

RARE STATE

WA becomes Australia's first heavy rare earths producer

PROSPECT





Western Australia has a world-class resources industry, covering a diverse range of minerals and energy and our State's resources sector is powering ahead.

The opening of Northern Minerals' Browns Range Heavy Rare Earth Project's pilot processing plant in the Kimberley region has marked the start of a new era for tech metals in Western Australia (story page 2).

Browns Range is now the only operating dysprosium and terbium mine and processing plant located outside of China.

Western Australia has some of the biggest deposits of tech metals in the world and the industry will be a major job-creator for local jobs.

The State is seizing opportunities in the lithium and energy materials sector—the inaugural Lithium and Energy Materials Industry Consortium was recently held in Perth with industry, government and academia coming together to help formulate the State's Future Battery Materials Strategy (page 4).

Western Australia is the world's largest producer of lithium, has the world's third largest resources, and we are strategically located to large lithium-ion battery manufacturers in Asia, most notably China, Japan and South Korea.

In June, the State Government travelled to China to promote Western Australia's strengths in the resources sector and focus on growing business ties and investment in our State (page 7).

Chinese investment in our State creates thousands of jobs for Western Australians, which is why it is crucial we maintain strong trading relationships.

The spirit of cooperation between China and Western Australia was also the push behind geoscientists working together on vital mineral research projects in each other's jurisdictions (story page 10).

Western Australia's resources industry expertise was showcased to more than 50 international carbon capture and storage scientists and experts, who travelled to Perth in June (story page 9), and Western Australian industry experts also travelled to Africa to share their knowledge (page 14).

Across our diverse resources sector Western Australia is powering ahead, seizing opportunities in expanding industries and building on our strengths, to grow jobs for Western Australians and for the future prosperity our State.

Mark McGowan
PREMIER; MINISTER FOR STATE DEVELOPMENT, JOBS AND TRADE

Bill Johnston
MINISTER FOR MINES AND PETROLEUM

ISSN 1037-4590

Prospect

Western Australian Prospect magazine is published quarterly by the Western Australian Government's Department of Mines, Industry Regulation and Safety (DMIRS) and Department of Jobs, Tourism, Science and Innovation (JTSI).

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Cover Photo: Northern Minerals' Browns Range Heavy Rare Earth project (story page 2).
Photo: Northern Minerals

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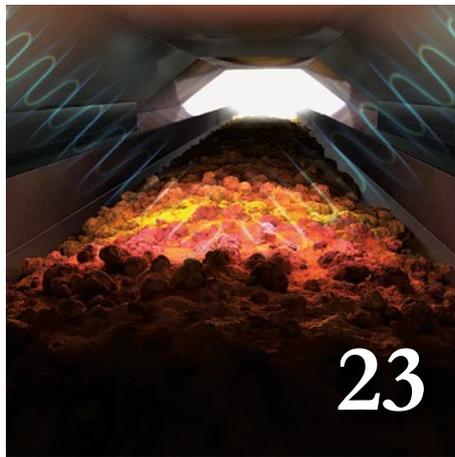
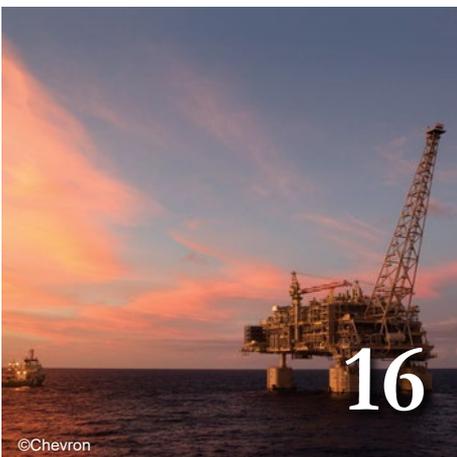
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Northern Minerals' Browns Range Heavy Rare Earth Project. Photo: Northern Minerals

BROWNS RANGE BRINGS TECH METALS OPPORTUNITIES

The official opening of Northern Minerals' Browns Range Heavy Rare Earth Project's pilot processing plant has marked the start of a new era for tech metals in Western Australia – Browns Range is now the only operating dysprosium and terbium mine and processing plant located outside of China.

Regional Development Minister; and Minister Assisting the Minister for State Development, Jobs and Trade, Alannah MacTiernan, officially opened the pilot plant in late July, highlighting the potential for tech metals to create new job opportunities for Western Australians.

"Tech metals are the minerals of the 21st century, and WA has some of the biggest deposits in the world," Ms MacTiernan said.

"The Browns Range pilot processing plant is a major milestone for this industry and will be a major job-creator for the Kimberley region and Western Australia."

The pilot plant is located 165 kilometres south east of Halls Creek in northern Western Australia.

The pilot plant will process and produce 1,719,000 kilograms of mixed rare earths carbonate over the next three years for export to Chinese customers.

Capital expenditure for the pilot plant is expected to reach \$67 million. Northern Minerals has not yet taken a financial investment decision (FID) to undertake the full-scale project, which is expected to have a CAPEX of \$329 million.

Western Australia's North West is home to some of the biggest deposits of high-grade dysprosium and terbium in the world – heavy rare earth elements that are critical components of emerging technologies, including those used in permanent magnetic motors for electric vehicles, wind turbines and industrial robots.

The Browns Range project has already created an additional 62 jobs in the Kimberley through the pilot plant construction phase, with 33 positions expected to be created in operational roles over the next three years.

The pilot plant project will allow Northern Minerals to learn more about the geology and processing

characteristics of the ore, as well as producing mixed rare earth carbonates for offtake sales.

The pilot plant can produce 15 per cent of the final full-scale production of the project and is expected to generate \$20 million per annum in rare earth sales.

Northern Minerals will be able to use its product to demonstrate Australian heavy rare earths to users throughout the world. This will enable the company to measure demand and more effectively assess the economic and technical feasibility of the planned larger full-scale development.

Managing Director and CEO George Bauk said, "The opening of the Browns Range Heavy Rare Earths Project is nearly eight years in the making, since the initial discovery in 2010."

"Australia is now a heavy rare earths producer. I am extremely proud of the entire Northern Minerals team as well as our construction partners that have helped make this project a reality.



"We are also particularly grateful for the support that we have received for the project from the WA State Government and the Federal Government."

Northern Minerals is also exploring options for further downstream processing, which will allow products to be sold to a greater range of markets globally.

Ms MacTiernan said Northern Minerals has a strong focus on local procurement and Aboriginal employment, including its \$8.1 million 'training-to-work' programme to support the Ringer Soak (Kundat Djaru) community.

"It's great to see WA going further than just digging up minerals, and moving into the value-add chain," Ms MacTiernan said.

"Congratulations to Northern Minerals on getting this project off the ground, and we look forward to working together as Browns Range scales up in coming years." ■

- **Dysprosium is a component used in electric vehicles. Permanent magnet electric motors are the key drivers of electric vehicles and dysprosium is a vital ingredient as it reduces the weight requirement and allows operation at very high temperatures.**
- **Dysprosium and terbium are used also in wind turbines, industrial robots, air conditioning and many other new technologies in development.**



Regional Development Minister Alannah MacTiernan (fourth from right) with attendees at the official opening of the pilot plant.



Ms MacTiernan with Northern Minerals' Managing Director George Bauk (at right), touring the site.



Altura's Pilgangoora lithium mine in the Pilbara is adding to the State's lithium production. Photo: Altura Mining

SEIZING OPPORTUNITY: WA'S LITHIUM AND ENERGY MATERIALS FUTURE

Western Australia is seizing opportunities in the lithium and energy materials sector with an extensive list of key stakeholders from industry, government and academia coming together recently to assist the State Government to formulate the State's strategy.

An inaugural Lithium and Energy Materials Industry Consortium was held in Perth in July, initiated by the Minister for Mines and Petroleum, Bill Johnston; the Departments of Jobs, Tourism, Science and Innovation; Mines, Industry Regulation and Safety; the Chamber of Commerce and Industry; the Chamber of Minerals and Energy; and the Association of Mining and Exploration Companies.

Western Australian Governor Kim Beazley opened the event and attendees had the opportunity to share their perspectives during the facilitated workshop.

In May, the Western Australian Government announced a Ministerial Taskforce to oversee the development of a lithium and energy materials industry strategy for the State, with the strategy to be fast-tracked for completion within six months.

The strategy is building on Western Australia's competitive advantages and will help to develop a world-leading energy materials industry that maximises benefits to Western Australia and creates jobs.

Mr Beazley said that advances in vehicle and battery storage technology had driven demand for lithium and related energy materials, with Western Australia in prime position to make the most of global growth.

"Western Australia is the world's largest producer of lithium and has the world's third largest resources," Mr Beazley said.

"Western Australia has a strategic advantage – it is close to large lithium-ion battery manufacturers in Asia, most notably China, Japan and South Korea.

"Our competitiveness in the battery supply chain is the highest in the early 'raw materials'. This is followed by the 'processed materials' phase which Western Australia is currently developing."

Western Australia has seven lithium mines. The Greenbushes mine in the State's south west is the world's largest and highest-grade source of lithium bearing spodumene ore, and the mine contributes 40 per cent of the world's current lithium supplies.

Mr Beazley outlined Western Australia's assets, as well as potential growth areas for the State.

"Western Australia will be home to three of the world's top four global producers of lithium: Tianqi (China), Albemarle (US), and SQM (Chile) are actively pursuing plans to process lithium bearing minerals into lithium hydroxide and lithium carbonate in Western Australia," he said.

"The planned investment by these companies in Western Australia is over \$2 billion with an operational workforce of nearly 900 and has



Tianqi Lithium Australia General Manager Phil Thick with Mines Minister Bill Johnston and Western Australian Governor Kim Beazley. Photo: CCI



led to interest by other firms into battery related minerals processing.

“Western Australia is prospective for many of the key raw materials contained within lithium-ion batteries; lithium, nickel, cobalt and aluminium.

“The opportunity is to develop further downstream processing for additional steps in the lithium-ion battery value chain.”

Mr Beazley said that Western Australia will need to produce a stable supply of battery-grade lithium and other battery minerals to attract companies looking to establish further

downstream processing, such as cathode (electrode) manufacturers.

“Western Australia is in the process of developing the capacity to convert its lithium into hydroxide/carbonate and its nickel into nickel sulphate,” Mr Beazley said.

“Additionally, companies are undertaking feasibility and concept studies to assess the financial viability of developing processing facilities to convert cobalt into battery-grade cobalt sulphate and cathode precursor factories in Western Australia.

“This processing will add substantial value to Western Australia’s lithium industry with increases in the value of the products shipped overseas, job creation and increased expertise in a growing industry,” he said.

“These downstream processing opportunities will, over time, help establish the necessary services, infrastructure and technical capacity to move further down the battery supply chain.

“The strategy for further development of this value chain will build on Western Australia’s competitive advantages in this market, balancing support for established industry while exploring further opportunities.” ■

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Lithium and Energy Materials Industry Taskforce for WA

- A Lithium and Energy Materials Industry taskforce chaired by the Minister for Mines and Petroleum Bill Johnston will oversee the development of Western Australia’s strategy.
- Taskforce members include representatives from the Department of the Premier and Cabinet; Directors General of the Departments of the Premier and Cabinet; Jobs, Tourism, Science and Innovation; Mines, Industry Regulation and Safety; and Primary Industries and Regional Development; as well as the Chief Scientist; and the CEOs of the Industrial Land Authority and Minerals Research Institute.
- The taskforce is engaging with key companies and other industry stakeholders.
- Visit www.jtsi.wa.gov.au for more information.

WA INDUSTRY LINK: LINKING THE REGIONS

Creating jobs for Western Australians and assisting regionally based local businesses to secure work on government contracts was the push behind the recent WA Industry Link regional roadshow held across the State.

WA Industry Link is a key component of the Western Australian Government's Jobs Act that aims to help local businesses compete for work on government contracts – and ensure the \$27 billion spent annually on State Government procurement benefits more regionally based businesses and creates more jobs.

The regional roadshow introduced dedicated Local Content Advisers to prospective regional suppliers and provided information on the advisory services available.

The first round of the roadshow consisted of 13 events across nine regions, with events held in Albany, Broome, Bunbury, Carnarvon, Esperance, Geraldton, Kalgoorlie, Karratha, Kununurra, Mandurah, Narrogin, Northam, and Port Hedland.

One of the roadshow highlights was a sundowner event held in Broome where Regional Development Minister and Minister Assisting the Minister for State Development, Jobs and Trade, Alannah MacTiernan announced a new round of Local Capability Funds to assist regionally based Aboriginal businesses secure more procurement opportunities in the public and private sectors.

The roadshow events were deemed a success with 525 registered attendees, and feedback from the events offering valuable insights into the concerns of regional suppliers.

Planning for further regional events will take place following the full implementation of the *Western Australian Jobs Act 2017* on 1 October 2018.

"The WA Industry Link Regional Roadshow helps regional businesses to learn more about maximising opportunities for local suppliers and contractors in government contracts," Ms MacTiernan said.

"Dedicated Local Content Advisers will engage with local businesses in the regions, building knowledge and capability to make it simpler and easier for suppliers to secure State Government contracts."

Premier and Minister for State Development, Jobs and Trade, Mark McGowan said the Government's Jobs Act "is vital in ushering in a new era of job creation."

"The State Government is committed to ensuring local businesses are connected to supply and tendering opportunities within regional Western Australia.

"We're determined to ensure this initiative helps grow and diversify our regional economies." ■

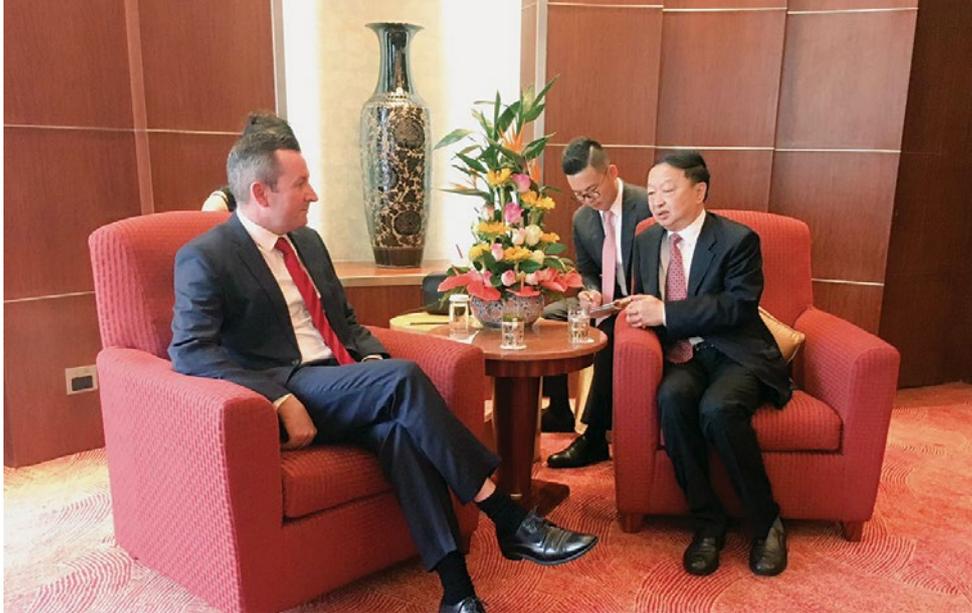


McCarthy, Senior Project Officer Industry Development (JTSI), introduces the WA Industry Link at the Kalgoorlie Regional Roadshow Breakfast event.



Lisa Campbell, Policy Adviser, Land Access, Chamber of Minerals and Energy of Western Australia; Dylan Heath, Broome Local Content Adviser; Regional Development Minister Alannah MacTiernan; and Andrew Griggs, Acting Manager Industry Development, at the WA Industry Link Regional Roadshow Broome Sundowner.

Visit the WA Industry Link portal at industrylink.wa.gov.au



Premier Mark McGowan in Beijing met with key Chinese Central Government agencies to maximise opportunities for Western Australia. Photo: Mark McGowan Twitter @MarkMcGowanMP

DESTINATION CHINA

Western Australia has a close relationship with China and welcomes Chinese investment and trade – strengthening economic and business ties between Western Australia and Beijing was the focus of Premier and Minister for State Development and Trade, Mark McGowan’s visit to China in June.

The mission focused on strengthening Western Australia’s robust relationship with key Chinese Central Government agencies, and promoting the State’s strengths in the resources sector.

The Premier met some of Western Australia’s biggest investors from China and was involved in a roundtable discussion with senior representatives of the major State-owned enterprises and a number of top private investors.

The visit followed meetings in Shanghai, Hangzhou and Japan in November last year, in which the Premier led a delegation of 40 representatives from the tourism and education sectors.

“Creating jobs for Western Australians is my number one priority and as Premier I’m very keen to promote our State to the world,” Mr McGowan said.

“I want Beijing to know that WA is open for business and that we are focused on growing business ties and investment in our State.

“China is Australia’s biggest trading partner, and I want to ensure that Western Australia is in the box seat to maximise opportunities that will create more jobs in the resources sector, as well as industries like tourism and education.”

Resources for growth

With a long history of economic and cultural ties, Western Australia has built a strong trading relationship with China, which has seen China become the State’s number one customer of goods and services.

The value of Western Australia’s merchandise exports to China in 2017–18 was \$61.5 billion, which accounted for 47 per cent of Western Australia’s total merchandise exports.

Western Australia also accounted for over half (58 per cent) of Australia’s merchandise exports to China in 2017–18.

China is also an important market for Western Australia’s services exports. In 2017, Chinese visitors were the largest spenders amongst international visitors to Western Australia.

China was also Western Australia’s largest market for international students in 2017–18.

“Chinese investment in Western Australia creates thousands of jobs for Western Australians, which is why it is crucial we maintain a strong trading relationship,” Mr McGowan said.

“The mission to Beijing was my second to China as Premier, following meetings in Shanghai and Hangzhou in November last year.

“The visit was hugely productive and rewarding. Meetings were scheduled with the chairmen of some of the most important organisations in China, including Mr Xiao Yaqing, Chairman of the State-owned Assets Supervision and Administration Commission of the State Council and Mr Ning Jizhe, Vice-chairman of the National Development and Reform Commission.

“I also met with businesses such as China National Offshore Oil Corporation, CITIC Group, Sinosteel Corporation, Cheung Kong Infrastructure Holdings and the Bank of China.

“All these businesses were very keen to work with Western Australia and to maintain a strong relationship.”

Mr McGowan said there was great potential for future growth in several industries including resources, education, and tourism.

“Chinese businesses invest in various iron ore and liquefied natural gas projects in Western Australia that create jobs for local workers,” he said.

“We are keen to support these projects into the future and, as the Chinese Government is focused on reducing pollution and greenhouse gas emissions, there are huge opportunities to continue to grow our LNG exports to China.

“At virtually every meeting, I highlighted that WA is very keen for more Chinese students to come to WA to study and vice versa.

“The State Government is also working hard to secure more direct flights from China, particularly from Shanghai.”

While in China, Mr McGowan attended a long table event hosted by the Australia China Business Council and the China Chamber of Commerce in Australia where he committed to an annual dialogue with leading businesses in China to further investment opportunities.

“I invited them to come to Perth next year, and the State Government will put in place plans to make that happen,” he said.

“The continued strengthening of our cooperative relationship with China will create more job opportunities for Western Australians.”

The Western Australian Government has an international trade and investment office in Shanghai. For more information on trade and investment opportunities with China, visit the Department of Jobs, Tourism, Science and Innovation website, www.jtsi.wa.gov.au ■



Commissioners and Agent General of the Western Australian Government's international trade and investment offices. Photo: CEDA

OPENING DOORS FOR WA BUSINESS

The heads of Western Australia's

came together in Perth recently to promote opportunities for the State to diversify the economy and create jobs.

The Western Australian Government operates overseas offices in the State's key trading regions, with headquarters based in Perth at the Department of Jobs, Tourism, Science and Innovation (JTSI).

The overseas offices are the first point of contact for international investors with a specialty in linking like-minded investors with real opportunities in Western Australia.

The overseas heads include seven Commissioners and the new Agent General, Commodore Mike Deeks CSC RAN (Rtd), who took up his position in the Europe Office in July this year.

They gathered in Perth as a group for the first time since 2016, where they met with the Premier and Minister for State Development, Jobs and Trade, Mark McGowan and other ministers, as well as the Governor of Western Australia, Kim Beazley, and industry groups.

The Western Australian Ministers included Minister for Regional Development; Agriculture and Food, Alannah MacTiernan, Minister for Mines and Petroleum; Asian Engagement, Bill Johnston, and Deputy Premier; Minister for Health and Mental Health, Roger Cook.

This year, the focus was on tourism, international education, and investment.

The Premier discussed with the Commissioners how to attract more overseas direct flights to Perth by exploring opportunities for a second direct route from China and other destinations in Asia.

Discussions also included the development of an International Education Strategy to increase Western Australia's market share of international students.

They also focussed on ensuring Western Australia capitalises on its status as the world's leading producer of lithium, with the potential to increase downstream processing of lithium and other energy materials in the State.

During their time in Perth, the Commissioners engaged with industry organisations and businesses to update them on existing and forthcoming major investment projects and opportunities.

Industry briefings included a "sell out" first-time panel event by the Committee for Economic Development of Australia (CEDA), during which the Commissioners outlined Western Australia's global positioning and potential into the future.

The event, hosted by KPMG Australia, saw the overseas Commissioners introduced by Tianqi Lithium head, Phil Thick, to the packed audience made up of some of the State's senior business leaders – whose feedback deemed the breakfast event a 'great' success and the Commissioners praised for their insights regarding opportunities for local businesses.

While in Perth, the Commissioners also met with innovative exporters across a range of priority industries such as education, defence and

marine, mining and mining equipment technology and services, oil and gas and petroleum equipment technology services, agriculture and food, health and aged care, and tourism.

"My priority is to create jobs and diversify the economy," Mr McGowan said.

"Our overseas Commissioners and teams work hard to foster greater trust and mutual respect with our international counterparts, and open doors for Western Australian businesses.

"This is an exciting time for Western Australia to showcase and broaden its strengths, and attract new industries."

Western Australia's international trade and investment offices cover key trading markets for Western Australia and include:

- China – Shanghai
- Europe – London
- India – Mumbai
- Indonesia – Jakarta
- Japan – Tokyo and Kobe
- Middle East and Africa – Dubai
- Singapore
- South Korea – Seoul.

Western Australia accounts for nearly 32 per cent of Australia's total trade and the State's exports alone account for about 48 per cent of Australia's total exports.

For more information on trade and investment opportunities and contact details of the State's overseas offices, visit www.jtsi.wa.gov.au ■



Geological Survey of WA Senior Geologist Dr Sarah Martin (left) discusses core samples from Harvey with visitors.

CARBON CAPTURE SPOTLIGHT SHINES ON PERTH

Western Australia's famous fauna competed with core samples for the attention of more than 50 international carbon capture and storage scientists and experts who were in Perth in June.

A day-long tour of the Department of Mines, Industry Regulation and Safety's core library and CSIRO's National Geosequestration Laboratory, also included an outing to Whiteman Park recreation and conservation reserve in the Swan Valley, to get better acquainted with WA's kangaroos, koalas and wombats.

The tour, organised by the department, Geoscience Australia and CSIRO, was part of a visit that included a symposium marking a decade of scientific cooperation between the Chinese and Australian Governments, and a Carbon Capture Utilisation and Storage (CCUS) conference.

The department's Carbon Storage Coordinator, Dominique Van Gent hosted a large delegation of Chinese Government officials who attended the one-day China Australia Geological Storage of CO₂ symposium.

Visitors from other countries including Japan, Korea, France and Norway attended the CCUS conference along with the Chinese contingent.

"The theme of the two-day conference was advancing carbon capture and storage through global cooperation and it was gratifying to watch that in action as we discussed a wide range of topics that helped showcase recent research progress in this important scientific field," Mr Van Gent said.

"Nearly 60 papers were presented and the subjects discussed at the conference were extraordinarily diverse, ranging from pre and post combustion carbon capture, geological storage and CO₂ utilisation involving enhanced oil recovery, to geomechanics and negative emissions."

Mr Van Gent said it was clear to everyone at the conference that CCUS was vitally important to China, and the world.

"China has a large number of small and medium CCUS projects handling up to 400,000 tonnes per annum of CO₂ and seven major projects under development that will work with more than one million tpa of CO₂," Mr Van Gent said.

"There are 17 large-scale CCS facilities operating around the world and it's expected that by 2020 there will be 22.

"The conference showed that CCUS remains an essential technology to reduce global emissions and that our major trading partners in China and Japan are increasingly investing in the technology.

"We demonstrated through conference papers and the inspection of the facilities at the core library and the CSIRO that Western Australia has the expertise to play a vital role in CCUS into the future." ■



Geologists from GSWA and the China Geological Survey examine drill core from the Xiarihamu nickel deposit, in the East Kunlun Mountains of Central China.

GEOSCIENCE STRENGTHENS BONDS BETWEEN WESTERN AUSTRALIA AND CHINA

The spirit of cooperation between China and Western Australia is alive and well with geoscientists working together on vital mineral research projects.

As part of an ongoing partnership under a Memorandum of Understanding (MoU), the Department of Mines, Industry Regulation and Safety hosted three geoscientists, from the Xi'an Centre of the China Geological Survey (CGS) in Shaanxi Province, for a month during May and June this year.

"Our CGS colleagues are active in mineral deposit studies and they worked with us on studies of nickel mineralisation in the Eastern Goldfields," Geoscience Minerals Manager Dr Trevor Beardsmore said.

"The department's Geological Survey of WA (GSWA) is in the second year of a three-year project with CGS that involves cooperative research on nickel sulphide mineral systems in China and Western Australia.

"Our aim is to better understand their origin and therefore improve the chance of discovering new deposits."

Geoscientists from GSWA made a four-week reciprocal visit to China during July and August to work with their Chinese colleagues on studies of nickel deposits in their country.

"The China trip included field visits to the giant, newly-discovered Jinchuan and Xiarihamu nickel deposits to sample the host intrusions and collect samples for age dating and chemical analysis," Dr Beardsmore said.

"The GSWA visit also included a visit to the Physical Geological Data Center of the CGS in Langfang to log and sample drill core from the Xiarihamu deposit."

Dr Beardsmore said that GSWA geophysicists took part in the mutual exchange of minerals geoscience knowledge through workshops and seminars with CGS geoscientists.



Yalei Wang (CGS), Mines and Petroleum Minister Bill Johnston, Yongbao Gao (CGS), Lauren Burley (GSWA), Trevor Beardsmore (GSWA) and Bing Qian (CGS).

The visit by geoscientists from China is the second hosted by GSWA.

The first visit in October 2017 was by a six-person team, which included senior CGS managers from Xi'an and Beijing.

Two of the geoscientists from Xi'an stayed on in Western Australia for a month to take part in field reconnaissance of selected nickel and lithium deposits, and technical training workshops.

This year, three Xi'an Centre geoscientists worked with DMIRS staff to collect and evaluate geological data for a significant, potentially nickel-mineralised tract of the far-eastern Goldfields of the Yilgarn Craton.

"This region has few known nickel deposits, but has potentially prospective geology," GSWA Project Leader Lauren Burley said.

"Reciprocal work in China will focus on studies of nickel sulphide deposits in Northwest China and the East Kunlun orogenic belt."

Ms Burley said that the projects followed on from a similar three-year program between the geological mapping divisions of the department and CGS.

"The current projects includes more geological mapping, tectonic analysis, mineral system studies, geochronology and isotope geology, and the interpretation of regional geophysical and geochemical datasets," she said.

The team from China visited Mines and Petroleum Minister Bill Johnston before they returned home.

"As I am also Western Australia's Minister for Asian Engagement, I am very pleased that the strong partnership between GSWA and CGS continues to reaffirm the ties between China and Western Australia," Mr Johnston said.

"The MoUs in place between us on geoscience and policy and trade involve deep engagement between Western Australian and Chinese public servants that assists bilateral investment and trade." ■

LOCAL INNOVATORS A STEP CLOSER TO SUCCESS

From Cottesloe to Kununurra and across diverse industries including artisan food producers and outback shed manufacturing – the 23 successful applicants announced in the 2018 Innovation Vouchers program provide a snapshot of the wealth of innovations Western

The voucher program is part of the State Government's \$16.7 million New Industries Fund, which supports local innovation to create Western Australian jobs and diversify the economy.

The program enables small to medium enterprises to improve their capability and commercialise their innovations through the support of the Western Australian Government.

The 2018 Innovation Vouchers Program participants span several industries including agriculture, healthcare, ICT, mining, environmental, manufacturing, energy, aviation and transport.

The successful applicants were chosen by an independent evaluation panel and will receive up to \$20,000.

The funding can go towards research, product development, technology transfer, and support services for intellectual property and commercialisation.

Innovation and ICT Minister Dave Kelly announced this year's recipients and highlighted the success of previous years' recipients.

"Through the New Industries Fund we are able to provide these grants to help grow our local innovative small to medium businesses to the

benefit of the economy and to help create WA jobs," Mr Kelly said.

"I congratulate all 23 winners of the 2018 program and wish them all the best in using these grants to develop their innovation and businesses to support local jobs and the economy.

"WA-based company KodeKLIX® is an example of how local innovative companies can grow their businesses with the help of this State Government program.

"Last year, KodeKLIX® received an innovation voucher which enabled them to develop their STEM hardware in time for the start of the 2018 school year. So far this year, 19 schools from Geraldton to the South West have implemented KodeKLIX® in their classrooms.

"The specialised parts of the KodeKLIX® kits are made here in WA, and the company has recently received interest in their product from South Australia."

The New Industries Fund was announced in November 2017 as a \$16.7 million fund over four years that will support and accelerate new and emerging businesses to diversify the Western Australian economy and create new Western Australian jobs and industries.

The Department of Jobs, Tourism, Science and Innovation on behalf of the State Government administers the New Industries Fund and the Innovation Vouchers program. For more information, visit www.jtsi.wa.gov.au ■

2018 Innovation Voucher recipients:

- Laconik (Canning Vale)
- Salutem Analytics (Scarborough)
- Red Rust Contracting (Kununurra)
- iSOL8 Pty Ltd (Guildford)
- IQ Seven Actionable Intelligence Pty Ltd (Perth)
- Atom Minerals Pty Ltd (Perth)
- LIVEstock Systems Pty Ltd (Cottesloe)
- Dr Chill (Cottesloe)
- M3B Labs Pty Ltd (Willetton)
- Galvin Engineering (Malaga)
- Syrinx Environmental Pty Ltd (Perth)
- Healthregen Pty Ltd (Scarborough)
- ProofDB Pty Ltd (South Fremantle)
- Cadds Group Pty Ltd (Bibra Lake)
- Energon Pty Ltd (Perth)
- Electro.Aero Pty Ltd (Mount Hawthorn)
- EcoDrive Solutions Limited t/as EcoDrive (Kalamunda)
- Trisphasic Cardiac Pump Pty Ltd (Kallaroo)
- Apetics (Cowaramup)
- AntiSense Pty Ltd (Woodlands)
- Poach Pear (Bayswater)
- GENiux (South Perth)
- Shawn Kay Ryan (Mundaring)

GOVERNMENT OF WESTERN AUSTRALIA INTERNATIONAL OFFICES



Government of Western



China
Stuart Crockett
 Commissioner
 Shanghai,
 People's Republic of China



Europe
Mike Deeks
 Agent General
 London, United Kingdom



India
Peter Baldwin
 Commissioner
 Mumbai, India



Middle East and Africa
Pankaj Savara
 Commissioner
 Dubai, United Arab Emirates



● United States

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International Education, Trade and Investment**

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Indonesia
Jennifer Mathews
Commissioner
Jakarta, Indonesia



Singapore
John Catlin
Commissioner
Singapore



Japan
Craig Peacock
Commissioner
North Asia Agency
Tokyo, Japan



South Korea
Jean Ough
Commissioner
Seoul, Republic of Korea



Executive Director of Resource Tenure Rick Rogerson (far right), Australian Ambassador for Madagascar Jenny Dee (centre) and Team Leader Environmental Compliance Danielle Risbey (back row, centre) with workshop participants in Madagascar. Photo: Madagascar Ministry of Mines

WA REGULATORY EXPERTISE ON THE INTERNATIONAL STAGE

Recent workshops across four African countries have strengthened international ties and highlighted Western Australia's world-class regulation of its resources sector.

From May to June, representatives from the Department of Mines, Industry Regulation and Safety (DMIRS) visited Tanzania and members of the Common Market for Eastern and Southern Africa (COMESA) Kenya, Uganda and Madagascar.

The visits formed part of the department's commitment to Western Australia's Memorandum of Understanding with COMESA.

The workshops were hosted by DMIRS' Executive Director Geoscience and Resource Strategy Jeff Haworth, Manager Royalties Assessment John Sharman, Executive Director of Resource Tenure Rick Rogerson and Team Leader Environmental Compliance Danielle Risbey.

Dr Rogerson and Dr Risbey held the first Kenyan workshop in Nairobi, attracting executives, geologists and mines inspectors from the Ministries for Petroleum and Mining and Labour and Social Protection, the Kenya Revenue Authority and the County Government of Taita Taveta.

Ministry of Petroleum and Mining Director Frederic Ndambuki opened the workshop, acknowledging the importance of strong relations between Kenya and Australia, and further developing Kenya's 'young' minerals industry.

"There was considerable interest in small mining and prospecting, and how Australia regulates the sale of gemstones and small amounts of gold," Dr Rogerson said.

Mr Haworth and Mr Sharman held a separate Nairobi workshop with attendees from the Kenya Revenue Authority, Ministry of Petroleum and Mining and the Central Revenue Allocation.

"The main points of interest were around safety and royalties, and the issue of transfer pricing," Mr Haworth said.

At the Kampala workshop in Uganda, Mr Haworth outlined WA's approach to petroleum regulation to some 30 officials, including those from the Uganda National Oil Company, National Environmental Management Authority, Ministry of Finance and the Petroleum Authority of Uganda.

"Similar to the Nairobi workshop, Kampala officials were particularly interested in our views on safety, royalties and the issue of transfer pricing, but also on environmental issues," Mr Haworth said.

Dr Rogerson and Dr Risbey held further workshops across Madagascar and Tanzania.

The two-day workshop in Antananarivo, the capital of Madagascar, was held at the Mining Business Centre, where Dr Risbey gave a presentation on regulating to minimise environmental impacts from mining.

"Madagascar has enormous mineral potential, so it was no surprise other topics of considerable

interest included royalty settings, resource tenure types, tenure compliance and environmental management," Dr Rogerson said.

The next workshop in Tanzania had a strong focus on local tenement applications and local content.

The Deputy Minister for Minerals, Doto Mashaka Biteko, emphasised the importance of increasing local content in minerals projects, and assisting artisanal miners.

Participants asked questions about how to prioritise applications received at the same time, landowner notice in the tenement application process, special agreement acts, and the role of the Foreign Investment Review Board.

"They also wanted to know more about 'use it or lose it' as a principle backed up by minimum expenditure conditions on tenements, and payments required as part of online tenement applications," Dr Rogerson said.

"Our relationship with the COMESA countries is definitely stronger as a result of these collaborative workshops and they have gone a long way towards further promoting the State's resource profile in Africa," Dr Rogerson said.

DMIRS wishes to thank the Department of Foreign Affairs and Trade (DFAT) and the Australian Embassies in Africa for their dedication and continued support towards the workshops. ■



David Crook with a pollucite core sample from drilling at Pioneer Dome.

INNOVATIVE SCIENCE AND ‘LOTTO LUCK’ LEAD TO RARE MINERAL FIND

A lucky break looks like resulting in Australia’

Hunting for lithium at its Pioneer Dome project about 140 km south of Kalgoorlie, Western Australian company Pioneer Resources found a substantial deposit of pollucite ore containing the rare mineral caesium and is now planning to mine it.

“Finding one white mineral in a series of trays of other white minerals was like winning Lotto,” Pioneer Resources Managing Director David Crook said.

They may have hit the jackpot finding pollucite in a core sample, but Mr Crook believes the company put itself in the right place for the discovery by using Geological Survey of WA (GSWA) data to target exploration and following through with good exploration practices involving tens of thousands of soil samples, detailed geological mapping, and then drilling along a prospective 15 km corridor.

Pollucite is a rare mineral of caesium, mainly used to make caesium formate brine, which is an additive to drilling fluids used in high pressure oil and gas drilling.

There are only two other commercial-sized pollucite deposits in the world – the Bikita mine in Zimbabwe and the Tanco mine in Canada.

Mr Crook said that the caesium in a pollucite core sample from the Sinclair Zone at Pioneer Dome was “reading off the charts” on a portable handheld analyser and was later confirmed by lab tests.

The search for pegmatite rocks hosting lithium-caesium-tantalum (LCT) that led to the caesium find started about two-and-a-half years ago when the company used GSWA information to initiate exploration at the Pioneer Dome Project.

“After looking at GSWA mapping notes, which recorded lithium mineralisation, and checking out the Survey’s granite database, the Pioneer Dome came into focus,” Mr Crook said.

“We then went through systematic field processes and have now drilled about 200 holes.

“As soon as we announced the caesium find, we started getting calls from potential off takers.”

Earlier this year, the company signed an offtake agreement with Canada’s Cabot Corporation, which runs the Tanco mine, to take 100 per cent of pollucite ore from the proposed mine.

The life of the Sinclair Zone caesium mine will be short – about six months – but it will fund the company’s continuing interest in mining lithium from the reserves.

And there are bonuses at the end of mining.

“The Sinclair Mine includes a very significant zone of high quality potassium feldspar that will be extracted as overburden on the way down to the pollucite,” Mr Crook said.

“Potassium feldspar is used in hard-wearing ceramics, such as sanitary wares and floor tiles, and when high in rubidium, can be used in high-temperature ceramics such as spark plugs.

“So, it’s ironic that we were originally looking for lithium, the mineral that may mean the end of the internal combustion engine, and now we have significant reserves of a mineral that makes those engines run.”

The Sinclair project also has significant deposits of lepidolite and petalite – lithium-bearing minerals that can be exploited at the end of the mine.

“Lithium from petalite can be used in different markets, again in ceramics, and lepidolite may also provide a future source of caesium,” Mr Crook said.

The company has received approval from the Department of Mines, Industry Regulation and Safety for the Sinclair mining proposal, including the mine plan, mine closure plan, and the project management plan.

Mining is expected to start in the third quarter of this year. ■



The Chevron-operated Wheatstone LNG Project, Train Two. Photo: Chevron

WHEATSTONE DELIVERS LONG-TERM JOBS

The start of liquefied natural gas (LNG) production from the second train of the Chevron-operated Wheatstone Project has secured hundreds of permanent Western Australian jobs.

Chevron Australia's announcement in June was welcomed by Premier and Minister for State Development, Jobs and Trade, Mark McGowan.

"I congratulate Chevron Australia on this important milestone for the Wheatstone Project, which secures hundreds of jobs for Western Australians into the future," Mr McGowan said.

"This achievement is yet another sign that WA is getting back on track – the economy is improving, confidence is up and jobs are being created.

"Oil and gas projects help drive our economy, generating jobs in the industry and revenue with flow-on effects to the rest of the economy."

The Wheatstone Project is located 12 kilometres west of Onslow and is expected to deliver more than 300 full-time operational jobs over the next 30 years, with about 50 employees and their families currently living in Onslow.

MAJOR OIL DISCOVERY HERALDS POTENTIAL NEW SUPER BASIN

A major oil discovery off Western Australia's Pilbara region is set to put the State's relatively under-explored Roebuck Basin 'on the map' and boost exploration.

Joint venture partners Carnarvon Petroleum and Quadrant Energy confirmed various oil discoveries at its Dorado-1 well in the Roebuck Basin earlier this year.

In mid-July, light oil was recovered in the primary target of the well, the Caley Member sandstone, with a gross hydrocarbon package of 96.1 metres and a net pay thickness of 79.6 metres.

The result was confirmed with wireline testing, which found excellent reservoir characteristics with average porosity of around 20 per cent with hydrocarbon saturation of 82.5 per cent.

Carnarvon Petroleum Managing Director Adrian Cook said the discovery was transformational for the company.

"This is a significant discovery given the quantum of the net pay thickness, the quality of the oil and the extremely good reservoir characteristics," Mr Cook said.

Wheatstone fast facts:

- The Wheatstone Project is Australia's first third-party natural gas hub enabling future development of the vast natural gas resources offshore Western Australia.
- Wheatstone first LNG production was announced on 9 October 2017 with first LNG cargo sailing away on 31 October 2017.
- At full capacity, the Wheatstone Project's two train LNG plant is expected to contribute around six per cent of the Asia Pacific region's total future LNG production, delivering 8.9 Mtpa of LNG for export to customers in Asia.
- A single Chevron cargo of LNG from the Wheatstone Project could power Japan for approximately 9 hours.
- The Chevron-operated Wheatstone Project is a joint venture between Australian subsidiaries of Chevron (64.14%), Kuwait Foreign Petroleum Exploration Company (13.4%), Woodside Petroleum Limited (13%), and Kyushu Electric Power Company (1.46%), together with PE Wheatstone Pty Ltd, part owned by JERA (8%).



Wheatstone Platform. Photo: Chevron

More than \$20 billion has been spent on Western Australian goods and services during the construction of the project, creating more than 7000 local jobs.

The Wheatstone Project has been a catalyst for growth in nearby Onslow, which is being transformed by the project's \$250 million plus contribution to local infrastructure and amenities, along with \$455 million in spending with local Onslow businesses and services.

The Wheatstone Project is one of Australia's largest resource developments and consists of two LNG trains with a combined capacity of 8.9 million tonnes per annum (Mtpa), and a domestic gas ("domgas") plant.

The Western Australian Government's domestic gas policy aims to secure the State's long-term energy needs by ensuring that LNG export project developers also make gas available to the domestic market.

Wheatstone has the capacity to add another 200 terajoules a day into Western Australia's domestic gas network when the final phase of construction, the domgas plant, comes on stream later this year.

In March this year, the Western Australian Government announced plans to form an LNG Jobs Taskforce to establish Western Australia as an LNG hub, and ensure industry and government work collaboratively to maximise benefits that flow from the local LNG industry. ■

In late July, the company discovered more oil and gas at the well, with gas and condensate in the top of the Baxter Member sandstone.

Samples recovered contained an estimated gross hydrocarbon package of 21 metres and a net pay thickness of 10.5 metres.

August then saw Carnarvon Petroleum confirm additional oil discoveries in the Crespin and Milne Members of the well.

Light oil was recovered from the Crespin Member containing a gross hydrocarbon package of 50 metres and a net oil pay thickness of 22 metres. The Milne Member contained a gross hydrocarbon package of 30 metres and a net pay thickness of 18 metres.

Mr Cook said the results made the Dorado result more impressive.

"The oil discovered in the Caley Member is very significant in terms of its likely scale and in proving that this play works in the basin," he said.

"Discovering more oil in the Crespin and Milne Members makes this a truly incredible find, for Dorado and for similar structures nearby that have been identified in Carnarvon and Quadrant's prospect list."

Department of Mines, Industry Regulation and Safety Executive Director Geoscience and Resource Strategy Jeff Haworth said there was potential for similar discoveries in the Roebuck Basin.

"Roebuck Basin is a frontier basin with potential, as it's relatively underexplored with only 11 wells drilled there in the past," he said.

"This discovery should breathe new life into the basin, which used to be regarded as gas prone – but truly has the potential to become the next oil and gas province in Western Australia." ■



Rio Tinto's Paraburdoo mine. Photo: Rio Tinto

MAJOR MINE PROJECT BOOSTS WA JOBS



Rio Tinto Iron Ore Chief Executive Chris Salisbury. Photo: Rio Tinto

Western Australia received an investment and local content boost in June, after Rio Tinto Iron Ore (Rio Tinto) announced a \$50 million major capital project for the Pilbara.

The company will be replacing the original stackers that distribute ore into stockpiles at its Paraburdoo mine, creating 80 jobs during implementation and up to 30 Pilbara-based roles during plant installation.

Global advanced technology provider Tenova TAKRAF is leading the project design and implementation phases, while a multimillion dollar contract has been awarded to WA business Paradigm Engineers (Paradigm).

Paradigm will provide engineering design and control system programming services and electrical equipment to the project.

Premier Mark McGowan, who visited the site to mark the start of the project, said it would allow Rio Tinto to work out of Paraburdoo for years to come and create job opportunities for Western Australians.

"I congratulate Tenova TAKRAF for committing to sourcing materials from well-known, reputable suppliers with a preference for local content," he said.

"The construction of the new stackers provides opportunities for local businesses which are well placed to win a majority of contracts generated by the works.

"Through our WA Jobs Bill and local procurement policy, my Government will continue to deliver on its number one priority; creating more local jobs for local workers."

Rio Tinto Iron Ore Chief Executive Chris Salisbury said the company was pleased to be supporting local businesses.

"A further feature of our commitment to local jobs is our local procurement programme that we launched last year," he said.

"The programme already has over 750 business registrations and more than 200 packages of work placed online."

The design of the stackers is underway and fabrication is expected to begin later this year, with installation and commissioning set to be completed by 2020. ■

Rio Tinto's Paraburdoo mine commenced operations in 1972 and is located in the Pilbara, approximately 80 kilometres south of Tom Price.

The old stackers were part of the mine's original infrastructure, stacking the very first load of iron ore from Paraburdoo in 1972.

In 46 years of operation, they have stacked just over 800 million tonnes of iron ore, requiring only minimal structural changes throughout that time.

The new stackers include the following features:

- Modern advances in engineering design and mechanical technology
- Latest generation variable-speed drive control and fibre optic network infrastructure
- Anti-collision system with GPS back up
- Fully automated and monitored from the Operations Centre in Perth.

EIS GEOSCIENCE REKINDLES KIMBERLEY DIAMOND EXPLORATION



A scenic view of one of DevEx Resources' prospect areas in the southwest Kimberley region.

Cutting-edge geoscience funded by the Western Australian Government's Exploration Incentive Scheme (EIS) has sparked new exploration for diamonds in the State's Kimberley region.

Junior explorers are using geoscience datasets and geological information provided by the Department of Mines, Industry Regulation and Safety's Geological Survey of WA (GSWA) to identify diamond mine targets and peg tenements for exploration.

Perth-based DevEx Resources has applied to the department for eight exploration licences covering about 2700 square kilometres in WA's diamond hot spot between Rio Tinto's Argyle diamond mine and the former Ellendale mine in the southwest Kimberley region.

DevEx Managing Director Brendan Bradley said the company relied heavily on GSWA datasets in targeting its Kimberley exploration.

"GSWA commands enormous respect in the industry," he said.

"GSWA datasets comprise a wide range of information that exploration companies cannot compile on their own.

"The datasets help to fast-track the ground selection process by providing a regional context to exploration data and a window into current exploration and applied science thinking."

The resurgence of interest in the Kimberley follows the recent discovery of diamonds from drilling at the Little Spring Creek prospect by the Lucapa Diamond Company and other encouraging exploration by West Australian companies such as India Bore Diamond Holdings and POZ Minerals.

The GSWA diamond prospectivity report released earlier this year and associated datasets were used by DevEx to target its exploration.

The prospectivity report contains results for more than 88,000 diamond exploration samples and 30,000 high quality mineral chemical analyses.

Mr Bradley said that the find of 119 micro and macro diamonds by Lucapa in drilling late last year put the spotlight on the area.

"The timing of the Lucapa discovery fitted in perfectly with the release earlier this year of the GSWA diamond database, which along with the Survey's mapping projects, helped us to quickly place the Lucapa find into context," he said.

Mr Bradley said that the company would now focus on mapping at the Oscar prospect and reassessment of geophysics at Mount Hann to rank anomalies.

Once tenements were granted, the company would conduct field investigation including mapping and sampling, and then drilling.

He said that, all going well, DevEx was keen to apply for a co-funded drilling grant through the Exploration Incentive Scheme (EIS).

"The Exploration Incentive Scheme has been a welcome source of financial assistance for junior explorers willing to take the next step towards discovery," he said.

"Much of the hard work has already been completed here, as can be seen in the GSWA diamond database.

"With this work available to us, our field investigations are designed towards prompt identification of drill targets and we hope to apply for a co-funded grant sooner rather than later."

GSWA Resources Director Don Flint said that the exploration by DevEx was a perfect example of how GSWA geoscience funded by the EIS could give miners a precompetitive advantage in targeting potential discoveries.

"The very popular EIS Co-funded Drilling Program, with its image of rigs and roughnecks in hi-viz, is the public face of the way DMIRS helps explorers, but the real hero behind the scenes is the geoscience data that the EIS funds," he said. ■



Minister Dave Kelly (middle, front row) and Chief Scientist Peter Klinken (second right, front row) with award recipients at the ceremony.

AWARDS CELEBRATE LEADING WA SCIENTISTS

Outstanding Western Australians leading the way in research and science have been awarded for their contributions, with prizes totalling \$80,000 in this year's Premier's Science Awards.

Now in their 17th year, the awards cover all fields of science, including natural, medical, applied and technological science, engineering and mathematics, and recognise success in community engagement.

ExxonMobil, Chevron and Woodside have sponsored the awards since 2013 and Western Australia's five universities are proud supporters.

A panel led by Western Australia's Chief Scientist Professor Peter Klinken decides the finalists and winners of the awards.

An awards ceremony was held in August where Minister for Innovation and ICT; and Science, Dave Kelly, took the opportunity to release the new WA Science and Innovation Framework (2018-2022), outlining the Western Australian Government's science and innovation priorities.

The 2018 Premier's Science Awards winners are:

- Professor Peter Newman AO (Curtin University) – Scientist of the Year (\$50,000)
- Dr Melissa O'Donnell (Telethon Kids Institute/The University of Western Australia) – Woodside Early Career Scientist of the Year (\$10,000)

- Arman Siahvashi (The University of Western Australia) and Ryan Urquhart (Curtin University) – joint winners of the ExxonMobil Student Scientist of the Year (\$10,000)
- Rio Tinto Naturescape Kings Park – Chevron Science Engagement Initiative of the Year (\$10,000).

Emeritus Professor David Blair was inducted into the WA Science Hall of Fame in recognition of his extensive achievements in experimental physics, focusing on the direct detection of gravitational waves.

"Each of the 2018 Premier's Science Award winners have demonstrated great achievement and impact in their area of science," Mr Kelly said.

"Professor Peter Newman AO is a world leader in the science of cities and their sustainability.

"His decades of crucial research have had a significant impact on the science community and public policy at all levels, contributing to urban design and transport sustainability in Western Australia."

Premier and Minister for State Development, Jobs and Trade, Mark McGowan congratulated all finalists and winners for their outstanding contributions.

"Emeritus Professor David Blair's impressive career has helped secure a high profile for

Western Australia in the international gravitational wave community, and was aptly recognised when he was admitted into the WA Science Hall of Fame," Mr McGowan said.

The State Government's new science and innovation framework is focused on priority areas in science and innovation considered especially important for enriching lives, creating jobs and diversifying the economy.

These priority areas are mining, energy, health, food, environment, space, technology and STEM (science, technology, engineering and mathematics).

Mining and energy commitments include supporting research and development to encourage innovation in the mining sector, particularly building on the State's leading role in the use of automation, robotics and remote operations; and supporting research and technological innovation to advance opportunities in the energy sector including renewables and new energy materials.

For more information about the WA Science and Innovation Framework, visit www.jtsi.wa.gov.au/scienceandinnovationframework ■



Lead scientist Paul Breuer holds up a one ounce commemorative gold ingot from the first gold pour using CSIRO's cyanide-free process. Photo: CSIRO

GOLD PROCESSING GOES GREEN

CSIRO, Australia's national science agency, has produced the country's first gold using a non-toxic chemical process in an effort to provide an alternative to cyanide and mercury to extract the yellow metal.

The first gold is the result of early industry trials of CSIRO's 'going for gold' technology and was produced in partnership with small gold miner Eco Minerals Research at a demonstration plant in the Western Australian goldfields town of Menzies.

Cyanide is used in more than 90 per cent of global gold production, but producers are facing increasingly tough regulations that prevent or restrict its use due to environmental and health concerns.

In response to recent spills of toxic cyanide, several regional agencies in the United States, South America and Europe have banned the use of cyanide for gold extraction.

The technology replaces cyanide with thiosulphate, a non-toxic alternative, and a simple process flowsheet.

Eco Minerals Research Managing Director Paul Hanna believed it could be a game-changer for the company which has its sights set on becoming the first Australian producer to go cyanide-free.

"The first gold is a major milestone in our progress towards becoming one of the world's first green gold producers," Mr Hanna said.

"In close collaboration with CSIRO we've gone through the design, engineering and fabrication stages and set up a processing facility in Menzies, delivering the first gold pour in just 10 months, which is a fantastic achievement."

The CSIRO research team behind the innovation has already had commercial success with another tailored cyanide-free gold solution developed with Barrick Gold specifically for their Goldstrike Mine in Nevada where it has been used for nearly four years to maintain production rates.

The \$2.1 million demonstration project was made possible through \$860,000 in funding from the Science and Industry Endowment fund (SIEF)

and an Australian Government Innovation Connections grant.

CSIRO Chief Executive Dr Larry Marshall said the process could be a game-changer for small gold producers or those looking to get ahead of increasing market demand for greener commodities.

"Early industry trials like this are critical to innovation and go to the heart of CSIRO's mission to tackle big, real-world challenges and unlock a better future for everyone," Dr Marshall said.

To reduce economic barriers to entry for small producers and help turn stranded gold deposits into production, CSIRO's vision is to deliver the alternative process technology direct to mine sites via a mobile service.

A typical cyanide-based processing plant costs around \$30 million, whereas the new technology has a lower capital investment costing as little as \$2–2.5 million to build. ■

“Silver Yachts have been manufacturing superyachts at the CUF since 2009 and provide quality vessels for the overseas market. Each yacht sees approximately 160 people employed.

“This demonstrates the diversity of skills employed on the wide variety of projects that use the CUF to secure major contracts.

“By being a ‘common user facility’ with a broad market focus, it has provided companies, who otherwise wouldn’t have this level of capacity, the ability to bid for, win and complete work that would otherwise miss Western Australia,” Mr McGowan said.

“The ability to service many markets helps the AMC precinct to retain the skilled labour needed across diverse sectors.

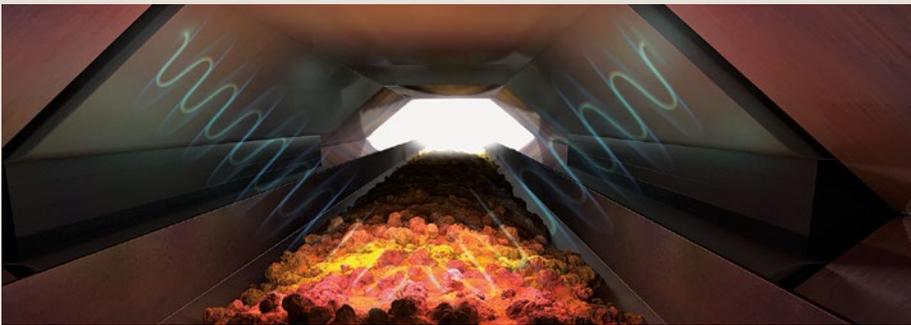
“The diversity of work reduces the cyclical impact of the State’s resource-based industries, while also ensuring highly skilled workers are available when major new projects are financed.

“I congratulate the Australian Marine Complex on 15 successful years and wish them more success for the future.” ■



The Australian Marine Complex in Henderson, Western Australia. Photo: AMC

NEW ANALYSER CUTS COSTS FOR COPPER MINERS



Ore moves through the analyser, which uses magnetic resonance radio waves to rapidly identify high quality ore.

Copper miners can significantly reduce energy and water use for every tonne of the metal produced thanks to a breakthrough ore-sorting analyser developed by CSIRO.

The analyser uses magnetic resonance technology to quickly identify ore grades, which means big volumes of waste rock can be rejected before even entering a plant, dramatically cutting down the amounts of energy and water needed for processing.

The analyser is being marketed by NextOre, a company created by RFC Ambrian, Advisian Digital and CSIRO.

“Bringing the analyser to market opens up the opportunity to transform the global copper industry and reduce its environmental footprint,” CSIRO research director Nick Cutmore said.

“We have identified 59 mature copper mine sites where the analyser could be applied to extend their life.

“The analyser could also enable undeveloped, low grade mines to be brought into production, so the economic benefits are huge.”

By illuminating batches of ore with short pulses of radio waves, magnetic resonance penetrates through copper ores – much like medical MRI “sees into” human bodies – to rapidly and accurately detect ore grade.

It has an advantage over other ore sorting analysers that can often only go “skin deep” to detect mineral particles on the surface of ore, producing less reliable results.

While the productivity benefits vary depending on the characteristics of the orebody, the analyser has the potential to more than double the average ore grades once sorted.

It could represent as much as a 20 per cent reduction in processing costs in some copper mines.

In addition to copper, the magnetic resonance analyser can be applied to gold and iron-bearing ores. ■

INNOVATE STATE: COUNTDOWN TO CROWN WA'S 2018 INNOVATOR OF THE YEAR

The finalists for this year's WA Innovator of the Year program have been announced, with the chosen eight now in the running to be crowned the overall winner.

Established in 2006, the awards acknowledge and reward exceptional innovators in Western Australia who have developed an outstanding innovative product, technology or service.

The innovation must be at the emerging or growth phase of development, and demonstrate an economic, social or environmental benefit for the State.

This year, the criteria for the awards was revised to focus on innovations that would lead to creating and supporting Western Australian jobs.

The eight finalists are in the WA Innovator of the Year's Mitsubishi Corporation Emerging Innovation category and the Mitsubishi Corporation Growth category, and are in the running to be crowned the WA Innovator of the Year – Overall Winner.

In addition, there are 16 finalists for the program's Encouragement Awards. This year, the program has four Platinum Encouragement Award sponsors – Woodside, South32, DXC Technology and Business News.

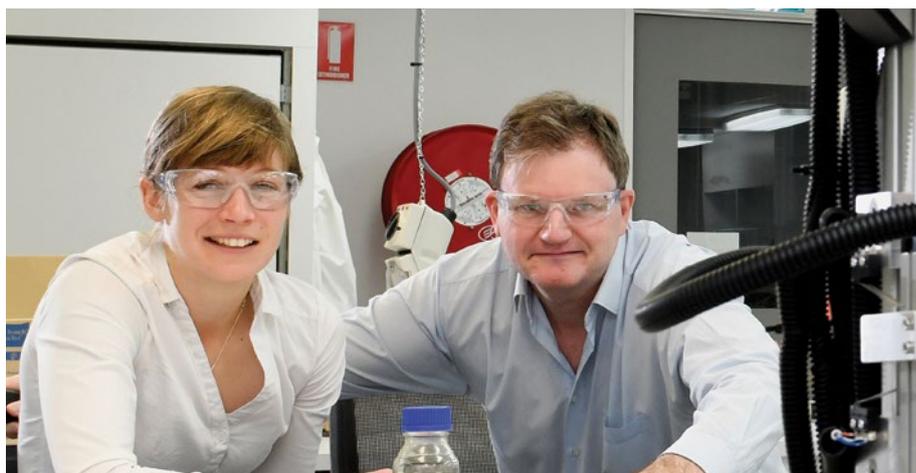
The WA Young Innovator of the Year award also continues this year, open to high school students taking part in the Just Start IT program.

The winners will be announced at the program's awards ceremony on 7 November and share in a prize pool of \$165,000.

Innovation and ICT Minister Dave Kelly announced the finalists and said the State Government is committed to raising the profile of innovation in Western Australia and supporting the growth of the State's innovation-based industries.

"These awards recognise and promote innovative Western Australians so that they can grow and develop their ideas locally," Mr Kelly said.

"By supporting our local innovators we can help keep great ideas in WA to create WA jobs and grow our economy." ■



Lisbeth Wagner and Professor Mike Johns from The University of Western Australia are nominees of the Woodside Oil and Gas Encouragement Award.

The WA Innovator of the Year program has showcased innovative and entrepreneurial individuals, businesses and creative minds since 2006.

The program has benefited many of the participants as well as the broader community of Western Australia.

The WA Innovator of the Year program is a valuable initiative that provides support to innovators and entrepreneurs across our State.

It builds capability through commercialisation training and mentoring as well as acknowledging, showcasing and awarding eligible innovators, entrepreneurs, businesses and young creative minds.

For more information, visit www.jtsi.wa.gov.au

Mitsubishi Corporation Emerging Innovation Category

Company	Innovation
OncoRes Medical Pty Ltd	OncoRes Medical
udrew PTY LTD	Automated construction planning and approvals
East Metropolitan Health Service	Putting on a New Thinking Cap
The University of Western Australia	Noisy Guts Project
Advanced Transmission Systems Holdings Ltd	Universal Continuously Variable Transmission

Mitsubishi Corporation Growth Category

Company	Innovation
chemo @ home Pty Ltd	Administering chemotherapy to cancer patients in their home
Definitiv International Pty Ltd	Definitiv
Coplin Corp Pty Ltd	KodeKLIX – STEM curriculum aligned digital technology teaching system

WA Young Innovator of the Year

School Name	Innovation
Sacred Heart College	AusTrailia
Como Secondary College	Skill Box
Cecil Andrews College	PLASTIGO



Mines and Petroleum Minister Bill Johnston and Perth Mint Chief Executive Officer Richard Hayes unveiling the Discovery gold and Argyle pink diamond coin. Photo: Perth Mint

HISTORY-MAKING COIN PRODUCED BY PERTH MINT

The Perth Mint has released Australia's most valuable collector coin in history, worth almost \$2.5 million.

The Discovery gold and Argyle pink diamond coin was unveiled by Mines and Petroleum Minister Bill Johnston at a special event at the Mint in September.

The Discovery coin weighs in at two kilograms and was inspired by the holey dollar, which was introduced as Australia's first official currency in 1814.

The coin is made of 99.99 per cent pure gold and features four rare Argyle pink and purplish-pink diamonds – the largest is 1.02 carat.

Discovery's outer coin features a sailing ship and rowboat ferrying hopeful diggers ashore, while a 19th century prospector pans for gold in front of miners' tents.

Adjacent is a vista of where pink diamonds were found. The Kimberley region is depicted by an iconic boab tree and kangaroos, with a brilliant cut pink diamond representing the tropical sun.

With the first glimpse of one of these rare pink prizes reportedly glinting from the soil of an anthill, the adjoining scene portrays a worker ant on a mound of earth with an emerald cut pink diamond clasped between its mandibles.

To complement the external coin, the heart of the coin features a stylised image of Australia with two additional pink diamonds marking the location of Ophir in the southeast, where gold

was first found, and the Argyle Diamond Mine in the northwest, the source of these exquisite coloured gemstones.

Mr Johnston said he was pleased to be able to unveil the magnificent coin.

"The Discovery coin showcases our country's prized treasures, and the talents of our craftsmen and women who have transformed them to create this collectors' item," Mr Johnston said.

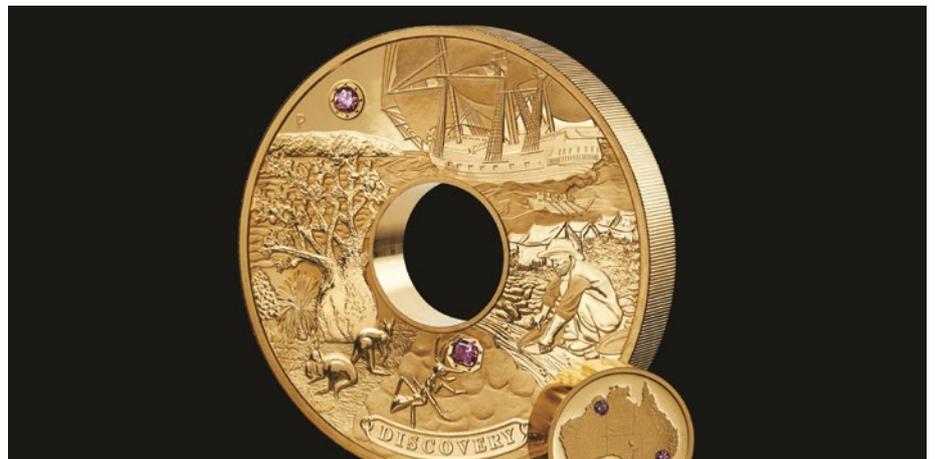
"The Perth Mint continues to showcase the wealth of resources found in Western Australia by launching exceptional creations such as Discovery."

Perth Mint Chief Executive Officer Richard Hayes said the coin was released in response to the increase in demand for exclusive luxury items.

"Discovery is just that, a collectors' item of distinction," Mr Hayes said.

"The coin showcases rare pink stones handset in the most famed of precious metals, telling the inspirational rags to riches tales of mining for these prized resources."

In 2017–18, Western Australia's gold sector produced 7.5 million ounces, worth \$11.4 billion. ■



The Discovery coin weighs in at two kilograms and is worth almost \$2.5 million. Photo: Perth Mint



Director General of the Department of Jobs, Tourism, Science and Innovation, Rebecca Brown.

NEW DIRECTOR GENERAL TO LEAD JOBS, TOURISM, SCIENCE AND INNOVATION

The Department of Jobs, Tourism, Science and Innovation (JTSI) welcomed a new Director General in September.

Rebecca Brown was appointed to the role after a formal process run by the Public Sector Commission.

Ms Brown will be responsible for attracting investment to Western Australia, and overseeing the State Government's agenda to diversify the economy and create jobs for Western Australians.

Ms Brown has extensive experience across the public sector, holding positions in a range of departments and has a strong record in delivering real outcomes for the State.

As Director General of JTSI, Ms Brown will ensure the State Government can capitalise on the growth in new and emerging industries, such as lithium, to support the economy and create new jobs. ■

WA CLOSES IN ON NEW WORKER HEALTH AND SAFETY LAWS



Mines and Petroleum; and Commerce and Industrial Relations Minister Bill Johnston.

New worker health and safety laws for Western Australia are one step closer, with recommendations for an overhauled Work Health and Safety (WHS) Act released for consultation in July.

The proposed new WHS laws cover all workplaces in Western Australia including mines, petroleum and general workplaces.

Consultation on the changes closed in late August, after information sessions were held across the State, in Joondalup, Perth, Mandurah, Katanning, Albany, Bunbury Karratha, Port Hedland, Kalgoorlie, Geraldton and Broome.

Mines and Petroleum; and Commerce and Industrial Relations Minister Bill Johnston, who formed a Ministerial Advisory Panel to advise on the new and improved WHS Act, said consultation was crucial.

"The most critical part of this process is making sure the community has a voice throughout the development of these laws, which are designed to keep them safe at work," Mr Johnston said.

Mr Johnston said the overhaul was well overdue, with the State's occupational, health and safety legislation being 30 years old.

"The modernisation of these laws is one of the State Government's top priorities, as it is a fundamental right of every Western Australian to be safe at work," he said.

Following the consideration of consultation feedback, a Bill is expected to be introduced to State Parliament in mid-2019.

The new Bill will align with legislation in other Australian jurisdictions.

"It will also create a single Work Health and Safety Act to cover all Western Australian workplaces and will ensure the same, high standards of safety are applied throughout the State," Mr Johnston said.

"While based on the national model WHS Act, it is important these changes are tailored for Western Australian workplaces to protect Western Australian workers.

"This means a continuation of the successful risk-based approach for mines, and safety cases for petroleum and major hazard facilities."

To view the WHS recommendations, visit www.commerce.wa.gov.au ■



Department of Mines, Industry Regulation and Safety
**RESOURCES SECTOR
 AWARDS FOR EXCELLENCE**

Golden Gecko • Community Partnership • Safety & Health



For 26 years the Golden Gecko awards for environmental excellence have recognised resources projects that have set new standards in environmental outcomes and innovation in Western Australia.

More recently, the addition of the Community Partnership and the Safety and Health Resources Sector Awards has increased the number of projects sharing learnings with industry and receiving recognition for their work.

Western Australian resource companies and service providers are creating innovative solutions to everyday problems that arise within the sector. Some are simple changes or processes, and others are uniquely engineered pieces of equipment with potential applications across the industry.

The Community Partnership Resources Sector Awards celebrate partnerships that provide enduring benefits and outcomes to communities around the State.

Conservation and worker safety were the key focus for the recently announced award finalists. Mines and Petroleum Minister Bill Johnston will announce the winners at the Resources Sector Awards for Excellence Ceremony on Thursday 25 October 2018. For more information on the Awards visit www.dmirns.wa.gov.au/excellenceawards. ■

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INNOVATION ON SHOW FOR RESOURCES SECTOR AWARDS FOR EXCELLENCE

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Golden Gecko nominees

Rapid Impact Detection – Roy Hill Holdings and Astron Environmental Services

Rapid Impact Detection is an innovative method of identifying environmental phenomena as they occur, enabling immediate response activities.

The State-Wide Array Surveillance Program – Multiple Port Authorities and Department of Primary Industries and Regional Development

The State-Wide Array Surveillance Program (SWASP) is a world-first in the use of molecular

techniques by a collaborative marine biosecurity surveillance network to more rapidly respond to a potential incursion of an introduced marine pest.

Alcoa and Murdoch University Partnership Eradicates Biological Bulldozer Phytophthora Dieback – Alcoa of Australia

Alcoa and Murdoch University's project has delivered a world-first – a technique that can eradicate the Phytophthora dieback pathogen without toxic chemicals and on a large scale. This technique has immediate application by others in the resources and extractive industries worldwide.

Chasing Ghosts: Understanding Ghost Bat Ecology in the Pilbara – BHP Iron Ore Pty Ltd

Evidence of the Ghost Bat in BHP's Mining Area C started a collaborative project across industry, government and academia that has resulted in a better understanding of the ecology of the Ghost Bat in the Pilbara and enabled effective management of the species.

Biosecurity Management in Quarrying: Best Practice Dieback Management – Hanson Construction Materials

Hanson has embarked on a statewide redevelopment of its sand and aggregates quarry operations located in the South West of Western Australia in an effort to responsibly restrict the spread of Dieback across the State and reduce the risk to award-winning restoration efforts onsite.



Safety and Health Resources Sector Awards nominees

Engineering

Improving Electrical Safety of High Voltage Switchgear, Rio Tinto Iron Ore

Rio Tinto Iron Ore's online partial discharge solution has enabled employees to take a holistic view of the process of risk reduction across its extensive fleet of high voltage switchgear assets. With the ability to predict failures, resources can be better allocated to corrective and preventative actions that will minimise the risks from arc flash and hazardous gas exposure.

SkyHook MKIV Mobile Fall Arrest Anchor System, Fremantle Commercial Diving

The SkyHook MKIV (SkyHook) is a unique truck mounted, mobile rated overhead anchor point for two people, designed and engineered to allow safe working at heights, or the rescue of an injured person from a water tank, in situations where no other suitable anchor point and/or rescue equipment is installed on an asset.

Lightning Protection System, Roy Hill Holdings

The Lightning Protection System (LPS) is an innovative, unique and long-term solution to a frequent hazard in the mining industry. The LPS allows people to safely move around facilities during lightning red alerts, by capturing lightning strikes at preferred points then redirecting the energy to a grounding system.



VHF tracking of the Ghost Bat. Photo: BHP

Elimination of Chlorine Gas from Rio Tinto Pilbara Villages, Rio Tinto

Rio Tinto Iron Ore identified gas chlorinators were still in use at the main potable water treatment systems at their accommodation villages. To eliminate the risk of exposure to chlorine gas for both personnel maintaining potable water at the village and residents, an onsite Electrolytic Chlorination system was successfully installed at four facilities.

Spring Leaf Pack Hoist, Mineral Resources Limited (MRL)

MRL identified the need for an engineering design to eliminate the risk of musculoskeletal injuries and significantly reduce impact injuries to hands and fingers associated with the task of removing and replacing Leaf Spring Packs on their extensive range of multi-combination and super-quad Road Train trailers.

Elimination of Working Under a Suspended Load, Rio Tinto

Any crane lifting operation where there is a risk of personnel being exposed to a suspended load requires effective controls to mitigate potential risks. An engineer designed guide system successfully eliminates the requirement for an operator or maintainer to work in proximity to the drop zone of a suspended load during this task.

Systems and People

Driving down injuries and incidents in road train haulage, Atlas Iron

There are many factors involved in ensuring personnel are fit for work and free from fatigue. Atlas Iron has shown a considered, well-structured plan that has had measureable improved outcomes to the drivers, community and companies.

Reduction of sprains and strains in mining industry, Kalgoorlie Consolidated Gold Mine

Redesigning the storage racks for steel rods and repositioning hydraulic fluid storage is a simple,

cost effective engineering solution. It has had a significant impact in minimising sprains and strain injuries to staff, improving not only the health and wellbeing of employees but also increasing production and contributing to the success of the business.

Emergency Response Exposure Reduction Initiative – BARRIO, Rio Tinto Iron Ore

Best practice, Airborne Contaminants, Risk, Reduction, Initiative and Operation, or 'BARRIO' is an effective and practical solution to mitigate the risk of exposure to fire based atmospheric contaminants that have been identified as health risks.

Newmont Boddington Gold Health and Safety Representative (HSR) Mentoring Program, Newmont Mining

The HSR mentoring program is designed to support Health and Safety Representatives, by providing education on their legal responsibilities and requirements, as well as equip them with skills to successfully engage their work groups and the workforce. The program delivers 11 topics and workshops over 11 months.

Controlling Energy Sources – Mobile Maintenance, Fortescue Metals Group

A safety package designed for upskilling and keeping mobile maintenance workers in control of potentially damaging stored energy.

Reducing exposure to working on live equipment, Rio Tinto Iron Ore

An isolation incident in 2015 at Rio Tinto Iron Ore Ports Dampier highlighted the risk of working on live equipment associated with mirror-image conveyors with multiple access points. Several mitigating measures were implemented for working among mirror-image conveyors including a human factors approach, and an easily deployed, low cost, sustainable method of plant identification.



Community Partnership Resources Sector Award

Community Partnership Resources Sector Award

KCGM and EKPS Goldfields Community Partnership – East Kalgoorlie Primary School (EKPS) and Kalgoorlie Consolidated Gold Mines

The community partnership between East Kalgoorlie Primary School (EKPS) and Kalgoorlie Consolidated Gold Mines (KCGM) started in 2010, and has grown to become a multi-faceted collaboration creating sustainable outcomes for the Goldfields community.

Through a variety of sponsorship programs, in-kind donations, engagement initiatives and a long-term partnership agreement the relationship between EKPS and KCGM has proven to be advantageous, with many positive outcomes.

Munda Biddi Trail Foundation and Alcoa Partnership

This community partnership of more than 18 years is focused on working together to help build, maintain, promote and foster sustainable support for the Munda Biddi Mountain Bike Trail – a unique, world-class and enduring asset for Western Australia.

The partnership between Alcoa and the Foundation has from the outset extended beyond financial support to include in-kind assistance. Recently it has grown to also link the Alcoa employee volunteer program and the Foundation trail maintenance program, and to support visioning projects for the communities through which the Trail passes.

Pilbara Mentoring Partnership – EdConnect Pilbara Mentor Me program and Roy Hill Holdings

Pilbara Mentor Me is a partnership program designed by Roy Hill Community Foundation and EdConnect Australia that offers life-changing mentoring and learning support in schools for young people.



The community partnership between East Kalgoorlie Primary School and Kalgoorlie Consolidated Gold Mines started in 2010.

This community volunteer program was established in Port Hedland in 2016 to provide local students with the academic and social support they need to succeed. It offers volunteers an opportunity to undertake specific training and immerse themselves in a program that is making a real difference in their local community.

Makerspace Project – Yule Brook College and Carey Mining

Yule Brook College and Carey Mining shared a vision for improving opportunities and outcomes for Indigenous young people. The alliance resulted in Carey Mining coming on board as the College's major partner for the innovative 'Makerspace' program.

Makerspace is a multi-purpose space for students to explore and experience making material artefacts. Through this process, they learn to value and appreciate the importance of STEAM disciplines (science, technology, mathematics, arts, and engineering) while developing their personal skills and qualities such as creativity, persistence and collaboration.

Makerspace is a place where members of the school community and beyond can come in and act as mentors to students, particularly young Indigenous students.

Healthy Food for All – Pilbara Regional Strategy – Foodbank and BHP Iron Ore

Food, cooking and eating together are associated with sharing and social cohesion, and as such are an important part of the social fabric within schools, families and communities. Foodbank WA's School Breakfast Program and Food Sensations suite of programs in the Pilbara, in partnership with BHP, are important vehicles for bringing together broad groups of students and adults within a social rather than formal educational or health setting.

Rio Tinto Earth Assist – Conservation Volunteers Australia, Department of Biodiversity, Conservation and Attractions, Department of Education and Rio Tinto

Rio Tinto Earth Assist (RTEA) is a statewide environmental education program, funded by Rio Tinto and delivered by Conservation Volunteers Australia that enables Western Australian teachers and students to make a real on-ground difference. Working in close partnership with the Department of Education and the Department of Biodiversity, Conservation and Attractions, RTEA provides incursion and excursion activities that link to and support the WA Curriculum and cross curriculum priorities, specifically Sustainability and Aboriginal & Torres Strait Islander Histories and Cultures.

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

The Sino Iron project is located at Cape Preston, 100km southwest 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, with an annual capacity to produce up to 24Mt of magnetite concentrate. The downstream processing facility has required significant investment in dedicated supporting infrastructure including a new port facility, a 51GL desalination plant and a 450MW combined cycle gas fired power station.

Expenditure: \$12b.

Employment: Construction: 4000

Operation: 1500

OIL & GAS DEVELOPMENTS**Pilbara – Wheatstone LNG Development
CHEVRON AUSTRALIA PTY LTD**

Chevron Australia Pty Ltd as Operator of the Wheatstone Project is completing construction of two LNG trains and a domestic gas plant at the Ashburton North Strategic Industrial Area near Onslow. The Project, which includes a deepwater port, will initially produce 8.9Mtpa of LNG and have a 200TJ per day domestic gas plant connected to the Dampier-to-Bunbury Natural Gas Pipeline. First LNG production commenced on 9 October 2017, and the first export shipment left on 31 October 2017.

Expenditure: \$40b.

Employment: Construction: 7200

Operation: 400

**Carnarvon Basin – Persephone Project
WOODSIDE ENERGY**

The Persephone project achieved start-up in July 2017, six months ahead of schedule. The Persephone field produces using subsea tieback to the existing North Rankin Complex.

Expenditure: \$1.2b.

**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 at least 300TJ/d of gas to the mainland. Cost estimates for the project construction are expected to total more than A\$55b. The project involves the processing of gas from both the Gorgon and Jansz/lo gas fields and includes potentially the largest commercial CO₂ 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 of the CO₂ injection project is expected in Q1 2019.

Expenditure: \$55b.

Employment: Construction: 8000

Operation: 300

IRON ORE**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 per cent 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 2,500 jobs during peak construction and more than 600 ongoing operational roles over its expected 25 year life span.

Expenditure: Approximately \$4.7b

Employment: Construction 2,500

Operation: 600

**Pilbara – 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 143km railway project. The \$1.7 billion project has an expected mine life of over 20 years and an average production rate of 30 million tonnes per annum. The company is targeting construction to begin in mid-2019, creating up to 1900 jobs during construction with 500 full-time site positions once operational.

Expenditure: \$1.7b.

Employment: Construction: 1900

Operation: 500

LITHIUM

Kwinana – Tianqi Lithium Processing Project

TIANQI LITHIUM AUSTRALIA PTY LTD

Tianqi Lithium Australia Pty Ltd holds a 51 per cent interest in Talison Lithium, the operator of the Greenbushes mine in the South West of Western Australia. The company has committed to a major expansion of the mine and the construction of a lithium hydroxide processing plant at the Kwinana Strategic Industrial Area, south of Perth. The processing plant will be constructed in two stages. The first stage will accommodate the production of 23,900tpa of lithium hydroxide and will occur between 2016–2018. The second stage will expand the plant to produce up to 47,800tpa of lithium hydroxide and will occur between 2018–2020. The final product will be shipped to customers in China. Lithium hydroxide is a highly-valued resource for industries involved in energy storage, hybrid vehicles, aviation and other technological industries.

Expenditure: \$608m.

Employment: Construction: 500

Operation: 115

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-lo 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-lo 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.

Expenditure: \$5.1b.

Carnarvon Basin – Greater Western Flank Phase 2

WOODSIDE ENERGY

The Greater Western Flank 2 Project was approved in December 2015 and will develop gas and condensate from the Keast, Dockrell, Sculptor, Rankin, Lady Nora and Pemberton fields via a subsea tieback to the existing Goodwyn platform. Drilling and completion activities have been successfully completed. Subsea construction will commence in Q3 2018. The project is expecting start-up from the initial tranche of five wells in 1H 2019, with the remaining three wells expected in 1H 2020.

Expenditure: \$2.8b.

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, 1000ha 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 Q4 2018 or Q1 2019.

HEAVY MINERAL SANDS

Shark Bay – Coburn Mineral Sands Project STRANDLINE RESOURCES LIMITED

The Coburn Mineral Sands Project, located south of Shark Bay and approximately 250km north of Geraldton, contains total ore reserves of 308Mt at an average grade of 1.2 per cent heavy minerals. At a mining rate of 23.4Mtpa, the project is expected to produce 49,500tpa of zircon, 109,000tpa of chloride ilmenite and 23,500tpa of a mixed rutile-leucocoxene over its 19 year mine life. In June 2018, Strandline announced that it had commenced a full Definitive Feasibility Study.

Expenditure: \$173m.

Employment: Construction: 170

Operation: 110

IRON ORE

Pilbara – Balla Balla Infrastructure Project BALLA BALLA JOINT VENTURE

BBI 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 50Mtpa. 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 165km single-track standard gauge railway and a multi-user port facility. The Railway (BBI Rail Aus Pty Ltd) Agreement 2017 was executed between the State, the Company and the Guarantors in January 2017 with the Railway (BBI 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 282km 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

Shire of East Pilbara – Koodaideri Iron Ore Mine and Infrastructure Project

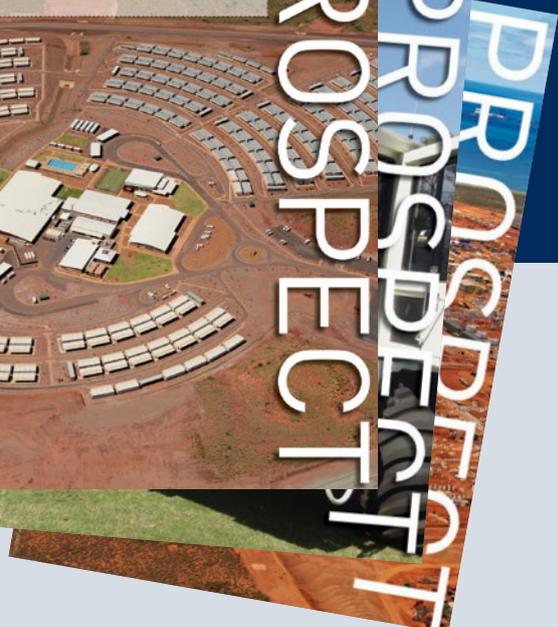
MOUNT BRUCE MINING PTY LTD (RIO TINTO)

Rio Tinto is investigating the development of the Koodaideri iron ore deposit located about 110km north west of Newman. The Koodaideri Project would have a capacity of about 40Mtpa of iron ore requiring the development of a new mining area at Koodaideri, crushing, screening, stockpiling and rail load out infrastructure plus a 170km railway. Rio Tinto is currently undertaking a project feasibility study that is focusing on obtaining consents and providing data to validate the project.

Expenditure: \$3b.

Employment: Construction: 1600

Operation: 600



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Significant resource projects in Western Australia

Western Australia continues to be a priority destination for resources investment in Australia. There is almost A\$30 billion worth of projects either committed or under consideration for the State during the next few years. These would create nearly 11,000 future construction jobs and over 3,500 permanent jobs.

This section is intended as an overview and does not constitute an exhaustive list of projects within the Western Australian resources industry. The information is compiled from company announcements. Note: Projects that have completed foundation construction or where operations have commenced are not included in the Significant Projects list.

Significant Projects as at August 2018

	Project Value (estimated A\$m)	Employment Construction Permanent
Iron and Steel		
API Management Pty Ltd – West Pilbara Iron Ore Project	6800	1500 900
Balla Balla Joint Venture – Balla Balla Infrastructure Project	5600	3300 900
Mount Bruce Mining Pty Ltd (Rio Tinto) – Koodaideri Iron Ore Mine and Infrastructure Project	3000	1600 600
FMG/TPI Eliwana Mine and Rail Project	1700	1900 500
BHP Billiton Iron Ore Pty Ltd – South Flank	4700	2500 600
Sub Total	21800	10800 3500
Oil, Gas and Condensate		
Woodside Energy – Greater Western Flank Phase 2	2800	n/a n/a
Gorgon Joint Venture – Carnavon Offshore Basin – Gorgon Stage 2	5100	n/a n/a
Sub Total	7900	n/a n/a
TOTAL	29700	10800 3500

All currency figures are in Australian dollars unless otherwise specified.

Abbreviations Key

b	billion	m	million
EPC	Engineering, Procurement and Construction	Mt	million tonnes
GL	gigalitres	Mtpa	million tonnes per annum
ha	hectares	MW	megawatts
JV	joint venture	t	tonnes
km	kilometres	THM	total heavy mineral
LNG	liquefied natural gas	TJ	terajoules
LOA	length overall	tpa	tonnes per annum

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For forty years *Prospect* has helped promote the innovation, strength and resilience of Western Australian industries.

For the past 12 months, *Prospect* has suspended hard copy subscription renewals.

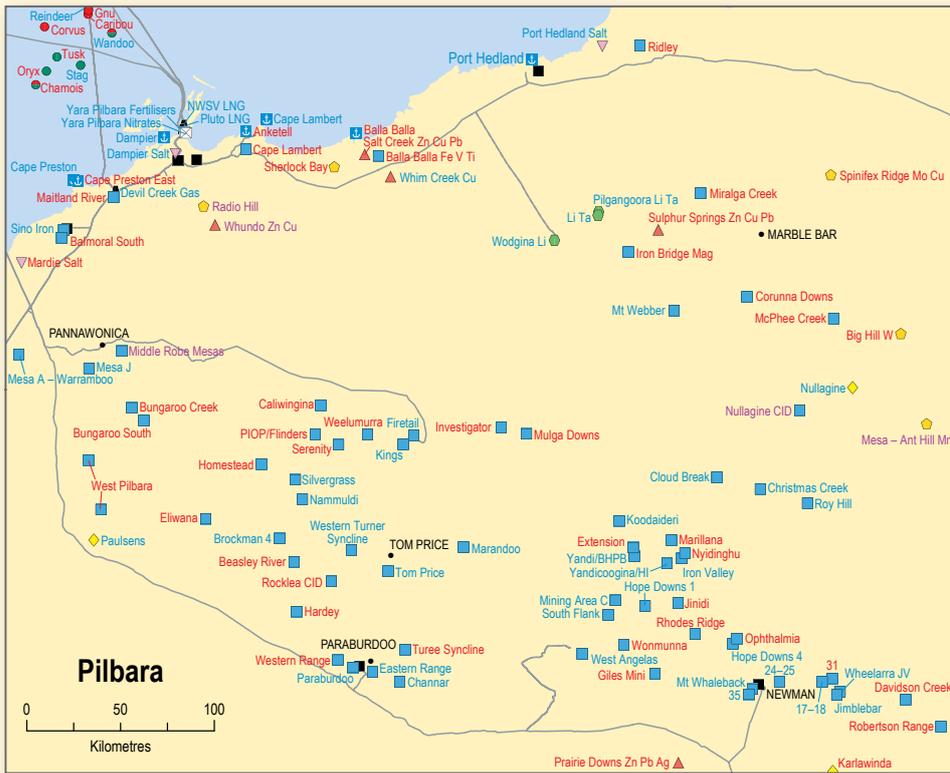
Starting from the June 2018 edition, the Department will no longer provide hard copy editions directly to subscribers and is encouraging current subscribers to sign up for the free digital version of the magazine.

Hard copies of the magazine will still be available for collection from front reception areas at DMIRS' Mineral House building in East Perth and JTSI's office at 1 Adelaide Terrace in East Perth.

In order to download your digital version free of charge visit www.dmp.wa.gov.au/prospect and sign up to the *Prospect* magazine mailing list.

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Mineral symbols		Commodities	
◆ Precious metal	Au (or as shown)	Ag..... Silver	
◆ Steel alloy metal	Ni (or as shown)	Au..... Gold	
● Speciality metal	Ti-Zr (or as shown)	Cu..... Copper	
▲ Base metal		Fe..... Iron	
▲ Iron		K..... Potassium	
▲ Alumina	All sites are bauxite	Kln..... Kaolin	
● Coal and lignite		Li..... Lithium	
● Industrial mineral		LNG..... Liquefied natural gas	
⊠ Processing plant		LPG..... Liquefied petroleum gas	
		Lst..... Limestone	
		Mag..... Magnetite	
		Mn..... Manganese	
		Mo..... Molybdenum	
		Ni..... Nickel	
		Pb..... Lead	
		Phos..... Phosphate	
		REE..... Rare earth elements	
		Sid..... Silica sand	
		Ta..... Tantalum	
		Ti..... Titanium	
		Tlc..... Talc	
		V..... Vanadium	
		W..... Tungsten	
		Zn..... Zinc	
		Zr..... Zirconium	

Petroleum symbols	
● Gas field	
● Oil field	
● Oil and gas field	
◆ Significant oil discovery	
▲ 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 (NOPATA) at <info@nopata.gov.au>



Project labels:

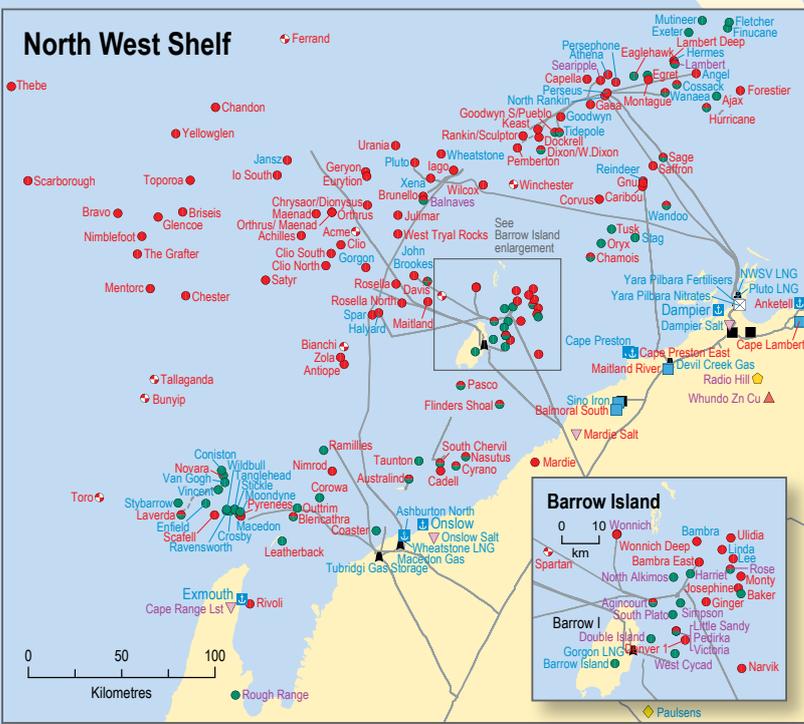
Projects operating or currently under development with an actual or anticipated value of production greater than A\$10 Million are shown in blue

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 September 2018

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



Commodities

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

Mineral symbols

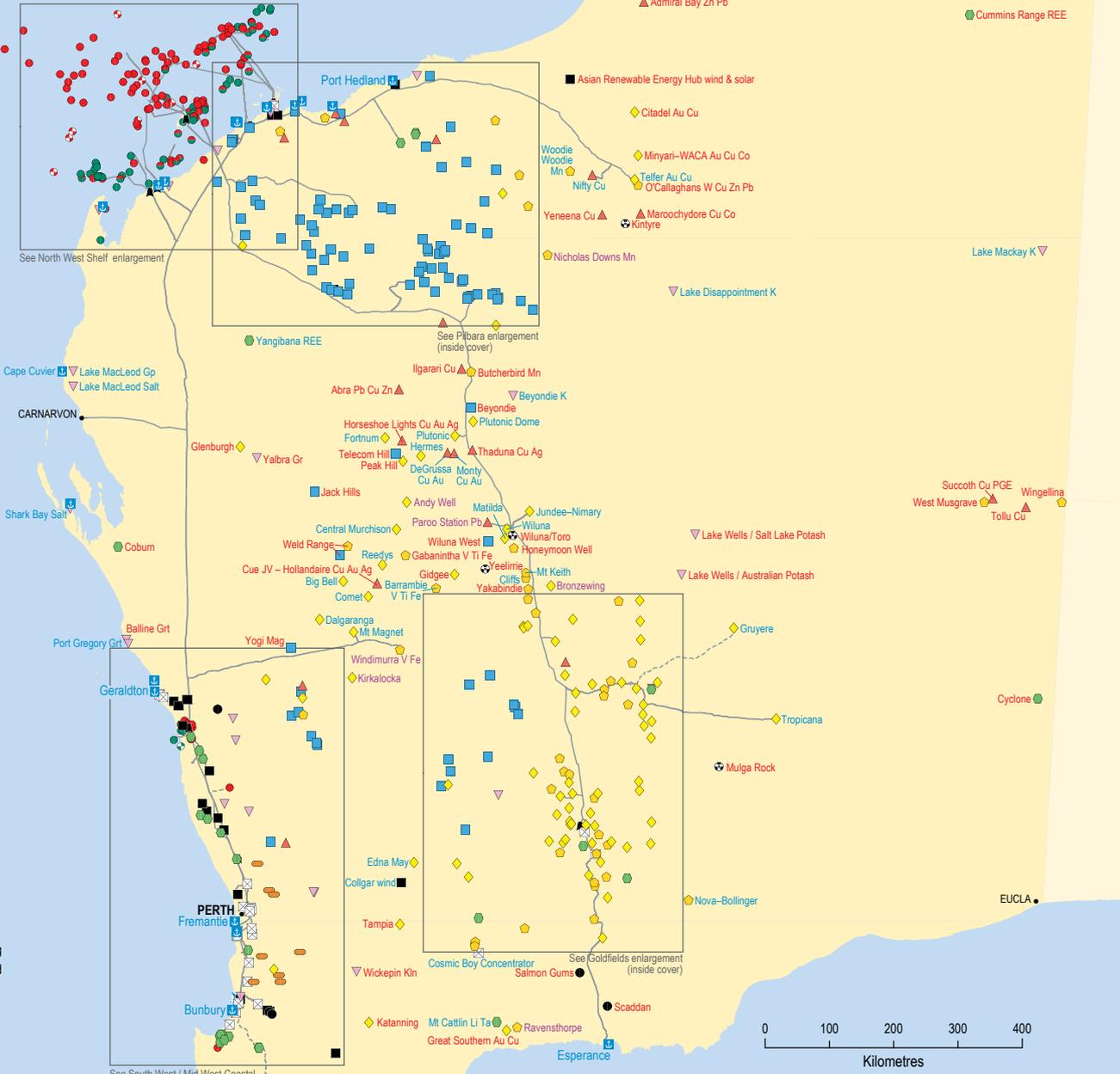
- ☆ Precious mineral
- Dmd
- ◆ Precious metal
- Au (or as shown)
- ◆ Steel alloy metal
- Ni (or as shown)
- Speciality metal
- Ti-Zr (or as shown)
- ▲ Base metal
- Iron
- Alumina
- All sites are bauxite
- Coal and lignite
- Uranium
- ▽ Industrial mineral
- ⊠ Processing plant

Petroleum symbols

- Gas field
- Oil field
- Oil and gas field
- Significant gas discovery
- Significant oil discovery
- Significant oil and gas discovery
- ⊠ 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

