

# World-leading Gorgon gas project carbon capture and storage program sets future standard

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# PROSPECT



Western Australia is a world leader in the delivery of natural gas and our State is well positioned to emerge on the world stage as a global energy hub.

This edition of *Prospect* sees the safe start up and operation of the carbon dioxide injection system at the Gorgon natural gas facility (story page 2).

Located on Barrow Island, off the north west coast of Western Australia, the Chevron-led Gorgon project's carbon dioxide injection system is one of the world's largest greenhouse gas mitigation projects undertaken by industry.

The project is the result of strong collaboration across industry and government.

My message at the Australian Petroleum Production and Exploration Association (APPEA) conference this year – Western Australia is open to new investment opportunities and unlocking new jobs in our LNG industry (story page 3).

Our LNG Jobs Taskforce is working collaboratively with industry to establish WA as an LNG hub servicing Australia and the broader Asia-Pacific region, to create new long-term job opportunities for Western Australians.

Through the LNG Jobs Taskforce, we can make Western Australia a major hub servicing the LNG industry in the Southern Hemisphere and beyond.

Also in this edition, Woodside has opened a new LNG truck loading facility for LNG distribution to the Pilbara, Kimberley and Gascoyne regions (page 4).

Woodside plans to develop infrastructure for supplying LNG to the international shipping industry, particularly carriers en route to Asia.

Natural gas is increasingly playing a major role in the world's energy mix, as more countries commit to reducing greenhouse gases and seek alternatives to other higher emissions fuels.

By capitalising on Western Australia's unique strength as one of the world's largest producers of LNG, we can produce lasting benefits for both industry and the people of Western Australia.

**Mark McGowan**

**PREMIER; MINISTER FOR STATE DEVELOPMENT, JOBS AND TRADE**

**Bill Johnston**

**MINISTER FOR MINES AND PETROLEUM**

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Cover Photo: Satellite image of the Gorgon LNG Plant on Barrow Island. Image: Chevron Australia. Story page 2.

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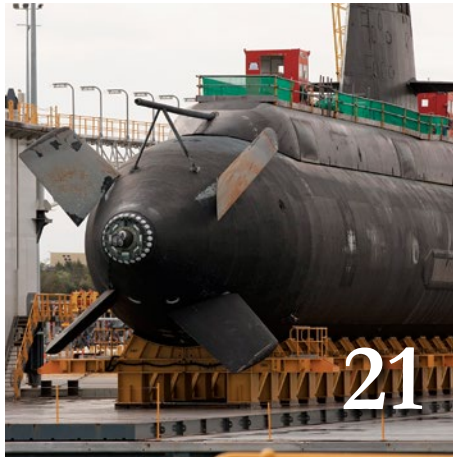
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Chevron Australia personnel at the Chevron-operated Gorgon carbon dioxide facility on Barrow Island. Image: Chevron Australia

## SUCCESSFUL START TO CARBON DIOXIDE INJECTION SYSTEM

**Chevron Australia and the Gorgon Joint Venture (GJV) participants announced the safe start-up and operation of the carbon dioxide injection system at the Chevron-led Gorgon natural gas facility on Barrow Island, off the north west coast of Western Australia, on 8 August 2019.**

Reservoir carbon dioxide from the Gorgon and Jansz-Io fields will be injected into the Dupuy Formation at a depth of about 2.5 kilometres beneath Barrow Island at rates of about 3.4 to 4.0 million tonnes (Mt) per annum.

Injection of carbon dioxide will be carried out over about 40 years, resulting in storage of more than 100 Mt of reservoir carbon dioxide underground in the rock formation instead of being released into the atmosphere.

Department of Mines, Industry Regulation and Safety (DMIRS) Deputy Director General Dr Phil Gorey said the State Government, working closely with the Federal Government and Chevron as the lead partner on the Gorgon project, had put in place a world leading regulatory regime for Carbon Capture and Storage (CCS).

"The project is the first commercial-scale CCS project in Australia and will set the standard for future projects," he said.

"Congratulations to all involved in its safe start-up. The Barrow Island project is now the world's largest carbon storage project, and when fully operational in the next year will be three to four times the size of any other such project.

"The project demonstrates WA's pre-eminent status in carbon reduction through CCS and provides the impetus to use other storage locations such as the South West Hub."

Dr Gorey said CCS technology had been proven to reduce carbon emissions in overseas locations.

DMIRS, in its capacity as a regulator, conducted several due diligence studies of the Gorgon carbon dioxide injection project leading to government approval for injection of carbon dioxide in 2009 under Section 13 of the *Barrow Island Act 2003*.

In 2011, the drilling of wells and establishment of pipelines for conveyance of the carbon dioxide to the injection site were approved under an amended *Petroleum Pipelines Act 1969*. However, the requirement to sequester the Gorgon carbon dioxide, was under the *Environmental Protection Act 1986*.

Dr Gorey said there was a legislative requirement for Chevron to provide monitoring data enabling DMIRS to review the performance of the Gorgon carbon dioxide injection project over the long term.

The Gorgon project's CCS program demonstrated that the technology would work in Australia and should be considered as part of the suite of carbon reduction strategies.

Chevron Australia managing director Al Williams said the company was pleased to reach the first milestone of safely starting the operation of the Gorgon carbon dioxide injection system.

"This achievement is the result of strong collaboration across industry and governments and supports our objective of providing affordable, reliable and ever-cleaner energy essential to our modern lives," he said.

"We are monitoring system performance and plan to safely ramp up injection volumes over the coming months as we bring online processing facilities."

Mr Williams said that when fully operational, the carbon dioxide injection facility would reduce Gorgon's greenhouse gas emissions by about 40 per cent.

The Gorgon facility incorporated many leading design features aimed at maximising energy efficiency and minimising greenhouse gas emissions. In steady-state operations, Gorgon expected to have the lowest greenhouse gas emissions intensity of any LNG project in Australia. ■



# GO WEST FOR GAS

**With an abundant gas supply, Western Australia is open to new investment opportunities and unlocking new jobs in the State's liquefied natural gas (LNG) industry.**

This was the message Premier and Minister for State Development, Jobs and Trade, Mark McGowan delivered at this year's Australasian Petroleum Production and Exploration Association (APPEA) conference and exhibition.

Held this year in Brisbane in May, APPEA is the premier oil and gas industry event in the southern hemisphere and has been running for more than 56 years.

More than 2,000 delegates from over 20 countries attended this year's event, with 670 companies represented and 133 exhibiting.

In an address to the conference, Mr McGowan reaffirmed the State Government's calls to businesses across Australia to relocate to Western Australia, to take advantage of the State's cheap, reliable and abundant gas supply.

The Premier also outlined the work of the LNG Jobs Taskforce that features industry and government collaborating to establish Western Australia as a global LNG hub servicing Australia and the broader Asia-Pacific region.

The State Government has prioritised growth in Western Australia's LNG industry, with the State Budget including \$10 million to develop a world-first microscale LNG plant as part of an LNG Futures Facility in Kwinana, south of Perth.

The facility will work to position Western Australia as a world leader in the development and testing of new technologies and processes.

"My pitch to east coast industry is simple. If you want a cheaper and more reliable supply of gas—go west, we have an abundant supply of cheap gas right here in WA," Mr McGowan said.

*"Western Australia is a world leader in LNG and one of my Government's key priorities is to grow our State into a global LNG hub, to unleash thousands of new jobs for Western Australians."*

"But it won't happen without a concerted effort from government and industry, and that's what the LNG Jobs Taskforce is all about. The taskforce has led to collaboration never before seen and we are keen to continue this co-ordination to make WA an even better place to invest," he said.



*Premier Mark McGowan at this year's APPEA event. Photo: APPEA*

Director General of the Department of Jobs, Tourism, Science and Innovation, Rebecca Brown also attended the APPEA conference.

Ms Brown said there would be a significant number of jobs given the growth in Western Australia's oil and gas industry during the past 10 years.

"We've obviously seen a significant amount of construction over the last 10 years and further areas of construction or ongoing investment in that construction," she said.

"What's really critical is the ongoing operations and maintenance, and that provides enormous opportunities for a whole range of industry players.

"What we do know about the LNG industry is that it both provides direct jobs and direct employment but that multiplier effect and the indirect jobs is critical and that provides many opportunities for a lot of local Western Australian businesses and obviously jobs for West Australians.

"The State Government has a strong agenda around skills and development, going back

to how we increase the number of children studying Science, Technology, Engineering and Mathematics (STEM) subjects at school, right through to supporting our vocational education and training sector and those collaborations between industry and our TAFE sector, and apprenticeships," she said.

"But also right through to our tertiary sector and our universities that play a really critical role as well.

"So it's all aspects of job development – from our kids at school and their interest in engineering and science and maths subjects right through to our post-graduate and PhD students who are doing some really exciting work at Western Australian universities."

Perth will host the 60<sup>th</sup> APPEA exhibition and conference (APPEA 2020) next year, to be held from 18-21 May 2020. ■





# New facility creates opportunities in LNG in WA

*Karratha Gas Plant, North West Shelf Project. Copyright: Woodside Energy*

**The Woodside-operated Pluto LNG Project has opened a new LNG truck-loading facility, marking a key milestone towards the development of a local LNG market for remote power generation and transport fuels.**

Premier and Minister for State Development, Jobs and Trade, Mark McGowan has officially opened the new facility at a ceremony in Karratha.

The new facility will draw LNG directly from Woodside's existing Pluto LNG production and storage facilities for distribution by truck to the Pilbara, Kimberley and Gascoyne regions.

The initial capacity of the facility is 0.1 million tonnes per annum, based on seven truck loadings per day during daylight hours.

Woodside has secured an agreement with Sheffield Resources to supply LNG to its Kimberley Thunderbird project, which will employ about 280 workers.

During construction of the facility, more than 60 workers, many of them local, were employed on the project and \$4 million worth of fabrication contracts were awarded to local businesses.

In a statement, the company said that in the longer term, the availability of LNG from the truck loading facility could support the transition towards cleaner fuel for trucks and trains in the region's heavy transport sector.

Woodside is also planning to develop infrastructure for supplying LNG to the international shipping industry, particularly iron ore carriers on the busy trade route from the Pilbara to Asia.

Woodside Chief Operations Officer Meg O'Neill said the Pilbara was an ideal hub for an LNG fuels market, with established LNG processing facilities located close to large-scale mining operations and port infrastructure.

"Around three billion litres of diesel are imported into the Pilbara every year, mainly for the mining industry," Ms O'Neill said.

"In addition, the ships exporting iron ore to international markets from the Pilbara consume approximately five billion litres of heavy fuel oil annually.

"Woodside believes that LNG produced here in Western Australia can replace those higher-emission fuels, delivering environmental benefits while supporting the growth of local industries and creating new markets for locally produced LNG," she said.

Mr McGowan said the State Government was continuing to position Western Australia as a global energy hub.

The Government's LNG Jobs Taskforce aims to work collaboratively with industry to establish Western Australia as a LNG hub servicing

Australia and the broader Asia-Pacific region, to create new long-term job opportunities.

"I congratulate Woodside on the opening of new LNG truck loading facility and the new opportunities this creates in our State's north," Mr McGowan said.

"Western Australia is now a world leader in the delivery of natural gas, and our State is ready to take the next step and create new investment opportunities to bolster our position as a global energy hub and create new jobs for local workers.

"Natural gas is increasingly playing a major role in the world's energy mix, as more countries commit to reducing greenhouse gases and seek alternatives to other higher emissions fuels.

"Through the LNG Jobs Taskforce, we can make Western Australia a major hub servicing the LNG industry in the Southern Hemisphere and beyond.

"By capitalising on the State's unique strength as one of the world's largest producers of LNG, we can produce lasting benefits for both industry and the people of Western Australia." ■





*Rio Tinto Pilbara operations. Copyright: 2018 Rio Tinto*

# LOCAL JOBS BILL MOVING FORWARD

## **Development of the State Government's Local Jobs Bill has increased momentum after the first round of consultation meetings with key industry groups.**

The Local Jobs Bill is a major focus of the State Government following the implementation of the *Western Australian Jobs Act 2017*.

The objective of the Local Jobs Bill is to help build and diversify Western Australia's economy by ensuring the benefits from energy, mining and construction projects flow through to local businesses and create more jobs for Western Australians.

Three industry consultation groups from the energy, mining and construction industries were established by the State Government to get meaningful and real feedback for the development and implementation of the Local Jobs Bill.

The Department of Jobs, Tourism, Science and Innovation (JTSI) hosted the first energy industry consultation group meeting on 8 May.

Membership of the energy industry consultation group was formed from the LNG Jobs Taskforce – a collaboration with industry led by the State Government to grow Western Australia's LNG sector and establish WA as an LNG hub for the Asia Pacific.

The first mining industry consultation group was held on 5 June. The group included representatives from Rio Tinto, BHP, Roy Hill, the Australian Steel Institute, the Australian Manufacturing Workers Union, and other key stakeholders.

The mining industry consultation group was formed with members from the Steel Fabrication Roundtable, hosted by Premier Mark McGowan in February, as well as members from the lithium, gold, and mineral sands industry sectors.

The construction industry consultation group held its first meeting on 6 June, with the group formed from Western Australia's construction sector and key industry bodies.

JTSI is planning more meetings with the three industry consultation groups in the coming months to gather more feedback for the implementation of the Local Jobs Bill.

The industry consultation groups will also help develop and collaborate on the inclusion of Skilled Work Agreements, which will form part of the project approval process and will outline a project's potential employment, skilling and contractual opportunities.

An inter-departmental working group featuring members from JTSI, the Department of the Premier and Cabinet, the Office of the Premier, State Solicitor's Office, Department of Training and Workforce Development, and the Department of Primary Industries and Regional Development, has also been established to guide the drafting of the Bill.

For more information visit [www.jtsi.wa.gov.au](http://www.jtsi.wa.gov.au) ■





# GEOLOGICAL DETECTIVE STORY LEADS TO BREAKTHROUGH

*Turee Creek Group in Western Australia's Pilbara region.*

**A new technique for geochronologists and sedimentologists will be put to the test later this year, providing unique information on the source of sedimentary rocks throughout the State.**

Accurately dating and tracking down the origin, or provenance, of rocks is critically important knowledge for explorers when targeting deposits.

During the past two decades, geoscientists have used uranium-bearing minerals called zircon in sediment (detrital zircon) for the isotopic dating of rocks because the uranium isotopes change to lead at a well-understood rate.

Uranium-lead zircon dating has come to be known as the 'gold standard' for geochronology, but it is far from perfect, as the Geological Survey of WA (GSWA) Chief Geoscientist Dr Simon Johnson found when trying to establish the provenance of sediments in the Edmund Basin.

That quest led to a geological detective story, which highlighted using lead isotopes in potassium (K) feldspar – one of the most common minerals in the earth's crust – as a more accurate alternative in certain situations.

Dr Johnson said zircon suggested that the Edmund Basin sediments had come from the Gascoyne Province to the south, despite evidence from rocks showing the direction of river currents, which indicated they came from the north.

Being extremely hardy, zircons can survive a number of cycles of uplift, erosion and deposition, sometimes ending up in a location nowhere near their source.

"We knew that using detrital zircons can be an issue because they get recycled, and then recycled again and again, and sometimes they're telling you the wrong answer when you're looking for their provenance," Dr Johnson said.

"We wanted to work out a way to use other minerals or methods to support or reject the story being told by the zircon."

In a happy coincidence, a former colleague at GSWA, Professor Chris Kirkland, who is now working with the Centre for Exploration Targeting (CET) at its Curtin University node, was looking into the lead isotope composition of K feldspar as an alternative to compare with zircon.

He wanted a project to test the new method and approached Dr Johnson, who jumped at the chance to use the laser-ablation mass spectrometer at the John de Laeter Centre to solve the Edmund Basin mystery.

The K feldspar compositions proved that the zircon and K-feldspar were definitely coming from different sources, but it did not completely solve the story because it did not prove where the sediments were actually coming from.

The question nagged at Dr Johnson and Professor Kirkland.

"It's not coming from the south. We proved that – it's clearly coming from the north, so we had to think about what sources of K-feldspar there would be in the north," Dr Johnson said.

"We hunted around in our collections of samples from the core library to find a potential source and in the end, the only samples left to analyse were granitic rocks from within the sedimentary basins which are part of the Pilbara Craton.

"We did a few of those, and then we got that perfect match, proving that the sediments were coming from the north."

**"We wanted to work out a way to use other minerals or methods to support or reject the story being told by the zircon."**





But the detective work wasn't quite over – where had the zircons really come from?

"The zircon story is ultimately correct, the zircons are really coming from the south, but it's a two-stage process," Dr Johnson said.

"They came from the south from an older period of time, where the granitic rocks were uplifted and the zircons eroded into a sedimentary basin in the north, and then during the deposition of the Edmund Basin, the northern basins were uplifted and the zircons were recycled."

In a complementary study, Dr Imogen Fielding, a PhD student at Curtin University at the time (now GSWA's Phosphate Geochronologist), was examining the timing of gold mineralisation in an area of the Pilbara hosting the Paulsens, Belvedere and Mount Olympus gold mines – the same area that was uplifted to provide the sediment to the Edmund Basin.

"Dr Fielding's study has shown that uplift, erosion, sediment transport and gold mineralisation were synchronous," Dr Johnson said. "The combined studies show that precisely defining the source region of a sedimentary basin may aid in identifying regions of highly prospective crust."

These results sparked publication of a paper – *The complexity of sediment recycling as revealed by common Pb isotopes in K-feldspar* – with Dr Johnson and Associate Professor Kirkland as lead authors, in the prestigious Geoscience Frontiers magazine. ■



Curtin University Centre for Exploration Targeting Professor Chris Kirkland (left) with Geochronologist Dr Imogen Fielding and Dr Simon Johnson from GSWA. Dr Fielding worked for Northern Star Resources for a number of years before being awarded her PhD in geochronology with Dr Johnson as one of her supervisors. "It's another great example of how GSWA works closely with industry," Dr Johnson said.

### Three-year project to create Statewide lead isotope map

As a result of the Edmund Basin breakthrough proving the worth of measuring the lead isotopes of K-feldspar, the Geological Survey of WA (GSWA) is partnering with the Australian Research Council (ARC), Professor Kirkland at Curtin University and medium-tier gold miner Northern Star Resources to carry out this technique in the Eastern Goldfields and the Northern Carnarvon and Canning Basins.

The three-year \$682,000 project is being funded by the ARC (\$352,000), the State Government's

Exploration Incentive Scheme (\$180,000) and Northern Star Resources Ltd (\$150,000), and will start this financial year.

The project will also involve the creation of a lead isotope map of WA. The map project will run in conjunction with a Geoscience Australia project which is collecting lead isotope data in mineral deposits across Australia.

"Both our datasets will be amalgamated to produce a State-wide and nation-wide lead isotope map," Dr Johnson said. ■



# DIESEL EMISSIONS RESEARCH HIGHLIGHTS RISKS FOR MINING OPERATIONS



“The principles contained in DMIRS’ diesel emission guideline are another tool mining operators can use proactively to promote a safe and healthy work environment.”

**The results of two research projects on diesel exhaust emissions (DEE) in Western Australia’s mining industry have reinforced the need for mine operators to develop appropriate control strategies.**

The projects studied the physical-chemical properties of nano diesel particulate matter (nDPM) in an underground mine and the potential health effects on workers from exposure.

The results were outlined at a free information session hosted by the Department of Mines, Industry Regulation and Safety in July.

DMIRS Director of Mines Safety Andrew Chaplyn said diesel particulates were a known hazard for mining operations, especially in underground mines where widespread use of diesel vehicles and equipment meant ventilation was critical for worker health and safety.

“DEE is a complex mix of many constituents and research around the world suggests nDPM is a harmful component of these emissions,” Mr Chaplyn said.

“The overall aim of our studies was to evaluate nDPM and assist the development of control measures to protect workers in underground mines and other environments where nDPM is generated.

“Now the research has been finalised, the Mining Industry Advisory Committee (MIAC) will consider the findings and make recommendations to the Minister for Mines and Petroleum.”

MIAC, which Mr Chaplyn chairs, is a statutory body that advises the State Government on matters relating to occupational safety and health in the mining industry. MIAC commissioned the studies in 2016.

DMIRS and the Mineral Research Institute of Western Australia (MRIWA) co-funded the first project, which focused on evaluating the physical-chemical aspects of nDPM.

The researchers used tracer gas technology at an underground gold mine to better understand the flow behaviour of sulfur hexafluoride – a non-flammable, non-toxic gas – which was used as a surrogate for diesel exhaust.

The study included the following key findings:

- The tracer gas study of several underground mining activities – such as charging, bogging, hydro-scaling, shotcreting and truck driving – demonstrated that during those activities there were relatively higher sulfur hexafluoride concentrations measured during the hydro-scaling and shotcreting activities.
- During shotcreting, the Agitator (Agi) truck operator experienced approximately the same exposure of sulfur hexafluoride from the Agi truck and spraymec exhaust. In contrast, the spraymec operator received almost twice the exposure from the spraymec exhaust than from the Agi truck exhaust. The Agi operator in this instance was at greater risk.
- During a short duration activity in a development heading, an unventilated cuddy (as represented by the stockpile in this study) could be a natural ‘place of safety’ or shelter area for personnel that are in the general area but not involved with the actual activity at a development heading.

The second study recruited 20 above-ground and 80 underground miners from Anglo Gold Ashanti’s Sunrise Dam mine in Western Australia.

The miners underwent a series of health screening tests before and after their working shift, and were fitted with personal exposure monitoring equipment to investigate if their exposure to DEE had an effect on their health status.

The findings from the second study are undergoing peer review prior to publication in academic journals.

DMIRS also commissioned a literature survey, which evaluated published scientific articles on the potential health effects arising from exposure to DEE and nDPM.

The ChemCentre, Curtin University and The University of Western Australia conducted the research in collaboration with DMIRS and MRIWA.

Mr Chaplyn said the research reinforced DMIRS’ guideline on DEE, which highlights the importance of monitoring diesel emissions and implementing control measures to make the environment suitable for workers.

“Diesel Emission Management Plans should focus on a range of risks, including the efficiency of on-site diesel engines, the use and maintenance of effective engine filtration systems, adopting good ventilation design standards and regular employee training to promote the importance of minimising emissions,” Mr Chaplyn said

“The principles contained in DMIRS’ diesel emission guideline are another tool mining operators can use proactively to promote a safe and healthy work environment.”

DMIRS’ mines inspectors will continue to investigate and participate in monitoring and evaluating activities that may lead to exposure to nDPM and the health impacts of DEE on Western Australian mine workers.

A copy of the literature survey and consolidated report on the physical-chemical aspects of DEE is available at [www.dmp.wa.gov.au/Safety/Reports-16199.aspx](http://www.dmp.wa.gov.au/Safety/Reports-16199.aspx)

For further information in relation to the journal articles published as a result of the health impacts study, please contact: Associate Professor Alison Reid via email to [alison.reid@curtin.edu.au](mailto:alison.reid@curtin.edu.au)

The DEE guidelines are available at: [www.dmp.wa.gov.au/Documents/Safety/MSH\\_G\\_DieselEmissions.pdf](http://www.dmp.wa.gov.au/Documents/Safety/MSH_G_DieselEmissions.pdf) ■





BHP's Jimblebar iron ore mine in Western Australia. Copyright: BHP

# MINING GIANT'S LONG-TERM PLAN FOR THE PILBARA APPROVED

**The Western Australian Government has approved a 50 to 100-year strategic mining proposal for the Pilbara by resources giant BHP, which outlines bold plans for new and existing mines, along with a vision to create tens of thousands of jobs for Western Australians.**

BHP's Pilbara Expansion Strategic Proposal details a cumulative picture of the miner's planned and potential operations across the Pilbara including mining operations, rail, storage areas, dams and associated mine infrastructure.

The Environmental Protection Authority (EPA) recommended environmental approval of BHP's strategic proposal, with conditions.

Strategic proposals help reduce red and green tape, allowing the EPA to consider the cumulative impacts of future proposals, rather than assessing impacts on a case-by-case basis, as individual mines or developments are proposed.

The EPA assessed the impacts to flora and vegetation, fauna, water quality and quantity, air quality as well as social surrounds.

The Ministerial Statement for BHP's strategic proposal includes conditions that may be applied to each development, including environmental management plans, a cultural heritage management plan, a mine closure plan

and offsets through contributions to the Pilbara Environmental Offsets Fund where significant residual impacts remain.

BHP is required to refer future individual proposals outlined in the Ministerial Statement to the EPA to determine if they meet the high standards set by the strategic assessment.

Premier and Minister for State Development, Jobs and Trade, Mark McGowan said the plan had the potential to deliver tens of thousands of jobs for local Western Australians.

"We expect this Australian-first plan will reduce environmental approval times by up to 50 per cent, while maintaining the highest environmental standards," Mr McGowan said.

"Industry has been crying out for this type of plan. It recognises the need to reduce unnecessary 'green tape' to increase investor confidence, and pave the way for more jobs.

"It is another sign our economy is improving with the major miner taking a long-term view of its proposals in the State.

"The State Government commends BHP for taking the time to put a strategic proposal for the Pilbara together."

Environment Minister Stephen Dawson said a key focus for the EPA was ensuring the proposal did not significantly impact the regional environment.

"The Pilbara region holds immense environmental value and a key focus of the EPA assessment was to ensure the proposal did not significantly impact on important regional environmental values including Karijini National Park and Fortescue Marsh," Mr Dawson said.

"The EPA gave BHP's strategic proposal careful consideration, including considering the impacts to fauna, flora, surface and ground water, air quality, landforms and social surrounds.

"Strategic proposals allow the EPA to take a bigger picture view of the potential environmental impacts the proposals may have, considering the cumulative impacts rather than on a case-by-case basis, as individual mines or developments are proposed." ■



# SEISMIC STUDY IN SOUTHERN WA TO ENHANCE EARTHQUAKE KNOWLEDGE



*Professor Liang Zhao (right) and PhD candidate Baolu Sun (left) from the Chinese Academy of Sciences performing a typical in-ground seismometer installation on Warrawagine Station in the East Pilbara.*

**The South West of Australia experiences some of the highest levels of earthquake activity on the continent. The Geological Survey of Western Australia (GSWA), represented by Dr Klaus Gessner, is a major partner in a new seismic monitoring study in the region.**

The Australian Research Council recently announced funding of more than \$440,000 for the three-year long project, which will include geophysicists, geologists and natural hazard specialists from the Australian National University (ANU), Macquarie University, Geoscience Australia, the WA Department of Fire and Emergency Services, and GSWA.

The State Government's Exploration Incentive Scheme, which is managed by the GSWA within the WA Department of Mines, Industry Regulation and Safety, is contributing \$240,000 to the project.

Executive Director Geological Survey and Resource Strategy Jeff Haworth said a team of geophysicists, led by ANU Associate Professor Meghan Miller, would install a network of 25 seismometers to record tremors caused by local and distant earthquakes.

The network is planned to cover an area south of Morawa and north of Bridgetown, extending from the Indian Ocean coast as far east as Hyden.

"The data from this new project in southern WA will be important in determining prospectivity for mineral resources and will also assist in hazard management," Mr Haworth said.

"The nature of earthquake behaviour in this seismically active region is largely unknown, even after more than 50 years since the devastating magnitude 6.5 earthquake at Meckering.

"The 14 July magnitude 6.6 earthquake near Broome is a reminder that significant seismic activity can and does occur in Western Australia, and this new project will enhance our understanding of these events."

The project will combine new seismic data with previously collected geophysical datasets to produce 3-D models of the Earth's crust.

GSWA is also a major partner in an earthquake recording study in the northwest of the State with Dr Huaiyu Yuan from Macquarie University and Professor Liang Zhao from the Institute of Geology and Geophysics at the Chinese Academy of Sciences (IGG-CAS) in Beijing.

More than 40 temporarily installed seismometers are recording local and distant Earth vibrations in the Pilbara and the Kimberley regions.

Many of these stations are placed close to the epicentre of the earthquake near Broome in July, which produced the largest release of seismic energy ever recorded in an Australian earthquake.

A related offshore study by Macquarie University and IGG-CAS, undertaken in close collaboration with GSWA, was completed in 2018 using ocean-bottom seismometers submerged across the continental shelf to record seismicity.

More information about GSWA is available at [www.dmirs.wa.gov.au](http://www.dmirs.wa.gov.au) ■



# AUSTRALIA'S LONGEST ONSHORE SEISMIC LINE SOUNDS OUT PILBARA POTENTIAL



*The Kidson survey being undertaken in Western Australia's Pilbara region.*

**Geoscientists from the Department of Mines, Industry Regulation and Safety (DMIRS) are interpreting data from a seismic reflection survey investigating the deep geology of the Kidson sub-basin.**

The project, known as the Kidson Deep Crustal Seismic Reflection Survey, is a collaboration between Geoscience Australia (GA), a division of the Commonwealth Department of Industry, Innovation and Science and DMIRS through its Geological Survey of Western Australia division and the Exploration Incentive Scheme.

The seismic survey was carried out in 2018 in Western Australia's Pilbara region along the road connecting Kiwirrkurra and Marble Bar, making it Australia's longest onshore seismic line.

The raw data can now be freely downloaded in digital "SEG-Y" format from the Western Australian Petroleum Information Management System (WAPIMS) database on the DMIRS website.

The data from the survey was first released to the public at the 2019 Australian Petroleum Production and Exploration Association Ltd (APPEA) conference in Brisbane in May and subsequently showcased at the Association of Mining and Exploration Companies (AMEC) Convention in Perth in June.

DMIRS Executive Director Geological Survey and Resource Strategy Jeff Haworth said the results of the survey would help to characterise key geological elements in the remote southern portion of the Canning Basin.

"The seismic survey extended for 872km along the road connecting Kiwirrkurra and Marble Bar, to probe what is considered to be one of the least geologically understood regions in Australia," he said.

"Co-funded by the State Government's Exploration Incentive Scheme, the survey is a collaboration between DMIRS and GA.

"DMIRS geoscientists are now analysing the data, working with GA to interpret the geology of the sedimentary basin.

"Our staff members are also working to interpret underlying crystalline basement with the Centre for Exploration Targeting at The University of Western Australia, with funding from a Minerals Research Institute of Western Australia (MRIWA) grant."

The geological interpretation will be released later this year, and will inform ongoing studies about the petroleum and mineral potential in this remote region.

The data is available for free download from the Western Australian Petroleum Information Management System (WAPIMS) database at [www.dmirs.wa.gov.au](http://www.dmirs.wa.gov.au) and the Exploring for the Future website at [www.ga.gov.au/efft](http://www.ga.gov.au/efft) ■



*Drilling begins at the Waukarlycarly site.*

## Waukarlycarly well project underway

A deep stratigraphic well is being drilled in the South West Canning Basin to investigate the geology within the Waukarlycarly Embayment, a fault-bound depression in ancient igneous and metamorphic rocks which has subsequently filled with a sequence of younger sedimentary rocks.

Using information acquired from the Kidson seismic survey in 2018, preparation work for the stratigraphic drilling program began in July and the project is expected to finish in November 2019.

DMIRS Executive Director Geological Survey and Resource Strategy Jeff Haworth said the drilling was on an existing cleared area next to the Marble Bar-Telfer Road, about 67 kilometres west of Telfer.

"Drilling began on 1 September and the well is planned to reach a total depth of about 2,200m. It will provide a much better understanding of the little-known subsurface geology of this region," he said.

"It will also provide a test of geological interpretations made from the Kidson survey."

The project is a collaboration between the WA State Government's Department of Mines, Industry Regulation and Safety (DMIRS) and Geoscience Australia (GA). It is funded from the Commonwealth Government's Exploring for the Future Program, which is managed by GA. The DMIRS Geological Survey and Resource Strategy Division will manage the drilling program. ■





Ore processing facility, Iron Bridge. Credit: Fortescue Metals Group Ltd

## MULTI-BILLION DOLLAR IRON ORE PROJECTS PAVE WAY FOR WA JOBS

### **Two Western Australian iron ore projects driven by Fortescue Metals Group and worth billions of dollars are paving the way for thousands of jobs.**

In April, Fortescue and the company's joint venture partners approved Stage 2 of the Iron Bridge Magnetite Project.

The US\$2.6 billion project will produce the equivalent of 22 million wet metric tonnes of magnetite ore per annum at full operational capacity.

The project is about 145 kilometres south of Port Hedland and is set to create about 3,000 construction jobs and up to 900 jobs when operational.

Premier and Minister for State Development, Jobs and Trade, Mark McGowan welcomed the company's announcement.

"I welcome this significant announcement from Fortescue Metals Group and congratulate them for reaching this important milestone," Mr McGowan said.

"It's another encouraging sign that confidence is returning to Western Australia's economy, and with thousands of jobs expected to flow from the Iron Bridge project, this will deliver a huge boost to our State."

Mines and Petroleum Minister Bill Johnston said the project was great news for local workers and the Western Australian economy because iron ore remained one of the State's most important commodities.

"This project will unlock resources that were previously not able to get to market," Mr Johnston said.

Fortescue has committed to using local suppliers and contractors for products and services, and has put in place agreements with the Njama and Kariyarra people to ensure it creates opportunities for local Aboriginal people.

Regional Development Minister Alannah MacTiernan said the project marked another great leap forward for the Pilbara.

"Iron Bridge will bring world-class magnetite processing technology to WA, driving hundreds of ongoing jobs for the region," she said.

Construction on the project will commence this year, with delivery of first ore expected in the first half of 2022.

In July, the Premier turned the sod at Fortescue's US\$1.275 billion Eliwana mine and rail project, 90 kilometres west-north-west of Tom Price in the State's Pilbara region.

Eliwana is a haematite iron ore mine scheduled to produce 30 million tonnes per annum.

The project includes 143 kilometres of associated rail, linking the Eliwana mine to Fortescue's existing railway and mining operations at the Solomon Hub.

Structural steel fabrication of the ore processing plant, overland conveyor, stockyard and train loadout facility, and rail bridge girders will occur within Western Australia.

Key environmental approvals for the mine site and Stage 2 of the railway have been finalised and secondary approvals are being progressed, with first ore expected in late 2020.

Fortescue was a member of the Premier's steel fabrication roundtable, which was convened in February, to create more opportunities for local steel fabricating businesses on major projects.

"The Eliwana mine and rail project will deliver a significant boost to WA's economy, with around 2,400 jobs in total created for WA workers," Mr McGowan said.

"It's great to see a strong local content component, with many Western Australian companies awarded contracts to carry out important works, including steel fabrication."





"Eliwana is one of a number of large projects we expect will come online in the next few years, which points to confidence returning to our State's economy."

Fortescue's Chief Executive Officer, Elizabeth Gaines said the company was built on the vision that creating a strong business could generate economic opportunities and contribute to thriving local communities.

"This vision is at the heart of the Eliwana development which has already generated business and jobs for Western Australians, with up to 1,900 jobs during construction and 500 full-time site positions once operational," Ms Gaines said.

"The business opportunities are also substantial. We're proud to be working with local businesses on the steel fabrication of key pieces of infrastructure and we are committed to supporting Aboriginal and WA businesses." ■

## Western Australia's Iron Ore

- WA's iron ore sales have grown from 306 million tonnes in 2008 to 811 million tonnes in 2018.
- The iron ore industry is a large part of the State's economy, accounting for 17 per cent of gross state product (\$45 billion) and 57 per cent (\$79 billion) of mining industry value added in 2017-18.
- The sector is important for growing jobs in Western Australia with direct employment rising from 23,000 jobs in 2008 to 43,000 jobs in 2018, equivalent to 7 per cent per annum growth over 10 years.
- The iron ore sector accounted for 46 per cent of direct employment in the State's mining industry in 2018 (excluding exploration) and provided flow-on opportunities for local industry.
- Western Australia is a premier destination for investment in the mining industry, with about \$17 billion of major iron ore projects under construction or committed. These include Fortescue Metals Group's Eliwana and Iron Bridge projects, BHP's South Flank Project, and Rio Tinto's Koodaideri Project.





## ROUND 20 OF EIS CO-FUNDED DRILLING

**Successful applicants for grants in round 20 of the Exploration Incentive Scheme's (EIS) Co-funded Drilling Program will be announced in late November.**

The six week application period for grants for exploration drilling to be undertaken in 2020 closed on 4 October 2019.

The EIS is managed by the Geological Survey of Western Australia (GSWA) Division at the Department of Mines, Industry Regulation and Safety (DMIRS).

The highly popular program provides \$5 million a year to encourage innovative drilling in greenfields and under-explored areas of the State.

Explorers can receive a refund of up to 50 per cent for innovative drilling projects, with caps of

\$150,000 (multi-hole project), \$200,000 (single deep hole), and \$30,000 for prospectors.

At the completion of Round 17 drilling in June this year, 71 per cent of projects offered a grant completed drilling, far exceeding the historical completion rate of 59 per cent.

Mines and Petroleum Minister Bill Johnston said it was encouraging to see the confidence and optimism displayed by the State's mining industry at the recent Diggers and Dealers Mining Forum in Kalgoorlie.

"Industry is keen to explore, and the State Government's EIS Co-funded Exploration Drilling Program helps them to do that," he said.

"The scheme's success can be seen in the ongoing high completion rate of co-funded drilling projects, and in the varied mix of new-energy and traditional exploration projects that were successful applicants in Round 19 earlier this year.

"The EIS program continues to produce major discoveries, which can lead to new mines being developed and more jobs for Western Australians.

"More than 806 kilometres of across projects exploring for precious and critical minerals have been drilled since 2009."

For more information, visit [www.dmirs.wa.gov.au](http://www.dmirs.wa.gov.au) ■

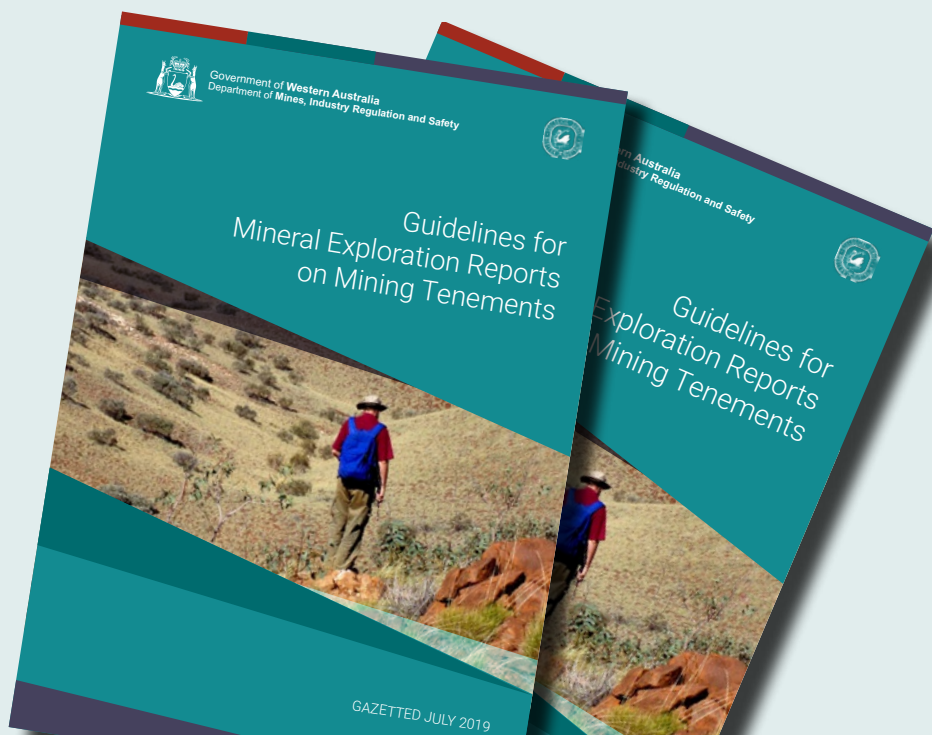
## NEW GUIDELINES FOR MINERAL EXPLORATION REPORTS

**The Department of Mines, Industry Regulation and Safety gazetted new Guidelines for Mineral Exploration Reports on Mining Tenements on 12 July 2019 following a period of consultation.**

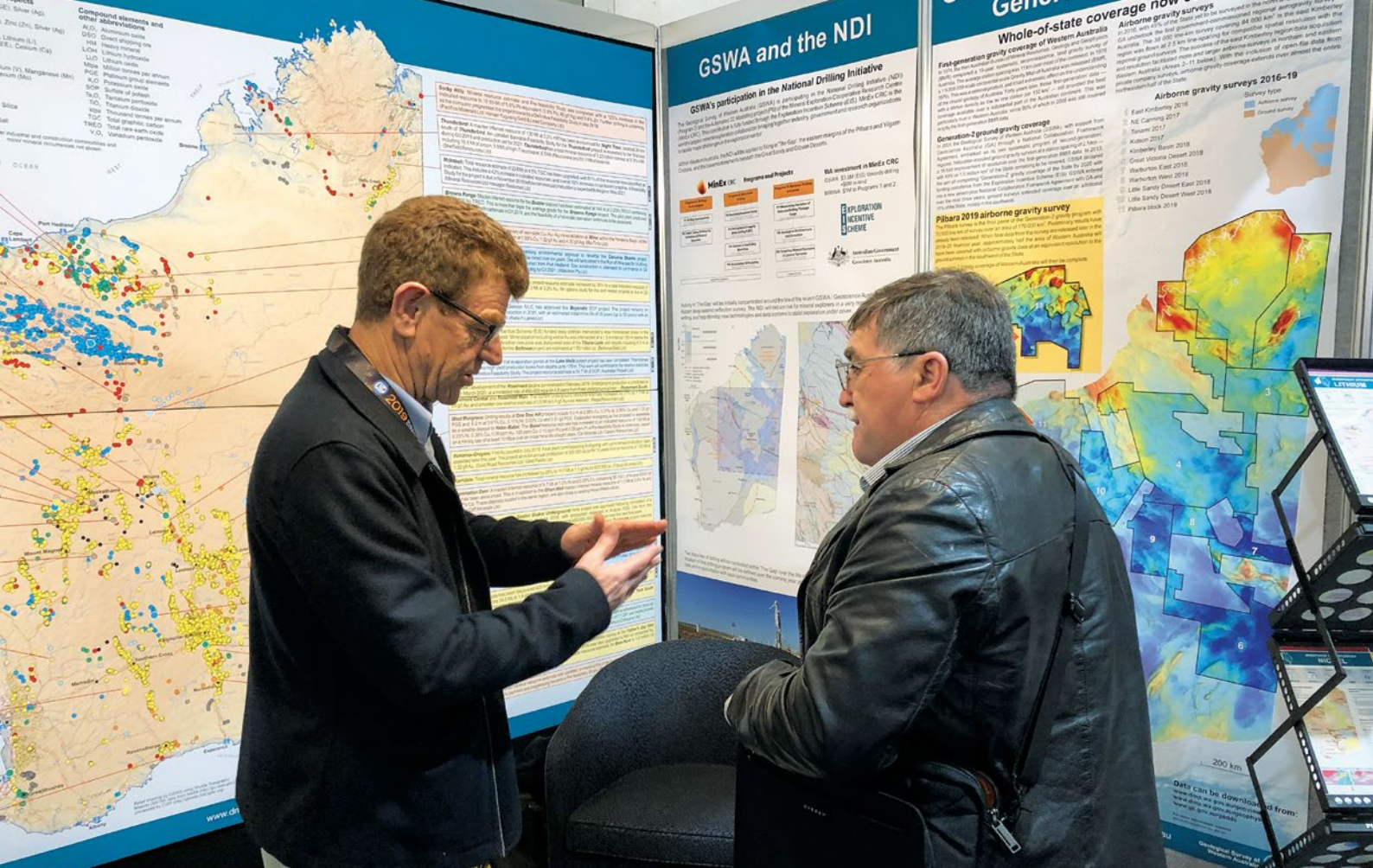
The guidelines replace the previous version gazetted on 15 February 2016, and are designed to assist holders of mining tenements in Western Australia in the preparation and submission of mineral exploration reports to comply with section 115A of the *Mining Act 1978*.

Tenement holders and operators are responsible for filing a mineral exploration report that complies with the reporting requirements under the Mining Act, including the gazetted guidelines.

Mineral exploration reports can be lodged online through the WAMEX Report Lodgement System on the DMIRS website at [www.dmirs.wa.gov.au](http://www.dmirs.wa.gov.au) ■







DMIRS Executive Director Geological Survey and Resource Strategy Jeff Haworth with Steve Argus from Lysander Resources Pty Ltd.

# SHOWCASE FOR DATA AND DRILLING AT DIGGERS AND DEALERS FORUM

**The Department of Mines, Industry Regulation and Safety (DMIRS) showcased its successful co-funded drilling program and recent airborne gravity data releases at the 2019 Diggers and Dealers Mining Forum in Kalgoorlie in Western Australia.**

The annual three-day mining industry event began on 5 August 2019 with an opening address by former Prime Minister John Howard and attracted more than 2,400 delegates, including representatives from mining and exploration companies, brokers, financiers and service industries.

The event featured exhibitors from the industry and presentations from mining and exploration companies.

DMIRS Executive Director Geological Survey and Resource Strategy Jeff Haworth said the mood at the event was positive.

"Companies are keen to get out there and explore, but with a measured approach using precompetitive data to determine prospectivity, refine targeting and ensure drilling programs maximise the chances of discovery," he said.

"Representatives from many of the companies that have been successful applicants with the Exploration Incentive Scheme's co-funded drilling program were at the event.

"They expressed their support for the State Government's ongoing commitment to fund the program, which offers up to a 50 per cent refund for innovative exploration drilling projects, capped at specific amounts."

Many delegates were also interested in data from the department's Geological Survey of Western Australia (GSWA) division, including the results of the latest airborne gravity survey in the Pilbara that was completed in June.

The preliminary survey data is available from the DMIRS GeoVIEW.WA interactive mapping application at [www.dmirs.wa.gov.au](http://www.dmirs.wa.gov.au) and the final, point-located dataset will be released later this year.

A group of delegates with the China Chamber of Commerce in Australia's Perth Branch also took the opportunity to visit the department's Joe Lord Core Library in West Kalgoorlie.

"Drillcore is an important tool for industry stakeholders to develop geological models and exploration programs," Mr Haworth said.

"There are two purpose-built core libraries administered by the GSWA, the Perth Core Library in Carlisle, Perth and the Joe Lord Core Library in Kalgoorlie, which are used to display and archive drillcore to assist exploration activity."

For more information visit [www.dmirs.wa.gov.au](http://www.dmirs.wa.gov.au) ■





# WA IN WORLD SPOTLIGHT AT US BIOTECH EVENT

**Western Australia was well represented at the 2019 BIO International Convention – the world's largest event for the biotechnology industry – held in June in Philadelphia, USA.**

The Western Australian delegation was led by Deputy Premier, Roger Cook and WA's Chief Scientist, Peter Klinken and included 11 Western Australian companies that exemplify world-class capability in the sector.

Western Australia's delegation to BIO 2019 was the first since 2007 and was the result of a collaboration between the Department of Jobs, Tourism, Science and Innovation (JTSI), the City of Perth and AusBiotech.

The delegation's itinerary included talks with science parks, large pharmaceutical companies and entrepreneurs; and included discussions about successful innovation systems; the importance of regulatory alignment; intellectual property management; and the potential impact of emerging technologies including artificial intelligence to streamline clinical trial recruitment.

Mr Cook delivered a presentation about Western Australia that highlighted innovations in the State's health sector, as well as its state-of-the-art health facilities (including new investment); new innovation hubs – cyber security, med tech pharma, data science; our universities' connections to industry; and WA as a great place to live and work.

Perth is home to the internationally recognised Queen Elizabeth II Medical Centre, one of the largest medical centres in the southern hemisphere, and the Australian National Phenome Centre.

The 11 Western Australian companies and organisations that attended highlight the State's

strengths in research and knowledge transfer, pharmaceuticals, clinical trials, biotechnology, biological research, drug discovery and commercialisation. They were:

1. Epichem
2. Linear Clinical Research
3. Murdoch University
4. Neuroscientific Biopharmaceuticals Ltd
5. Perth Convention Bureau
6. Proteolytics
7. Proteomics International
8. Suda Pharmaceuticals Ltd
9. Telethon Kids Institute
10. The University of Western Australia
11. YUUWA Capital.

During the event, the WA delegates toured Philadelphia's biotech clusters, including the University City Science Center. The centre is a leader in life sciences and tech-based economic development that supports a cluster of world-class academic and medical institutions by helping entrepreneurs and start-up companies to translate their cutting edge research into market-ready products and services.

The delegates also met senior representatives from leading biotech companies, including Merck, GSK, Pfizer, Amgen and Deep6.ai.

Mr Cook said the mission to BIO 2019 was "enlightening and inspiring".

"The mission was to learn about health and medical research and innovation...and to explore opportunities for Western Australia," he said.

"The mission gave us the chance to see firsthand some of the truly incredible advances being made in the field of health and medical research and innovation.

"We took advantage of opportunities to sell WA's research and innovation capabilities and pitch the State as a potential collaborator in future research and innovation projects."

JTSI's Science and Innovation division supports Minister Dave Kelly and Professor Klinken and works to facilitate linkages across government and between industry, research and academic organisations at local, national and international levels.

For more information visit [www.jtsi.wa.gov.au/what-we-do/science-and-innovation](http://www.jtsi.wa.gov.au/what-we-do/science-and-innovation) ■



*WA Chief Scientist Professor Peter Klinken AC; WA's quokka mascot Roger; JTSI Innovation Director Dr Deb Cousins and City of Perth Economic Development Unit's Michael Pasquale at Bio 2019.*



# WA START-UPS ON GLOBAL STAGE



*The WA cohort for London Tech Week 2019.*

**Leaders heading up five innovative Western Australian start-ups travelled to the United Kingdom in June to showcase their ideas and grow their businesses at London Tech Week.**

One of the world's largest technology conferences, London Tech Week comprises more than 300 technology events and attracts more than 40,000 attendees from around the world.

The five Western Australian start-ups were selected by the State Government through a competitive process and shared in \$30,000 (excluding GST) of funding to participate.

The funding enabled the start-up leaders to represent Western Australia as part of the Startup Catalyst Mission to London Tech Week. Startup Catalyst is an Australian not-for profit organisation based in Queensland that organises missions for Australian youth, start-ups, investors, corporates and innovation leaders to international start-up and technology hubs including Silicon Valley, Europe, Israel and Asia.

The Western Australian start-up heads included:

- Graeme Speak, CEO and founder of BankVault Pty Ltd, a financial technology and cyber security software company that secures online activity from banking to Facebook via its invisible keyboard;
- Kym Atkins, one of the four female founders of The Volte, a peer-to-peer fashion lending marketplace;
- Elio Adragna, CEO and founder of JUGGLR, a digital platform that connects professional mothers with flexible work in their local area;
- Michael Le Page, CEO, co-founder and lead designer of Exodus Space Systems, a start-up company focused on solving the growing problem of space debris; and
- David Martin, Managing Director of Power Ledger, an energy trading start-up that uses blockchain technology as a platform to allow for the selling and buying of renewable energy.

London is home to more than 200 start-up accelerators and tech hubs, and has the highest investment rates in Europe.

Participating in Startup Catalyst's Mission to London Tech Week offers Western Australian start-up companies the opportunity to access some of the world's leading tech and innovation thinkers, investors and policy makers; form valuable connections; build networks; and share their experience with other Western Australian start-ups.

Minister for Science and Innovation; ICT, Dave Kelly said the Western Australian Government was committed to using the State's existing trade relationships to attract investment in Western Australia's start-up community.

"There is an exciting opportunity to leverage investment in WA start-ups by promoting our innovators on a global stage," Mr Kelly said.

"Supporting start-up businesses will help grow Western Australia's jobs and diversify the State's economy.

"The McGowan Government went to the election with a commitment to use our existing trade relationships with the USA, UK and Europe to attract foreign investment in WA's start-up community. This program is one of the ways we are delivering on that commitment."

The Western Australian Government's London Trade Office assisted the five Western Australian companies throughout their mission to London, which was deemed a great success by all participants.

"(Australian start-ups) have a reputation of being very good at invention, and along with our cultural tendency to undersell and over-deliver, our delegation arranged some high level meetings," participant Mr Le Page said.

"So far to our knowledge, at least one of the companies on the Startup Catalyst mission has had a spectacular funding outcome." ■

# STATE STEM SKILLS STRATEGY LAUNCH

**Gearing up Western Australians for the jobs of the future is the push behind the State's first science, technology, engineering and mathematics (STEM) skills strategy, launched by the State Government in May.**

A cross-sectoral panel of experts chaired by WA's Chief Scientist Professor Peter Klinken developed the strategy, which has been welcomed by WA's industry, technology and education sectors as a way to prepare Western Australians for jobs of the future.

"One of the priorities for this Government is ensuring all Western Australians have the opportunity to develop STEM skills and participate in the jobs of the future that will drive our economy," Science Minister Dave Kelly said.

"Technological change, automation and a diversifying economy mean that every Western Australian needs some level of STEM skills, not just workers in STEM related jobs.

"If we can get our education, training and policy ahead of the game during this time of change, we can maximise the creation of WA jobs and create a bright future for all."

A core objective of the strategy is addressing the lack of diversity in STEM education and STEM related careers.

Women represent just 16 per cent of STEM qualified people in Australia and Aboriginal people represent less than one per cent of higher education engineering and science students.

The State Government has already committed more than \$3.3 million to kick-start delivery of the strategy. This funding includes two-year professional learning and mentoring programs to develop the teaching practice of more than 1,000 teachers in lower socio-economic public schools, impacting an estimated 25,000 students, which is already underway.

Other projects to drive the strategy include a digital and technology skills program and the development of a STEM communications campaign.

The strategy is available at [www.jtsi.wa.gov.au](http://www.jtsi.wa.gov.au) ■



# SPEAKER'S DELEGATION MISSION TO THE UNITED ARAB EMIRATES AND OMAN

## A Western Australian Parliamentary delegation visited Oman and the United Arab Emirates (UAE) in April on a mission aimed at enhancing WA's growing relationship with the two Gulf states.

The mission focused on several industries including education, mining and mining services, agribusiness, oil and gas, defence, police and public safety, and tourism.

Legislative Assembly Speaker, Peter Watson led the delegation, which included National Party leader Mia Davies; Shadow Minister for Police, Road Safety and Industrial Relations Peter

Katsambanis; Stephen Price, MLA; and Legislative Assembly Clerk, Kirsten Robinson.

While in Oman, the delegation met representatives of the Ministry of Commerce and Industry, Ministry of Tourism, the Oman Chamber of Commerce, Oman Consultative Assembly, the Royal Oman Police and the Royal Oman Navy.

The delegation attended the inaugural Oman Mining Expo, where Mr Watson was a keynote speaker and highlighted Western Australia's mining capabilities and international engagement.

During their visit to the UAE, the party visited three of the Emirates: Dubai, Abu Dhabi and

Sharjah. They engaged with several government departments, and UAE investment funds including the Mubadala Investment Group (the UAE Sovereign Wealth Fund).

They also met with members of the royal family of Abu Dhabi including His Excellency Sheikh Nahayan Mubarak Al Nahyan, Minister of Tolerance UAE, where 2019 is considered the 'Year of Tolerance'.

## WA and the Middle East

- Western Australia's total trade with the Middle East was worth more than \$7.6 billion in 2018. Countries include Bahrain, Cyprus, Egypt, Iran, Iraq, Israel, Jordan, Kuwait, Lebanon, Oman, Qatar, Saudi Arabia, United Arab Emirates and Yemen.
- The UAE (\$2.4 billion), Bahrain (\$1.27 billion) and Qatar (\$416 million) were Western Australia's top trading markets in the Middle East in 2018.
- The State's total trade with the UAE was valued at \$4.6 billion making the UAE WA's seventh largest trading partner in 2018 (represents 65 per cent of Australia's total trade with the UAE).
- The Middle East top imports from Western Australia include mineral commodities particularly alumina and mineral sands. There is also a significant amount of agricultural produce including carrots, turnips, canola seeds and lamb meat.
- Curtin and Murdoch Universities both have campuses in Dubai. Edith Cowan University (ECU) has a partnership with Emirates Group Security to deliver ground handling and security training. ECU has partnered with Emirates to provide a scholarship to enable students to undertake unpaid work placements with Emirates in Dubai.
- Emirates Airlines operates daily flights between Dubai and Perth and it is one of the largest carriers of inbound international visitors to Perth.
- The Western Australian Government has a regional trade and investment office located in Dubai.



While in Dubai the delegates visited the Expo 2020 Dubai site office and met the Dubai Government Expo management team.

## World Expo 2020 Dubai

World Expos are a major platform for countries to showcase themselves to a large international audience and Dubai will be hosting the World Expo in 2020.

Expo 2020 Dubai will take place from October 2020 to April 2021 with the theme 'Connecting Minds, Creating the Future' focusing on the development of innovative partnerships across sectors, organisations, geographies and peoples.

The expo will be a global experience; Dubai is a modern city located at a geographic crossroads with extensive transport links and direct global flights from 240 cities.

Expo 2020 Dubai will be the first world expo to be hosted in the Middle East, Africa and South Asia regions.

Expo 2020 is expecting 25 million visitors (70 per cent from outside the UAE) with a diversity of ages, interests, nationalities and incomes.

The Western Australian Government, represented by the Department of Jobs, Tourism, Science and Innovation, is part of the Australian Expo 2020 National Project Advisory Group which is chaired by the Department of Foreign Affairs and Trade.

Austrade is developing the Australian Business Program with a focus on industry sectors where Australian capabilities are globally competitive, including services and technology; international education; agriculture and food; major infrastructure; health; defence and advanced manufacturing (including space); and resources and energy.



# WA INDUSTRY AND EXPORT AWARDS: CELEBRATING 31 YEARS



*Kalgoorlie-based Dutjahn Sandalwood Oils won the 2018 National Emerging Export Award and this year became the first Australian organisation to receive the UN Equator Prize. Photo: Dutjahn Sandalwood Oils Photographer Jody D'Arcy*

**This year marks the 31<sup>st</sup> anniversary of the Western Australian Industry and Export Awards, which have grown during the past three decades to become the State's most prestigious business awards.**

The awards honour and acknowledge Western Australian businesses achieving success in international trade, and recognise the achievements of Western Australia's industry and exporters across diverse market sectors.

"Businesses that succeed, through vision, innovation and a commitment to excellence deserve the recognition that a WA Industry and Export Award brings," Premier and Minister for State Development, Jobs and Trade, Mark McGowan said.

"These successful businesses are vital to creating jobs and diversifying Western Australia's economy. Last year our annual merchandise exports were worth almost \$145 billion and accounted for 42 per cent of Australia's exports.

"While most of these were resources exports, many of the companies that supply expertise, specialist equipment or skills development to the resources sector, have become globally competitive exporters and important employers in their own right.

"That is why securing greater opportunity for local firms to supply our major export sectors is such an important focus for the Government. The awards complement the Australian Export Awards program, conducted nationally each year."

Last year, Kalgoorlie-based business Dutjahn Sandalwood Oils won the State Emerging Exporter Award and went on to win the National Emerging Exporter Award at the national awards in Canberra, held in November 2018.

In June this year, Dutjahn Sandalwood Oils became the first Australian organisation to receive the prestigious United Nations Equator Prize.

Applications for this year's WA Industry and Export Awards opened in early May, with winners to be announced at a gala event.

The awards have 17 categories for small, medium and large companies located in Western Australia. Of the 17 categories, 13 are export categories aligned with the Australian Export Awards.

There are four State exporter categories, including a new addition to this year's awards, the Exporter to Asia Award, and one industry award.

The State Government and the Export Council of Australia manage the awards, along with corporate sponsors including Austrade, Australian Defence Force, Chamber of Commerce and Industry WA, HSBC, City of Perth, Export Finance Australia, Australian Multilingual, and Business Foundations.

"This year's WA Industry and Export Awards might well reveal Western Australia's next international success story – or equally importantly – encourage another local firm to look to overseas markets," Mr McGowan said.

For more information visit [www.exportaward.com.au/wa](http://www.exportaward.com.au/wa) ■







# SHOWCASING WA'S DEFENCE INDUSTRY

## Indo-Pacific Conference comes to Perth

The second Indo-Pacific Defence Conference landed in Perth in August, with the Western Australian Government collaborating with the Perth USAsia Centre to deliver the conference at Crown Towers.

Strategic thinkers from the military, industry, academic and government sectors featured, with about 500 delegates from across the region attending.

The conference showcased the best of Western Australia's defence industry and research capabilities.

This year's theme was 'An era of new and renewed partnerships' with a focus on topics including a new role for Indonesia in the region, a growing role for Japan, an aspirational role for India, a renewed role for the United Kingdom and France, and a continued role for the United States of America.

Keynote speakers and panel discussions explored themes about industry support for the changing operational environment, new frontiers in defence technology, Western Australia's STEM agenda, and defence industry applications for the State's battery minerals and resources expertise.

Defence Issues Minister Paul Papalia said Perth was the ideal strategic location for the event.

"Perth is home to Australia's largest naval base, an advanced manufacturing sector and has an internationally recognised reputation for innovation and expertise," Mr Papalia said.

"It is the ideal location to discuss the critical defence and security issues impacting the region and highlight our competitive advantages and strategic global position to our Indo-Pacific neighbours.

"I am strongly committed to promoting our defence capabilities and harnessing WA's competitive edge to maximise defence business opportunities and increase jobs in the sector."

## New Defence Advisory Forum

In early June, a new Defence Advisory Forum for Western Australia was announced to provide a single mechanism for the State Government to seek and receive defence industry advice and feedback.

The forum will advise and support the State Government on defence industry capability and business development and investment issues including workforce, skills, research and infrastructure requirements.

Chaired by Western Australian Defence Advocate, Rear Admiral (Rtd) Raydon Gates AO CSM, the forum includes representatives from key industry and defence sector stakeholders including the Australian Industry and Defence Network; Chamber of Commerce and Industry WA; Henderson Alliance; Australian Industry Group; Construction Contractors Association; Centre for Defence Industry Capability; and each of the four Western Australian public universities.

State Government representatives from Defence West, the Department of Training and Workforce Development and South Metropolitan TAFE will also be included.

The forum will report directly to Minister Papalia, providing independent advice to support the sustainable growth of the Western Australian defence industry sector.

The State Government's steering committee, which is overseeing the implementation of the WA Defence and Defence Industries Strategic Plan, will also engage with the forum to seek feedback and advice.

## New WA training facility opens

Premier and Minister for State Development, Jobs and Trade, Mark McGowan, together with Education and Training Minister Sue Ellery and Defence Issues Minister Paul Papalia launched the South Metropolitan TAFE Naval Base Campus in Henderson in May.

The State Government has invested \$2.4 million in the new campus.

"South Metropolitan TAFE Naval Base Campus is a state-of-the-art, all-round training facility that will deliver a skilled workforce to meet the naval shipbuilding industry's requirements both in WA and nationally well into the future," Mr McGowan said.

Consolidating heavy fabrication, marine fabrication, welding and composite apprenticeship training from the old Henderson and Rockingham campuses, the new facility was designed with training in shipbuilding and defence work in mind.

South Metropolitan TAFE has been working in partnership with defence for more than two decades, delivering a range of qualifications and courses throughout the State and nationally to all arms of the defence industry.

Major defence partnerships include ASC Collins Class Submarine training services and technical services training for the Royal Australian Navy through a sub-contracting arrangement.

In close proximity to relevant employers, industry and the Australian Marine Complex, the SMT Naval Base Campus will offer a mix of apprentice training and fee-for-service as well as post trade training.

For more information on defence in Western Australia, visit [www.jtsi.wa.gov.au/economic-development/defence-west-homepage](http://www.jtsi.wa.gov.au/economic-development/defence-west-homepage) ■





Department of Jobs, Tourism, Science and Innovation staff with Director General Rebecca Brown (centre left), Defence Issues Minister Paul Papalia (centre right) and WA Defence Advocate, Rear Admiral (Rtd) Raydon Gates (far right) at the launch of the new Defence Science Centre in Perth.

## NEW WA DEFENCE SCIENCE CENTRE OPENS

**Western Australia is set to be at the forefront of cutting-edge science and innovation in the defence sector with the launch of a new Defence Science Centre (DSC).**

The new centre, launched in June by Defence Issues Minister Paul Papalia, came about through a collaboration between the State and Commonwealth Governments and Western Australia's four public universities.

One of the centre's key roles will be to act as a matchmaker between universities, government and industry to support the realisation of Australia's defence capability requirements.

The centre will support the commercialisation of defence-related research and cultivate a competitive, local defence industry – in turn, contributing to diversifying the State's economy and creating more Western Australian jobs.

"We have established the Defence Science Centre to create the right conditions for the development of cutting-edge science and innovation in Western Australia," Mr Papalia said.

"Developing a DSC in WA will greatly enhance collaboration between the academic and industry sectors, and makes us part of a broader national network of defence-related research.

"This will enable WA researchers to more easily link into projects, boosting our own State's capability and future-proofing WA's defence industry, keeping and growing skills and knowledge here and creating job opportunities for Western Australians."

Professor David Badcock, a researcher at The University of Western Australia, is already working as part of a national research team looking at realising the benefits of augmented reality devices.

Mr Papalia said the project, which seeks to understand risks and identify ways of realising enhanced capabilities through development of a prototype adaptive AR interface, was a prime example of how the Defence Science Centre will link Western Australian researchers with cutting-edge defence technology.

A board of academic and industry experts, chaired by Woodside GM Intelligent and Autonomous Systems, Russell Potapinski, will provide strategic advice to the centre.

Mr Potapinski said he was honoured to take up the position of inaugural Chair.

"I look forward to playing a role in promoting even greater knowledge sharing and collaboration between government, industry and universities," Mr Potapinski said.

"Woodside has a strong track record of collaborative innovation partnerships, including with NASA.

"Woodside is a big supporter of Western Australian innovation capabilities, including in the area of remote operations – where space, defence and resources share common interests and challenges."

The centre will facilitate university-government-industry research and skills exchange via actively cultivating relationships and linkages.

Defence Science Centre grants will be an important tool in supporting the facilitation of these exchanges and will set the conditions for commercial opportunities in industry, and business development.

The centre will partner with the Australian Mathematical Sciences Institute's APR.Intern program to increase the number of internship

projects undertaken by Small to Medium Size Enterprises (SMEs) in Western Australia's defence sector. The partnership will see 10 STEM PhD students placed into industry to undertake short-term focused research projects.

This program encourages university and industry collaboration that connects business and other organisations to the vast research expertise in Australia's universities, and supports Western Australia's STEM strategy.

Eligible industry partners will receive a subsidy through the centre as well as a 50 per cent Federal Government rebate through APR.Intern's Supporting more women in STEM careers: Australian Mathematical Sciences Institute – National Research Internship Program (NRIP).

Mr Papalia congratulated all parties involved in the creation of the centre, including Defence West, the Defence Science Technology Group of the Department of Defence, Curtin University, Edith Cowan University, Murdoch University and The University of Western Australia.

The establishment of the Defence Science Centre is a key outcome of the State Government's WA Defence and Defence Industries Strategic Plan.

The plan and more information about the centre is available on the Department of Jobs, Tourism, Science and Innovation website at [www.jtsi.wa.gov.au/economic-development/defence-west/defence-science-centre](http://www.jtsi.wa.gov.au/economic-development/defence-west/defence-science-centre) ■



# Hydraulic fracturing approach aims for balance

## **A whole-of-government Implementation Plan was released in July outlining the State Government's response to the Independent Scientific Panel Inquiry into Hydraulic Fracture Stimulation in Western Australia.**

The Department of Water and Environmental Regulation (DWER) and the Department of Mines, Industry Regulation and Safety (DMIRS) are co-chairing a Senior Officials Steering Group that will oversee its implementation.

DMIRS Director General David Smith said Western Australia had robust resource regulations and he was confident the actions outlined in the Implementation Plan will reinforce this strong regulatory framework.

"The State has a long history of safe and responsible oil and gas operations, and the steering group is working hard to maintain this world-class approach," Mr Smith said.

The steering group will action specific Government Policy Decisions such as the requirement to obtain consent from Traditional Owners and private landowners before hydraulic fracturing production is permitted, maintaining the existing ban in the South West, Peel and Perth Metropolitan regions, and further banning hydraulic fracturing in national parks, the Dampier Peninsula, and other iconic natural heritage areas.

DWER Director General Mike Rowe said that delivering the Implementation Plan would require a considered, staged and timely approach to better meet the needs of government, stakeholders and the community.

"DWER is committed to protecting the State's water resources and environment to enable thriving communities and a strong economy," Mr Rowe said.

"The Implementation Plan includes a number of safeguards such as the referral of all onshore exploration and production applications for hydraulic fracturing to the Environmental Protection Authority for assessment.

"The Plan also prohibits hydraulic fracturing within 2,000 metres of gazetted Public Drinking Water Source Areas."

The Hydraulic Fracturing Implementation Plan website provides a single source of information for stakeholders and parties interested in the Implementation Plan, including regular updates and progress reports.

To view a copy of the Implementation Plan and for progress updates, go to the dedicated website at [www.hydraulicfracturing.wa.gov.au](http://www.hydraulicfracturing.wa.gov.au) ■

*"The State has a long history of safe and responsible oil and gas operations, and the steering group is working hard to maintain this world-class approach."*



## MINEDEX UPDATE COMING SOON

### **MINEDEX is getting a makeover.**

The Department of Mines, Industry Regulation and Safety (DMIRS) spatial and textual database provides comprehensive data about more than 42,500 mining and exploration sites, plus 6,000 projects in Western Australia.

The database's unique site and project codes are also used to reference communication between industry and DMIRS relating to exploration and mining activities.

MINEDEX is maintained by the department's Geological Survey of Western Australia (GSWA) division and is free to use without registration.

The available data on mine and exploration sites includes 24,047 mine sites, 2,287 of which are operating, 3,325 deposits with resources, 4,438 mining infrastructure sites and other known mineral occurrences.

Executive Director Geological Survey and Resource Strategy Jeff Haworth said a new MINEDEX user interface was expected to be released in November 2019.

"The new interface will allow comprehensive searching, modernise the user experience, and improve compatibility with tablets and mobile devices," he said.

"The new MINEDEX also conforms to the standards of the Office of Digital Government."

MINEDEX provides data on:

- Location, development status and geology of mineralised sites
- Commodities
- Project structure, ownership and tenements
- Mineral resource estimates
- Mineral production data

- Environmental registrations
- Mine operators
- Inventory of Abandoned Mine Sites.

Custom reports and bulk downloads of MINEDEX data are also available in multiple file formats. Spatial data from MINEDEX can also be downloaded from the Data and Software Centre in ESRI, Mapinfo, KMZ and CSV formats.

For more information go to MINEDEX at [www.dmirs.wa.gov.au](http://www.dmirs.wa.gov.au) or contact [minedex@dmirs.wa.gov.au](mailto:minedex@dmirs.wa.gov.au) ■



# Developing the Implementation Plan

In September 2017 the State Government announced the establishment of the Independent Scientific Panel Inquiry into Hydraulic Fracture Stimulation in Western Australia. The Panel handed its final report to the government in September 2018, which included 91 findings and 44 recommendations.

Following careful consideration of the Inquiry's report, the government accepted in-principle the Inquiry's recommendations; and on 27 November 2018 announced a raft of new, world-class controls to ensure risks associated with hydraulic fracturing are low and manageable.

## State Government's Policy Decisions:

1. Lift the hydraulic fracture stimulation moratorium on all onshore petroleum titles existing as of 26 November 2018; and maintain the ban over the South West, Peel and Perth Metropolitan regions;
2. Ban hydraulic fracture stimulation in national parks, the Dampier Peninsula and other iconic natural heritage areas (to be defined and delineated on maps);
3. Introduce a requirement for consent of relevant Traditional Owners and private landowners before hydraulic fracture stimulation production is permitted;
4. Restore the 10 per cent royalty rate for all onshore petroleum;
5. Establish a Clean Energy Future Fund (with a \$9-million seed allocation), using net royalties from onshore hydraulic fracture stimulation petroleum projects, to support facilitation of clean energy developments; and
6. Prohibit hydraulic fracture stimulation within 2,000 metres of gazetted Public Drinking Water Source Areas.

To lead the government's response, a Senior Officials Steering Group (SOSG) was formed, which includes officials from the Departments of the Premier and Cabinet; Water and Environmental Regulation (DWER); Mines, Industry Regulation and Safety (DMIRS); Health; Biodiversity, Conservation and Attractions; Jobs, Tourism, Science and Innovation; Planning, Lands and Heritage; and Treasury. This group is co-chaired by DWER and DMIRS as the lead agencies charged with oversight of the Government response.

To drive the response, the SOSG was tasked with developing the Implementation Plan, designed to address the Inquiry's recommendations and government's decisions. The plan outlines the methodology and timelines of this process.

Implementation of the plan is designed to strengthen regulation, ensuring industry is accountable for its practices and risks associated with hydraulic fracture stimulation are low and manageable.

All applications for onshore exploration and production hydraulic fracturing activities will now be referred to the Environmental Protection Authority (EPA) for assessment under the *Environmental Protection Act 1986*. Using the EPA process, underpinned by regulatory changes to environmental and petroleum legislation, ensures that issues of scale and cumulative impact of hydraulic fracturing activities are addressed and managed. A new Code of Practice will also be developed, prescribing minimum enforceable standards for hydraulic fracturing activities.

Progress on Implementation Plan activities is being reported via a dedicated website at [www.hydraulicfracturing.wa.gov.au](http://www.hydraulicfracturing.wa.gov.au) – the website is a single source of information for stakeholders and parties interested in the Implementation Plan. ■

## Frequently Asked Questions

### Will the moratorium on hydraulic fracturing be lifted?

The moratorium has been lifted on land covered by onshore petroleum titles (exploration permits, retention licences and production licences) existing as of 26 November 2018.

### When will companies be able to submit proposals for hydraulic fracturing?

Companies holding onshore petroleum titles (exploration permits, retention licences and production licences) existing as of 26 November 2018 can submit hydraulic fracturing proposals at any time. Proponents considering hydraulic fracturing are encouraged to engage early both with the Environmental Protection Authority (EPA) and the Department of Mines, Industry Regulations and Safety (DMIRS) to ensure they understand the requirements of the assessment process.

### When will the Government implement all of the actions?

The State Government aims to implement the Inquiry's recommendations through the Implementation Plan by the end of 2020. Implementation of some actions will require complex and lengthy reforms across a number of agencies. This will involve further policy development and changes to legislation and processes, which may take a number of years to fully implement.

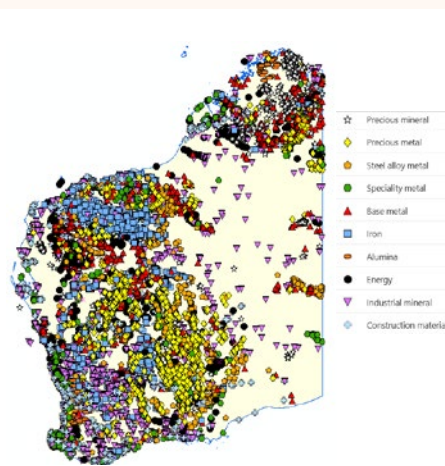
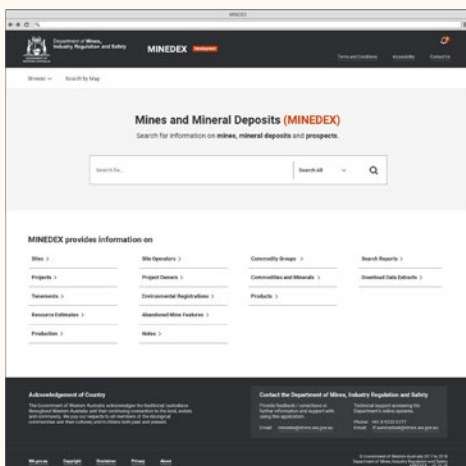
### Will the State Government consult in relation to the Implementation Plan?

Extensive stakeholder feedback was considered in the development of the Implementation Plan. Stakeholders will be consulted as work is undertaken to implement a number of actions from the plan.

### What will the consultation process involve?

A range of consultation methods is anticipated to be used throughout the stakeholder consultation process where required, including conducting workshops and briefings with impacted stakeholders; releasing draft proposals for public comment and feedback; publishing responses to feedback on the website; and informing stakeholders through the website once actions have been completed.

**More information, including additional frequently asked questions, is available at: [www.hydraulicfracturing.wa.gov.au](http://www.hydraulicfracturing.wa.gov.au)**



A new MINEDEX user interface is expected to be released in November 2019.





Minister for Mines and Petroleum Bill Johnston at the awards ceremony.

## AWARDS RECOGNISE EXCELLENCE AND INNOVATION IN RESOURCES SECTOR

### **Renewable energy powering mining projects and partnerships that reinvent community engagement were rewarded with top honours at the Department of Mines, Industry Regulation and Safety's (DMIRS) Resources Sector Awards for Excellence ceremony.**

Projects demonstrating innovation and sustainability took out the top awards for 2019, with a company from the petroleum industry winning the Community Partnership Award for the first time.

DMIRS Director General David Smith said the Western Australian Community was the real winner from these projects.

"These awards bring to the forefront the world-class work being done by companies in the resources sector and in the local communities," Mr Smith said.

"Western Australians expect the State's resources companies to be responsible. This includes companies being aware of their duties in

environmental stewardship and understanding the importance of working closely with the local community.

"As a member of the judging panel for the Community Partnership Award, I can tell you we were impressed with the high standard of projects and the positive outcomes being achieved. These are the stories we don't hear often enough and are keen to hear more."

Mr Smith announced there would be a new category added to the 2020 Community Partnership Resources Sector Awards, which would recognise smaller players in the industry. More information will be available when nominations open in February next year.

#### **The Award Winners**

The innovative Woombooriny Amboon Angarriya Partnership Initiative (WAAPI) received the **Community Partnership Resources Sector Award** for its unique Aboriginal-led co-designed

approach to improving the early childhood outcomes of Aboriginal children living on the Dampier Peninsula in the Kimberley.

Led by Save the Children and Woodside Energy, WAAPI focuses on bringing community members together and building strong local leadership to support better outcomes for children.

"By mentoring Community Navigators to inform and guide social planning, this initiative has shown it is a truly progressive model, which is now being considered for other communities across the State," Mr Smith said.

Janella Isaac, a Community Navigator with WAAPI, said the partnership was the realisation of a dream the communities' Elders had held for a long time.

"Woombooriny Amboon Angarriya is an infusion of two language groups in the region coming together and we wouldn't be able to do a nation building process without the support from the partners. It means a lot to us," Ms Isaac said.





## Community Partnership Resources Sector Award



*The innovative Woombooriny Amboon Angarriya Partnership Initiative (WAAP) received the Community Partnership Resources Sector Award.*



## 2019 GOLDEN GECKO Awards for Environmental Excellence



*Sandfire Resources NL received the Golden Gecko Award for Environmental Excellence for its DeGrussa Solar Project in the Mid West.*

"They've bought us together and united us, not just the members of the community, but the people who have been associated with us.

"They are now deeply part of our community. It's about us now continuing together and building the initiative up and moving forwards."

The awards' judges remarked that WAAP was truly innovative, sustainable and the co-designed approach had given ownership of the initiative to the community. It was an example of how engagement and partnerships could be completely reinvented to achieve the best possible outcomes for communities.

Woodside Energy Senior Corporate Affairs Adviser Cher Gibellini explained that the partnership was a departure from the traditional program-based funding models in order to achieve real change.

"Millions of dollars a year are put into communities through government, the public sector and private organisations like ourselves, but the situation in

communities wasn't changing, so in 2014 we had a rethink and decided to apportion some of our social contribution towards working in a different way," she said.

"We launched the Woodside Development Fund. WAAP is one of the initiatives in the fund. By building a collaboration rather than focusing on specific programs, we could make a real difference.

"Our senior executive supported the approach through the Woodside Development Fund and allowed us to start with the end goal of better outcomes for children, then create the collaboration to build the capacity in the communities to reach that goal."

Dr Jessica Bunning from Save the Children acknowledged the commitment from Woodside and its contribution to systems change in very complex issue areas.

"This project involved more than two partners, but the amazing thing about Woodside is it has

been a long-term supportive partner right from the beginning, trusting us, supporting us and helping us along this journey and being a real backbone of support right the way through," she said.

Sandfire Resources NL received the **Golden Gecko Award for Environmental Excellence** for its DeGrussa Solar Project in the Mid West.

Located at Sandfire Resources' DeGrussa Copper-Gold Mine, 900km north-east of Perth, this project is a global pioneer for the adoption of renewable energy in the mining industry.

The facility comprises 34,080 solar photo-voltaic panels and generates about 20 per cent of the total power requirement for the DeGrussa mine site, making it the largest integrated off-grid solar and battery storage facility in Australia.

Since commencing operations in 2016, the project has reduced Sandfire's carbon emissions by more than 30,000 tonnes and offset the use of 11 million litres of diesel.





*DMIRS Director General David Smith at the awards ceremony.*

Sandfire Resources Chief Commercial Officer Robert Klug said the project faced several of challenges but the end result was a great example of what innovative and motivated people could achieve.

"Everyone was saying it was going to be too difficult and too expensive. We were able with our partners' support to get it done and it's turned out really well," he said.

"It is now an option that is being looked at for most projects in the mining industry for power generation. We like to think it's been a bit of a leader in the industry.

"Similar projects had been done all around the world but not too many in mining. That presented some challenges for us and our partners, but it was a good thing, it educated them and Sandfire to an extent."

Mr Klug said the second challenge was the fact that it was an island power station without the reliability of a grid network to smooth power generation on start-up and shutdown, as well as during outages.

A further challenge was that a diesel station had already been built, so they needed to retrofit the solar power station into the network.

He said Sandfire Resources would definitely consider solar for all of their future operations and they were looking forward to when battery technology allowed solar energy to be stored during the day, so it could be used to power operations at night.

"If we make another discovery we would certainly look to expand the project if possible," he said.

"We've just signed an agreement to acquire MOD Resources in Botswana and we are looking at solar power generation as an option for that project."

The judges said it was great to see renewable energy being taken up in the mining sector, and that the learnings from Sandfire's project were being shared amongst the mining industry and community.

The project had been visited by representatives from mining companies, government, universities and schools. ■

## 2019 Resources Sector Awards for Excellence – full list of winners

### Community Partnership Resources Sector Award

#### Winner

**Woombooriny Amboon Angarriiya Partnership Initiative (WAAPPI)\***

Save the Children and Woodside Energy

\*The name means 'All People Moving Forwards Together' in the local Bardi and Nyul Nyul languages.

#### Certificate of Merit

**The Shooting Stars Program**

Glass Jar Australia and Sandfire Resources NL

#### Enduring Partnership Award

**The Alcoa Harvey Waroona Sustainability Fund**

Shires of Harvey and Waroona and Alcoa of Australia

### Golden Gecko Award for Environmental Excellence

#### Winner

**The DeGrussa Solar Project**

Sandfire Resources NL





## NEW STANDARDS SUPPORT SUCCESSFUL MINE CLOSURE

**Mines and Petroleum Minister Bill Johnston has announced a new set of standards that support better rehabilitation of Western Australia's mine sites. The work is the first in Australia to be produced in collaboration with government agencies, leading science experts and industry representatives.**

The new standards outline environmental criteria mine operators can use to demonstrate they have successfully rehabilitated their site to achieve a sustainable environmental outcome. The release means there is now a single set of standards for mine closure across Western Australia, resulting in better rehabilitation results for the community.

The standards were developed by the Western Australian Biodiversity Science Institute (WABSI) following its comprehensive, independent study into effective mine site closures.

Mr Johnston said the new set of standards was a great example of government and industry working together to deliver better outcomes for Western Australia.

"The standards and associated study will provide industry with greater guidance, clarity and consistency in the development of mine closure

plans across different locations and commodities," he said.

"Effective mine closure is critical to ensure the long-term environmental sustainability of the industry."

The Department of Mines, Industry Regulation and Safety (DMIRS) collaborated with WABSI to initiate the project after identifying a need to provide the resource industry with a clearer understanding of how to develop appropriate rehabilitation monitoring criteria to address key mine closure issues in WA.

The single set of standards, which DMIRS has endorsed, will:

- assist industry to develop site-specific risk-based completion criteria and monitoring plans;
- support regulators by providing greater consistency in the development of mine closure plans across companies, locations and commodities; and
- provide improved social and environmental outcomes to the community through an improved process for the definition of mine completion criteria, and contribute ultimately towards relinquishment.

While the standards primarily target the resources sector, other industries can potentially use them for guidance when undertaking ecological restoration.

DMIRS Deputy Director General Dr Phil Gorey said the new criteria were a good example of the department's efforts to reduce regulatory complexity, which is a key feature of the government's Streamline WA initiative.

"The department is focused on bringing government, community and business together to provide greater clarity and guidance to industry to allow them to manage risks," Dr Gorey said.

"We recognise collaboration is an effective means of meeting the regulatory challenges we face."

The report's rehabilitation research will provide a scientific basis for government policy and future studies.

A copy of the report and the new Government standards is available on WABSI's website at: [www.wabsi.org.au/](http://www.wabsi.org.au/) and [www.dmp.wa.gov.au/Environment/Environment-309.aspx](http://www.dmp.wa.gov.au/Environment/Environment-309.aspx) ■



# NEW PLAN LAUNCHED TO DIVERSIFY WA

## **The State Government announced in July a new framework for Western Australia's economy.**

'Diversify WA' sets out the government's vision for a strong and diversified economy that delivers secure, quality jobs across a broad range of industries.

The framework matches Western Australia's strengths to global megatrends, identifying six economic sectors to focus collective efforts to build the WA economy.

These include Energy; Tourism, Events and Creative Industries; International Education; Mining and Mining Engineering and Technical Services; Technology and Advanced Manufacturing; and Primary Industries.

Premier and Minister for State Development, Jobs and Trade, Mark McGowan said unlocking the State's potential would require close collaboration between government, industry, research organisations and the community.

"Diversify WA provides a framework for further collaboration between business, government and the community to ensure a sustainable, resilient economy that delivers secure, quality jobs for Western Australians," Mr McGowan said.

"There are considerable global opportunities for Western Australia to grow and diversify our economy by meeting the demands of the world's growing middle class, particularly in the Indo-Pacific region.

"Western Australia has substantial natural resources, a stable regulatory environment, skilled workforce and robust economy.

"Diversify WA sets out how we will capitalise on these strengths to attract trade and investment – growing our economy and creating jobs for the future.

In addition, the State Government is working to reduce barriers to diversification, foster innovation and demonstrate fiscal responsibility to attract investment, which will enhance economic growth and provide access to secure jobs as our population grows."

For more information, visit [www.dpc.wa.gov.au](http://www.dpc.wa.gov.au) ■

## OPENING DOORS IN COLLIE

### **Applications for funding are now open for the second round of the Collie Futures Small Grants Program with up to \$100,000 in funding available per initiative.**

Funding is available for initiatives from organisations, businesses and start-ups with initiatives that will have a positive impact on Collie's economy.

The financial support offered through the program is in addition to the \$2 million per industry-led project accessible through the \$18 million Collie Futures Industry Development Fund.

Both the Collie Futures Industry Development Fund and the Collie Futures Small Grants Program are part of the wider Collie Futures Fund, which the Western Australian Government established to stimulate economic development, industry diversification and create jobs in the Collie region.

Investment through the Collie Futures Fund is guided by local insights through the Collie Futures Economic Advisory Committee, which works to identify, consider and recommend worthwhile projects to Government.

"Projects supported through this program are expected to deliver a return on investment, helping to diversify Collie's economic base and creating new jobs," Regional Development and Minister Assisting the Minister for State Development, Jobs and Trade, Alannah MacTiernan said.

"The first round of the Collie Futures Small Grants Program provided financial assistance to several of initiatives which are progressing, including a demonstration marron farm, hay processing plant and energy-intensive data centre.

"The program is part of the McGowan Government's efforts to secure ongoing prosperity for Collie through broadening the economy to create jobs in a range of industries for local people."

For more information visit [www.jtsi.wa.gov.au/economic-development/economy/collie-futures-fund](http://www.jtsi.wa.gov.au/economic-development/economy/collie-futures-fund) ■



*Western Australia's south west town Collie. Copyright: SWDC*





# GRANTS FOR WA BUSINESSES TO ACCESS ASIAN MARKETS

**Western Australian businesses looking to increase engagement, trade and investment with Asian countries are invited to apply for a new grants program.**

The Access Asia Business Grants program provides funding to WA small to medium businesses, industry associations and Asian business councils seeking to enter or expand their trade with Asian markets.

The new grants program is the State Government's first action under Western Australia's Asian Engagement Strategy, launched by Asian Engagement Minister Peter Tinley in August.

The strategy provides a framework for WA's long-term engagement with key Asian markets and responds to the need for the State to diversify its economy and create future-proofed jobs.

Mr Tinley said WA's economic future was tied to Asia's burgeoning economies, and a vast range of opportunities existed to export WA's world-leading resources, produce, services and skills, as well as promoting the State's outstanding tourism and education industries.

"Developing deeper relationships and meaningful people-to-people links is essential and these grants focus on activities that bring people together and increase Asian literacy for WA businesses," Mr Tinley said.

Project funding for Asian market in-bound or export activities could be used for:

- product marketing
- expo/trade visits
- cultural/language training
- activities that help build businesses' capacity to trade with Asia.

"The Access Asia Business Grants demonstrates the State Government's plan to deliver on its Asian Engagement Strategy, diversify the economy and create jobs and prosperity for WA," Mr Tinley said.

Funding of up to \$10,000 will be available to approved projects which relate to the six priority areas identified by the State Government's economic development framework, Diversify WA:

1. Energy
2. International education
3. Mining and METS
4. Primary industries
5. Technology and advanced manufacturing
6. Tourism, events and creative industries.

Guidelines for applicants seeking to submit an application are available on the Department of Jobs, Tourism, Science and Innovation website: [www.jtsi.wa.gov.au/accessasia](http://www.jtsi.wa.gov.au/accessasia)

The guidelines contain important information about the State's six priority sectors and other grant eligibility requirements, and should be read prior to making an application. ■



**ACCESS ASIA  
BUSINESS GRANTS**

## APPLY ONLINE:

Grant applications can be submitted online via:  
[accessasia.grantplatform.com](http://accessasia.grantplatform.com)

## APPLICATIONS OPEN

Monday 16 September 2019 and

## CLOSE:

Friday 8 November 2019

To apply, check eligibility or for more information visit:

[www.jtsi.wa.gov.au/accessasia](http://www.jtsi.wa.gov.au/accessasia)



**IRON ORE PROCESSING****Pilbara – Cape Preston – Sino Iron  
CITIC PACIFIC**

The Sino Iron project is located at Cape Preston, 100km south west of Karratha. The project is the largest magnetite mining and processing development in Australia, with a mine life of more than 25 years. Six processing lines are now operational. The first shipment of magnetite concentrate to China occurred in late 2013. The project comprises in-pit crushers, a 29km slurry pipeline, and an annual capacity to produce up to 24 million tonnes of magnetite concentrate. The downstream processing facility has required significant investment in dedicated supporting infrastructure including a new port facility, a 51 gigalitre desalination plant and a 450 megawatt combined cycle gas fired power station.

Expenditure: \$12b.

Employment: Construction: 4000

Operation: 1500

**OIL & GAS DEVELOPMENTS****Carnarvon Basin – Greater Western Flank  
Phase 2****WOODSIDE ENERGY**

The Greater Western Flank 2 Project was approved in December 2015 to develop gas and condensate from the Keast, Dockrell, Sculptor, Rankin, Lady Nora and Pemberton fields via a subsea tieback to the existing Goodwyn A platform. Production commenced in Q4 2018, six months ahead of schedule.

Expenditure: \$1.37b.

**Carnarvon Offshore Basin – Barrow Island  
– Gorgon Project****GORGON JOINT VENTURE**

The Gorgon Foundation Project on Barrow Island, is a three train LNG development with a nameplate capacity of 15.6Mtpa and includes a domestic gas plant capable of delivering 300TJ/d of gas to the mainland. Cost estimates for the project construction are expected to total more than AU\$55b. The project involves the processing of gas from both the Gorgon and Jansz-Io gas fields and includes potentially the largest commercial CO<sub>2</sub> geosequestration project in the world. Train one start up and first shipment of LNG commenced in March 2016. Train 2 produced first LNG in October 2016 and train three was commissioned in March 2017. Commissioning and start-up of the CO<sub>2</sub> injection project commenced in August 2019.

Expenditure: \$55b.

Employment: Construction: 8000

Operation: 300

**ELECTRICITY GENERATION****Kwinana – Kwinana Waste to Energy  
Project****AVERTAS ENERGY**

On 18 October 2018, it was announced that the Project had achieved Financial Close. The facility will be Australia's first thermal waste-to-energy facility. Construction of the facility, which has been co-developed by Macquarie Capital and Phoenix Energy, has commenced and is scheduled to open by the end of 2021. The facility will divert 400,000 tonnes of household, commercial, and industrial waste from landfill each year and recover that waste as energy. The Project currently has 20-year waste supply agreements with the Rivers Regional Council, which represents seven Local Government Authorities, and the City of Kwinana. During the construction phase more than 800 jobs, including apprenticeships, will be created and approximately 60 full-time positions once the facility is operational.

Expenditure: \$668m.

Employment: Construction: 800

Operation: 60

**IRON ORE****Ashburton – Eliwana Mine and Rail Project  
FORTESCUE METALS GROUP PTY LTD**

Fortescue Metals Group announced a financial investment decision on 28 May 2018 for the development of its Eliwana mine and 143 kilometre railway project. The \$1.7 billion project is expected to have a mine life of over 20 years with an average production rate of 30 million tonnes per annum. The company is targeting construction to begin in the second half of 2019, creating up to 1900 jobs during construction with 500 full-time site positions once operational.

Expenditure: \$1.7b.

Employment: Construction 1900

Operation: 500

**Pilbara – South Flank Project****BHP BILLITON IRON ORE PTY LTD**

The A\$4.7 billion South Flank project is set to become the single largest annual production iron ore mine that BHP has ever developed. Leveraging off much of the existing Mining Area C infrastructure, South Flank will replace production from the 80Mtpa (100% basis) Yandi mine as its ore source depletes in the early to mid-2020s. Given the proximity of the South Flank deposit to the Mining Area C hub, the project will create a mining infrastructure hub within reach of several billion tonnes of high grade iron ore. Construction commenced in July 2018. First ore from South Flank is targeted in the 2021 calendar year, with the project expected to produce ore for more than 25 years. The South Flank project will create about 2500 jobs during peak construction and more than 600 ongoing operational roles over its expected 25 year life span.

Expenditure: Approximately \$4.7b.

Employment: Construction 2500

Operation: 600

**Shire of East Pilbara – Koodaideri Iron Ore  
Mine and Infrastructure Project****MOUNT BRUCE MINING PTY LTD  
(RIO TINTO)**

Rio Tinto has approved an investment for the development of the Koodaideri iron ore deposit located about 110km north west of Newman. The Koodaideri Project would have a capacity of about 43 million tonnes of iron ore per annum requiring the development of a new mining area at Koodaideri, crushing, screening, stockpiling and rail load out infrastructure plus a 170km railway. Rio Tinto has commenced construction on the project following receipt of key regulatory approvals.

Expenditure: \$3.5b.

Employment: Construction: 2000

Operation: 600

**LITHIUM****Kwinana – Lithium Hydroxide Processing  
Plant****TIANQI LITHIUM AUSTRALIA PTY LTD**

Tianqi Lithium Australia Pty Ltd holds a 51% interest in Talison Lithium, the operator of the Greenbushes mine in the South West of WA. Construction of a lithium hydroxide processing plant at the Kwinana Strategic Industrial Area, south of Perth is being constructed in two stages. The first stage will accommodate the production of 24,000tpa of lithium hydroxide. The second stage will expand the plant to produce up to 48,000tpa of lithium hydroxide. Lithium hydroxide is a highly-valued resource for industries involved in electric vehicles, energy storage, aviation and other technological industries.

Expenditure: \$700m

Employment: Construction: 500

Operation: 175

**OIL & GAS DEVELOPMENTS****Carnarvon Offshore Basin  
– Gorgon Stage 2****GORGON JOINT VENTURE**

Gorgon Stage 2 is an expansion of the existing subsea gas gathering network for the Gorgon and Jansz-Io gas fields, which is required to ensure future supply to the three existing LNG Trains on Barrow Island. Seven new wells are to be drilled in the Gorgon field and four in Jansz-Io field for connection to the existing subsea facilities, in water depths of between 220 and 1320 metres. The decision to proceed with the four-year project, with an estimated capital expenditure of about \$5.1b, was announced in April 2018 and the drilling campaign commenced in May 2019.

Expenditure: \$5.1b.

Employment: Construction: 200

Operations: 50



## AGRICULTURE

### East Kimberley – Project Sea Dragon SEAFARMS GROUP LIMITED

Seafarms Group is a Queensland based producer of farmed prawns. Seafarms proposes to invest up to US\$1.45b over the next eight years in Project Sea Dragon, a large scale, integrated, land based aquaculture project to produce black tiger prawns for export markets in Asia. The aquaculture component of the project will be located in the Northern Territory and is planned as a staged development commencing with Stage 1, 1,000 hectares of ponds and supporting infrastructure. In Western Australia a founder stock and quarantine centre is operational in Exmouth, a processing plant is proposed for Kununurra, and subject to competitive tender Wyndham port will be utilised for export and import. The project will create approximately 300 jobs in the Kimberley during construction, 150 direct jobs in the region at Stage 1 building to 700 direct jobs when fully operational. Seafarms Group expect to make a Financial Investment Decision in 2019.

## HEAVY MINERAL SANDS

### Shark Bay – Coburn Mineral Sands Project STRANDLINE RESOURCES LIMITED

Completion of the Definitive Feasibility Study for the Coburn mineral sands project, located south of Shark Bay and approximately 250km north of Geraldton, was announced in April 2019. The project's large ore reserve of 523 million tonnes, at 1.11% total heavy mineral, underpins an initial mine life of 22.5 years at the planned mining rate of 23.4 million tonnes per annum.

Expenditure: \$257m.

Employment: Construction: 316

Operation: 144

## IRON ORE

### Pilbara – Balla Balla Infrastructure Project BALLA BALLA JOINT VENTURE

BBJ Group (BBIG) is proposing the Balla Balla Infrastructure project (BBIP), a rail and port development, which when constructed will comprise an integrated port and rail infrastructure system that will provide a new gateway to the iron ore rich Pilbara region in Western Australia. Initial planned annual capacity of the rail and port is 50 million tonnes per annum. The Balla Balla port is located halfway between Dampier and Port Hedland. The proposed infrastructure for the BBIP includes a train loading facility at the central Pilbara iron ore source, a 165 km single-track standard gauge railway and a multi-user port facility. The Railway (BBJ Rail Aus Pty Ltd) Agreement 2017 was executed between the State, the Company and the Guarantors in January 2017 with the Railway (BBJ Rail Aus Pty Ltd) Agreement 2017 being ratified by the Western Australian Parliament in December 2017.

Expenditure: \$5.6b.

Employment: Construction: 3300

Operation: 900

### Pilbara – West Pilbara Iron Ore Project – API Port/Rail

#### API MANAGEMENT PTY LTD

The Australian Premium Iron Joint Venture is proposing to develop the West Pilbara Iron Ore Project. Stage 1 of the project is based on the production of 40Mtpa of direct shipping iron ore from deposits, including Red Hill and Mt Stuart deposits, located 35-80km south west of Pannawonica. The ore is proposed to be transported by a 240km heavy haul railway for export via the proposed multi-user port at Anketell. State and Federal environmental approvals for the mine, rail and port elements of the project are in place. Subject to the successful completion of feasibility studies, and receipt of final regulatory approvals, the company anticipates construction to commence following a decision to proceed by the joint venturers and completion of funding arrangements.

Expenditure: \$6.8b.

Employment: Construction: 1500

Operation: 900

## OIL & GAS DEVELOPMENTS

### Browse Basin – Browse to North West Shelf WOODSIDE ENERGY

In September 2018, the Browse Joint Venture (BJV) selected the Browse to North West Shelf concept to develop its gas resources at the Brecknock, Calliance and Torosa fields. These fields are estimated to contain a contingent resource of 13.9 trillion cubic feet of gas. The concept involves two floating production, storage and offtake vessels at the fields delivering gas to the North West Shelf Joint Ventures (NWSJV) gas facilities via a 900km pipeline. Through a tolling agreement with the NWSJV the project will produce 10 million tonnes per annum (Mtpa) of LNG and the equivalent of 1.5Mtpa of domestic gas. The BJV is aiming for commencement in mid-2020s and is expected to be operational for up to 50 years.

Expenditure: \$30b.

### Pilbara – Scarborough LNG Project WOODSIDE ENERGY

Woodside Energy and BHP are working together to identify an economically viable development option for the Scarborough gas field located offshore, 280 km northwest of Onslow, in about 950 metres of water. The project is at an early stage of consideration of a 430km pipeline to an expanded Pluto LNG facility. FID is targeted for 2020 and upstream ready for start up is 2023.

Expenditure: \$15b.





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## Significant resource projects in Western Australia

Western Australia continues to lead the way as Australia's premier resources investment destination. There are more than A\$140 billion worth of projects that have either recently commenced or are committed or under consideration for the State during the next few years. These would create more than 24000 construction jobs and over 5000 permanent jobs.

This section is intended as an overview and does not constitute an exhaustive list of projects within the Western Australia resources industry. Based on company announcements.

Significant Projects as at August 2019

	Project Value (estimated A\$m)	Employment Construction Permanent	
<b>Iron and Steel</b>			
API Management Pty Ltd – West Pilbara Iron Ore Project	6800	1500	900
Balla Balla Joint Venture – Balla Balla Infrastructure Project	5600	3300	900
BHP Billiton Iron Ore Pty Ltd – South Flank	4700	2500	600
CITIC Pacific – Cape Preston Mine & Processing Projects	12000	4000	1500
Mount Bruce Mining Pty Ltd – Koodaideri Iron Ore Mine and Infrastructure Project	3500	2000	600
<b>Sub Total</b>	<b>34300</b>	<b>15200</b>	<b>5000</b>
<b>Oil, Gas and Condensate</b>			
Browse to North West Shelf	30000	n/a	n/a
Gorgon Joint Venture Gas Processing Project	55000	8000	300
Gorgon Stage 2	5100	200	50
Scarborough LNG	15000	n/a	n/a
Woodside Energy – Greater Western Flank Phase 2	1370	n/a	n/a
<b>Sub Total</b>	<b>106470</b>	<b>8200</b>	<b>350</b>
<b>Other</b>			
Kwinana Waste to Energy Project	668	800	60
<b>Sub Total</b>	<b>668</b>	<b>800</b>	<b>60</b>
<b>TOTAL</b>	<b>141438</b>	<b>24200</b>	<b>5410</b>

*All currency figures are in Australian dollars unless otherwise specified.*

## Abbreviations Key

b	billion
EPC	Engineering, Procurement and Construction
GL	gigalitres
ha	hectares
JV	joint venture
km	kilometres
ktpa	kilo tonnes per annum
LNG	liquefied natural gas

LOA	length overall
m	million
Mt	million tonnes
Mtpa	million tonnes per annum
MW	megawatts
t	tonnes
THM	total heavy mineral
TJ	terajoules
tpa	tonnes per annum



# Major Resource Projects

August 2019



Mineral symbols	Commodities
Precious metal	Ag..... Silver
Steel alloy metal	Au..... Gold
Speciality metal	Cu..... Copper
Base metal	Fe..... Iron
All sites are bauxite	K..... Potassium
Coal and lignite	Kln..... Kaolin
Industrial mineral	Li..... Lithium
Processing plant	LNG..... Liquefied natural gas
	LPG..... Liquefied petroleum gas
	Mag..... Magnetite
	Mn..... Manganese
	Mo..... Molybdenum
	Ni..... Nickel
	Pb..... Lead
	Phos..... Phosphate
	REE..... Rare earth elements
	Sid..... Silica sand
	Sn..... Tin
	Ta..... Tantalum
	Ti..... Titanium
	Tic..... Taic
	V..... Vanadium
	W..... Tungsten
	Zn..... Zinc
	Zr..... Zirconium

Petroleum symbols
Gas field
Oil field
Oil and gas field
Processing plant
Oil / gas pipeline, operating
Oil / gas pipeline, proposed

Infrastructure
Power plant
Irrigation / water / desalination
Port

Enquiries for latest information for Commonwealth controlled waters is available from the National Offshore Petroleum Titles Administrator (NOPITA) at <info@nopita.gov.au>

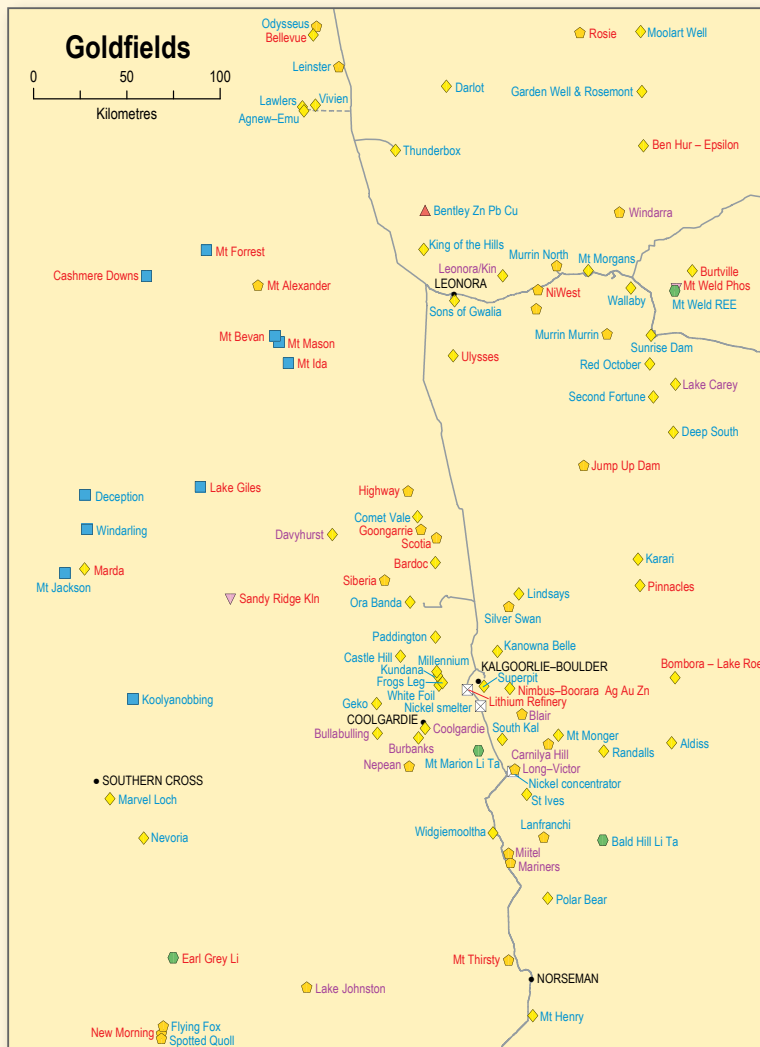


## Project labels:

Projects operating or currently under development with an actual or anticipated value of production greater than A\$10 Million are shown in blue

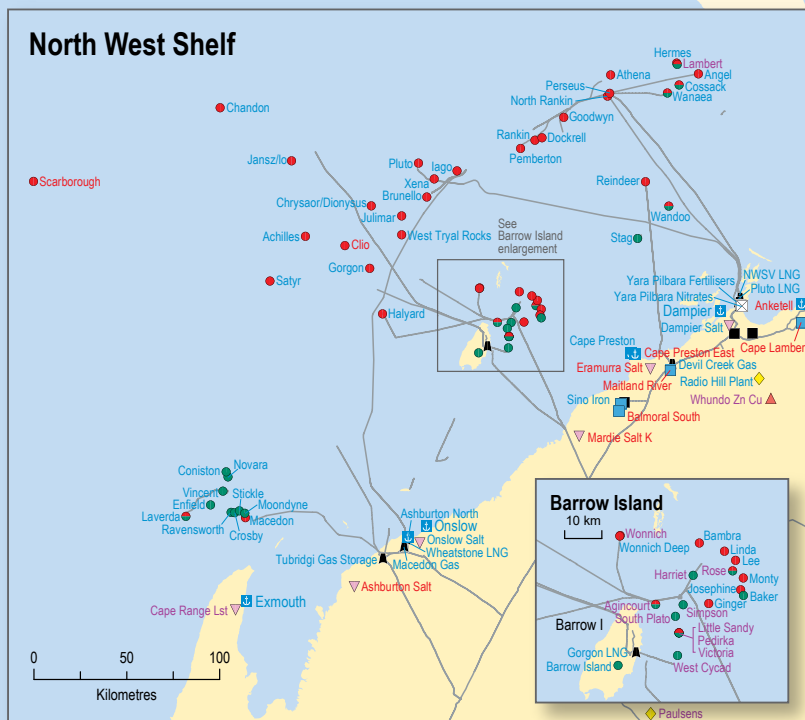
Proposed or potential projects with a capital expenditure greater than A\$20 Million are shown in red

Mineral Projects under care and maintenance and petroleum fields that are shut-in are shown in purple





## North West Shelf



# Major Resource Projects August 2019

## Project labels:

Projects operating or currently under development with an actual or anticipated value of production greater than A\$10 Million are shown in blue

Proposed or potential projects with a capital expenditure greater than A\$20 Million are shown in red

Mineral projects under care and maintenance and petroleum projects that are shut-in are shown in purple

## Commodities

Ag.....	Silver
Au.....	Gold
Co.....	Cobalt
Cu.....	Copper
Dmd.....	Diamond
Fe.....	Iron
Fl.....	Fluorite
Gp.....	Gypsum
Gr.....	Graphite
Grt.....	Garnet
K.....	Potassium
Kln.....	Kaolin
Li.....	Lithium
Lst.....	Limestone
LNG.....	Liquefied natural gas
Mag.....	Magnetite
Mn.....	Manganese
Nb.....	Niobium
Ni.....	Nickel
Pb.....	Lead
Pd.....	Palladium
PGE.....	Platinum group elements
Pt.....	Platinum
REE.....	Rare earth elements
Ta.....	Tantalum
Ti.....	Titanium
V.....	Vanadium
W.....	Tungsten
Zn.....	Zinc
Zr.....	Zirconium

## Mineral symbols

☆	Precious mineral
Dmd	Diamond
◆	Precious metal
Au (or as shown)	Gold
◆	Steel alloy metal
Ni (or as shown)	Nickel
●	Speciality metal
Ti-Zr (or as shown)	Titanium
▲	Base metal
■	Iron
■	Alumina
All sites are bauxite	
●	Coal and lignite
☼	Uranium
▽	Industrial mineral
⊠	Processing plant

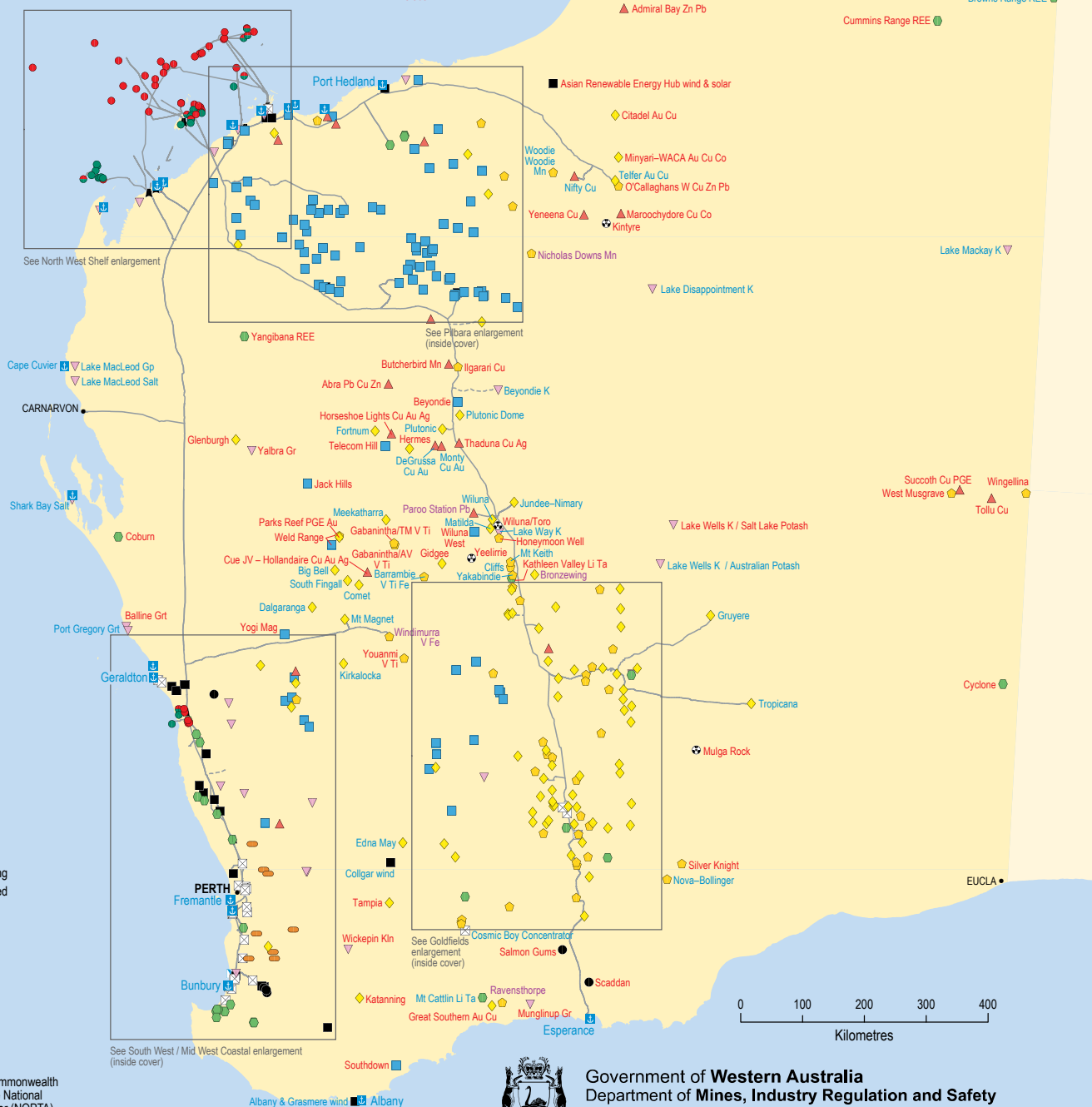
## Petroleum symbols

●	Gas
●	Oil
●	Oil and gas
▲	Processing plant
—	Oil / gas pipeline, operating
- - -	Oil / gas pipeline, proposed

## Infrastructure

■	Power plant
■	Irrigation / water / desalination
■	Port

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Government of Western Australia  
Department of Mines, Industry Regulation and Safety