology Centre (PTC) is a global technology and innovation hub for BHP.


BASF Mining Research Centre

Chemical company BASF established its global mining research and development centre in July 2012 at the Australian Minerals Research Centre (AMRC) in Perth, Western Australia. At the new facility, BASF scientists study specific innovation needs for mineral processing and metal production, to help reduce energy and reuse water at mines in Australia and around the world.


IBM Natural Resources Solution Centre

IBM’s Natural Resources Solution Centre in Western Australia offers state-of-the-art facilities designed to help Australia’s mining and petroleum industries work smarter. The mission of the Natural Resources Solution Centre (NRSC) is to promote smart operations for petroleum and mining businesses in Australia. The NRSC supports client briefings, research and development, joint solution developments and proof-of-concept development with clients. Located within IBM’s Hay Street offices in Perth, the NRSC leverages IBM’s annual global R&D budget of US$6 billion, which includes investment in the development of Smarter Planet natural resources sector solutions such as IBM’s Intelligent Oilfields. The NRSC will coordinate and support client driven research among clients, Australian research institutions, IBM research scientists and centres.


BHP Maintenance Centre of Excellence (MCoE)

BHP Billiton has created a maintenance centre of excellence which will operate across three hubs in Adelaide, Brisbane and Perth.

The MCoE has an ambitious remit to redefine the way BHP Billiton executes maintenance around the world.


OIL AND GAS

Chevron’s Perth Global Technology Centre

The Global Technology Centre in Perth is the local entity of Chevron’s Energy Technology Company and maintains close links with the technology hubs in the United States.

The centre provides services in research and development in areas such as health, environment and safety; process, analytical and catalysis; earth sciences, technical computing; facilities engineering; reservoir and production engineering and drilling and completions.

The Perth Global Technology Centre provides an intellectual hub supporting a key growth market for Chevron. The Centre employs more 130 subject matter experts and maintains a strong alliance with Australian universities and industry research partners.

The Centre has collaborated with Chevron Australia and industry partners to develop new geophysical solutions and provide consulting services.
These include industry-leading 3D seismic imaging which improves hydrocarbon detection at unparalleled depths to assist in ongoing exploration in the region, validation of complex reservoir models using seismic technology to improve field reserve estimates, and cutting-edge seismic algorithms that compensate for complex shallow geology to improve and optimise well placement.

chevronaustralia.com/docs/default-source/publications/perth_global_tech_centre.pdf?sfvrsn=0

KPMG Global Oil & Gas Centres

KPMG has 12 dedicated Oil & Gas Centres of Excellence in key locations around the world, one of which is in Perth. Working as part of KPMG’s global network, these centres transfer knowledge and information globally, quickly, and openly, share observations and insights, debate new emerging issues and discuss what is on clients’ management agendas. The centres also produce regular surveys and commentary on issues impacting the sector, business trends, changes in regulations, and the commercial, risk and financial challenges of doing business.


OTHER MINING RESEARCH PARTNERSHIPS

Centre for Mining, Energy and Natural Resources Law (University of Western Australia)

Education and research into legal issues in the resources sector.
law.uwa.edu.au/research/cmenrl

Centre for Nanoscale Science and Technology (Flinders University)

Research into analysing the properties of liquid/gas and liquid/solid interfaces.
flinders.edu.au/science_engineering/research/nanoscale

Mining3

Mining3 (formerly CRCMining) is the pre-eminent, industry-driven centre for global mining research and innovation.
They have a proven track record of collaborating and partnering with leading mining companies, original equipment manufacturers and universities to deliver transformational research and innovations that maximise mining productivity and enhance resource utilisation, safety and sustainability.
mining3.com

Resource Technologies Research (Murdoch University)

Research areas include minerals, hydrocarbons, biomass including waste, wind, wave and solar energy and water.
murdoch.edu.au/Research-capabilities/Looking-for-research

SMART Infrastructure Facility (University of Wollongong)

The SMART Institute carries out research activities in the mining and oil and gas sectors by contributing to their transport and logistic requirements. Results of research activities can be applied in the mine planning and approval, infrastructure development, excavation, blasting, mass transport and transport and shipping phases of the mining value chain.
smart.uow.edu.au

ARC Centre of Excellence for Geotechnical Science and Engineering (University of Newcastle, University of Western Australia, University of Wollongong)

The ARC Centre of Excellence for Geotechnical Science and Engineering is focused on two phases of the mining value chain, mine planning and approval and infrastructure development.
cgse.edu.au

Energy and Minerals Institute (University of Western Australia)

Undertakes research into energy, mining and exploration in collaboration with industry across METS and oil and gas. Includes Chairs in leadership, petroleum geoscience and gas-process engineering sponsored by Chevron and Woodside. Research activities results can be applied in all phases of the mining value chain, with key expertise across exploration, mine planning and approval, environment, infrastructure, processing/production and mass transport.
emi.uwa.edu.au

Research in Energy and Mineral Economics (Curtin University)

Research and collaboration with resources sector in economics, finance and business.
business.curtin.edu.au/our-research/programs-of-research/energy-and-mineral-economics

Australian Resources Research Centre

Research and development of petroleum and mining extraction in Western Australia through a joint initiative of the WA Government, CSIRO and Curtin University.
arrc.net.au
Newcastle Institute for Energy and Resources (University of Newcastle)

Research activities can be applied in all phases of the mining value chain. To address all research areas, several research centres and institutes were established including the Priority Research Centre for Advanced Particle Processing, the Priority Research Centre for Frontier Energy Technologies and Utilisation and the NSW Institute for Frontier Geosciences.


Institute for Mineral and Energy Resources (University of Adelaide)

Conducts research in petroleum engineering, mining engineering, petroleum and minerals, geoscience and geothermal energy.

[adelaide.edu.au/imer](adelaide.edu.au/imer)

Defence and Systems Institute (University of South Australia)

DASI is Australia’s largest provider of leading-edge research and postgraduate education in systems engineering, the design and integration of large and complex defence systems, and the modelling and simulation of engineering systems.


Sustainable Minerals Institute (University of Queensland)

World’s leading research institute dedicated to finding knowledge-based solutions to the sustainability challenges of the minerals industry.

The Sustainable Minerals Institute is made up of six inter-disciplinary centres. Each centre works to apply the principles of sustainable development to the minerals industry. The six research centres include the Centre for Social Responsibility, Minerals Industry Safety & Health Centre, Centre for Mined Land Rehabilitation, Centre for Water in the Minerals Industry, WH Bryan Mining & Geology Research Centre and Julius Kruttschnitt Mineral Research Centre.

[smi.uq.edu.au](smi.uq.edu.au)

Australia-China Joint Research Centre for Minerals, Metallurgy and Materials (University of New South Wales)

The main core research strengths for the centre are in mining engineering, bulk material handling and metal production. This centre provides a platform for fostering interdisciplinary collaborations between Australia and China to meet the challenges in the mineral, metallurgy and material industries which are of paramount importance to Australia and China.

[acjrc-3m.unsw.edu.au](acjrc-3m.unsw.edu.au)

Cooperative Research Centre for Optimising Resource Extraction - CRC ORE (University of Queensland)

Undertakes research, in collaboration with the mining industry, into innovative techniques to upgrade ore between mining and concentration in response to declining ore grades in Australia.

[crcore.org.au](crcore.org.au)

The Australian Centre for Sustainable Mining Practices (University of New South Wales)

Research focussed on new mining practices, and development and application of technologies and systems for sustainable mining initiatives.

[acsmp.unsw.edu.au](acsmp.unsw.edu.au)

Institute for Sustainable Futures (University of Technology Sydney)

The Institute carries out research activities in the METS sector, particularly related to iron ore, gold, copper and lithium.


Priority Research Centre for Complex Dynamic Systems and Control (University of Newcastle)

The Centre specialises in the analysis, design, optimisation and control of dynamic systems. The Centre works on complex systems to try to optimise their performance.

RESOURCES RESEARCH & DEVELOPMENT

ARC Centre of Excellence in Ore Deposits (University of Tasmania)

CODES undertakes multidisciplinary research in close association with industry on ore deposit location, formation, discovery and recovery including: igneous petrology, geochemistry, melt/fluid inclusions and magma genesis, hydrothermal systems, volcanology, structure, tectonics geophysics and geometallurgy.

utas.edu.au/codes

Institute for Supply Chain and Logistics (Victoria University)

The Institute serves a wide range of private and public sector clients throughout Australia and overseas, providing for traditional logistics disciplines in transportation and warehousing, through to sophisticated supply chain functions, including procurement, process and systems planning, and supply chain strategy. Recent developments at the Institute have extended its capability to incorporate critical areas such as infrastructure development, policy and planning frameworks, and risk and sustainability assessment.

vu.edu.au/institute-for-supply-chain-and-logistics-iscl

OTHER OIL AND GAS RESEARCH PARTNERSHIPS

Western Australian Energy Research Alliance (WA:ERA)

The Western Australian Energy Research Alliance (WA:ERA) is an alliance between the leading research institutions of CSIRO, Curtin University and the University of Western Australia, combining state-of-the-art facilities and multidisciplinary expertise to deliver technology-based solutions to the global energy industry. Specialising in gas technologies, geosciences and subsurface technologies. Industry alliance partners are Woodside, Chevron and CGG Veritas.

waera.com.au

Centre for Mining, Energy and Natural Resources Law (University of Western Australia)

Education and research into legal issues in the resources sector.

law.uwa.edu.au/research/cmenrl

Centre for Coal Seam Gas (University of QLD)

The Centre undertakes research into Coal Seam Gas and unconventional gas-related issues, primarily across the four main themes of water, petroleum engineering, geoscience and social performance.

ccsg.centre.uq.edu.au

SMART Infrastructure Facility (University of Wollongong)

The SMART Institute carries out research activities in the mining and oil and gas sectors by contributing to their transport and logistic requirements. Results of research activities can be applied in planning and approval, infrastructure development, excavation, blasting, mass transport and transport and shipping phases of the project life cycle.

smart.uow.edu.au

Energy and Minerals Institute (University of Western Australia)

Undertakes research into energy, mining and exploration in collaboration with industry across METS and oil and gas. Includes Chairs in leadership, petroleum geoscience and gas process engineering sponsored by Chevron and Woodside. Research activities results can be applied in all phases of the Mining Value Chain, with key expertise across exploration, mine planning and approval, environment, infrastructure, processing/production and mass transport.

emi.uwa.edu.au

Institute for Mineral and Energy Resources (University of Adelaide)

Within the Sustainable Minerals Institute, the IMER is an award-winning interdisciplinary research institute, which addresses scientific, technological and social and environmental challenges. Research and teaching in petroleum engineering, mining engineering, petroleum and minerals, geoscience and geothermal energy.

adelaide.edu.au/imer

UWA Centre for Energy (University of Western Australia)

Develops new knowledge and advanced technologies for efficient, effective and environmentally-friendly utilisation of fuels and energy in the resources industries.

cfe.uwa.edu.au

Research in Energy and Mineral Economics (Curtin University)

Research and collaboration with resources sector in economics, finance and business.

business.curtin.edu.au/our-research/programs-of-research/energy-and-mineral-economics
Research in Minerals and Energy (Curtin University)

Research into exploration technologies, planning and design, production infrastructure, processing and delivery within the resources sector.

Research encompasses mining, engineering and applied geology amongst other areas including marine science and technology for oil and gas and the clean gas Australia labs.

research.curtin.edu.au/focus-areas/minerals-energy

Centre for Offshore Foundation Systems

Since its establishment in 1997, the Centre for Offshore Foundation Systems has developed one of the most sophisticated research and modelling facilities in offshore geomechanics and engineering anywhere in the world. A team of 76 internationally recognised researchers, consulting engineers and technical staff work together to solve some of the key engineering challenges of today and tomorrow.

cofs.uwa.edu.au

UWA Oceans Institute

Brings together the strength of UWA’s researchers into an integrated, multidisciplinary research focus. The goal is to capitalise on UWA’s existing research strengths – in areas such as oceanography, ecology, engineering, coastal process and marine risk management.

oceans.uwa.edu.au

Institute for Mineral and Energy Resources (University of Adelaide)

Conducts research in petroleum engineering, mining engineering, petroleum and minerals, geoscience and geothermal energy.

adelaide.edu.au/imer

North Australian Centre for Oil and Gas (NACOG, Charles Darwin University)

Skills training for operators, higher education, research and asset management for projects in northern waters. Partners include ConocoPhillips and Inpex.

cdu.edu.au/oilandgas

John Grill Centre for Project Leadership (University of Sydney)

The Centre will partner with organisations to help them meet the challenges of leading and delivering large-scale, complex projects around the world, including in resources.

sydney.edu.au/john-grill-centre

Institute for Supply Chain and Logistics (Victoria University)

The Institute serves a wide range of private and public sector clients throughout Australia and overseas, providing for traditional logistics disciplines in transportation and warehousing, through to sophisticated supply chain functions, including procurement, process and systems planning, and supply chain strategy. Recent developments at the Institute have extended its capability to incorporate critical areas such as infrastructure development; policy and planning frameworks; and risk and sustainability assessment.

vu.edu.au/institute-for-supply-chain-and-logistics-iscl

Cisco Internet of Everything Innovation Centre (Curtin University)

The Cisco Internet of Everything Innovation Centre (CIIC) was established in 2015 at Curtin University’s campus at Bentley. Cisco with foundation partners Curtin University and Woodside Energy have committed approximately A$30 million for the centre in Perth. Cisco’s innovation centre aims to catalyse and showcase innovation and development. This is Cisco’s eighth global innovation centre and incorporates an additional node located in Sydney.

Research.curtin.edu.au/institutes-centres/cisco
The following organisations are some of the government and industry bodies involved in the Australian mining and oil and gas industry.

Contact your local Austrade representative about connecting and partnering with the Australian mining and oil and gas industry.

austrade.gov.au

FEDERAL GOVERNMENT

CSIRO

The Commonwealth Scientific and Industrial Research Organisation is Australia’s national science agency. It is one of the largest and most diverse scientific institutions in the world with more than 55 sites throughout Australia and overseas.

 csiro.au

Department of Industry, Innovation and Science

The Department’s vision is to enable growth and productivity for globally competitive industries. To realise this the Department has four key objectives: supporting science and commercialisation, growing business investment and improving business capability, streamlining regulation and building a high performance organisation.

industry.gov.au

The Office of the Chief Economist

The Office of the Chief Economist provides objective, robust and high-quality economic analysis to inform policy development across industry, innovation, resources, energy and evaluation.

Industry.gov.au/Office-of-the-Chief-Economist

Geoscience Australia

Geoscience Australia is Australia’s national geoscience agency and exists to apply geoscience to Australia’s most important challenges.

 ga.gov.au

The Minerals Council of Australia (MCA)

The Minerals Council of Australia represents Australia’s exploration, mining and minerals processing industry, nationally and internationally, in its contribution to sustainable development and society.

minerals.org.au

The National Offshore Petroleum Safety and Environmental Management Authority

The National Offshore Petroleum Safety and Environmental Management Authority is a Commonwealth Statutory Agency regulating the health and safety, structural integrity and environmental management of offshore petroleum facilities.

nopsema.gov.au
STATE GOVERNMENT

New South Wales
NSW Resources & Energy
resourcesandenergy.nsw.gov.au

Northern Territory
Department of Trade, Business and Innovation
business.nt.gov.au

Queensland
Trade & Investment Queensland
tiq.qld.gov.au

South Australia
Department of State Development
statedevelopment.sa.gov.au

Tasmania
Department of State Growth
stategrowth.tas.gov.au

Victoria
Department of Economic Development, Jobs, Transport and Resources
economicdevelopment.vic.gov.au

Western Australia
Department of State Development
dsd.wa.gov.au

OTHER INDUSTRY BODIES

Austmine
Austmine is an industry body promoting the advancement and competitive positioning of mining equipment, technology and services companies and assists member companies to internationalise.
austmine.com.au

The Mining & Energy Services Council of Australia (MESCA)
The Mining & Energy Services Council of Australia (MESCA) is an industry body created to assist members in developing and enhancing partnerships while maximising opportunities for contributions to mining and energy projects
mesca.com.au

The Australian Petroleum Production & Exploration Association (APPEA)
The Australian Petroleum Production & Exploration Association (APPEA) is the national body representing Australia’s oil and gas exploration and production industry.
appea.com.au

Subsea Energy Australia (SEA)
Subsea Energy Australia (SEA) is a not-for-profit industry association aimed at championing Australian subsea industry capabilities to the wider regional and global markets.
subseaenergy.org.au

The Petroleum Club of WA
The Petroleum Club of WA is an industry network and educational resource for the oil and gas sector.
petroleumclub.org.au

The Australian Marine Complex (AMC)
The Australian Marine Complex (AMC) is a world-class centre for excellence for manufacturing, fabrication, assembly, maintenance and technology servicing the marine, defence, oil and gas, and resource industries.
australianmarinecomplex.com.au

Oil & Gas Australia magazine
Oil & Gas Australia magazine provides coverage of developments in the Australian petroleum sector. It is recognised by leading global petroleum companies, industry and government bodies as a reference tool on oil and gas activity in the southern hemisphere.
oilandgasaustralia.com.au

Engineers Australia
Engineers Australia works to develop, promote and support professional development of engineers, including engineers in the oil and gas sector.
engineersaustralia.org.au

The Society of Petroleum Engineers
The Society of Petroleum Engineers aims to collect, disseminate, and exchange technical knowledge concerning the exploration, development and production of oil and gas resources, and related technologies for the public benefit, and to provide opportunities for professionals to enhance their technical and professional competence.
spe.org
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   airg.org.au

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    airg.org.au/new-page


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    csiro.au/en/About/We-are-CSIRO

15. CRC Ore Annual Report 2012-13, page 5

16. Why was DET CRC Created?
    detcrc.com.au/about/why-was-detcrc-created

17. Ibid
ABOUT AUSTRADE

The Australian Trade and Investment Commission – Austrade – contributes to Australia’s economic prosperity by helping Australian businesses, education institutions, tourism operators, governments and citizens as they:

• develop international markets
• win productive foreign direct investment
• promote international education
• strengthen Australia’s tourism industry
• seek consular and passport services.

Austrade helps companies around the world to identify and take up investment opportunities in Australia as well as to source Australian goods and services.

Our assistance includes:

• providing insight on Australian capabilities
• identifying potential investment projects and strategic alliance partners
• helping you to identify and contact Australian suppliers

W www.austrade.gov.au
E info@austrade.gov.au

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