

PER S T M C T

NEW FRONTIERS

WA building partnerships & possibilities



Western Australia has long enjoyed a close relationship with its regional neighbours, with a shared time zone and mutually beneficial opportunities driving a natural trade advantage.

In April, I visited India and Singapore to further advance Western Australia's trade and investment relationships with both countries.

During my visit to India, my first as Premier (story page 5), I met senior national and State government Ministers and leading Indian companies to explore investment opportunities in agriculture, science, education and resources, especially liquefied natural gas (LNG).

While in Singapore, I met several business and government representatives, including Prime Minister Lee Hsien Loong. Prime Minister Lee and I had an engaging discussion about greater collaborations between Singapore and Western Australia and the emergence of Singapore as a LNG trading hub for Asia.

I also delivered a keynote address at the University of Western Australia's In the Zone conference, the first time the series has been held in Singapore (stories pages 9 and 11).

I took this opportunity to dispel the notion that Western Australia is a "dig it up, ship it out" economy. Rather, we are a highly specialised economy that exports not only raw materials, but also significant research, technical expertise and innovation to other parts of the world.

In early June, as part of a 10-day trade mission to Asia (story page 7), Mines and Petroleum Minister Bill Marmion was in Shandong to witness the signing of a conditional iron ore offtake agreement between the Shandong Iron and Steel Group and a subsidiary of Rutila Resources joint venture partner, Todd Corporation.

The agreement continues to expand Western Australia's world-leading resources industry.

While the resources industry is facing challenging times, the fundamental strengths of the State's resources sector remain.

Western Australia has world-class resources and our proximity to the world's fastest-growing markets coupled with strong relationships with our regional partners provides unique opportunities that we will continue to exploit.

Colin Barnett
PREMIER OF WESTERN AUSTRALIA & MINISTER FOR STATE DEVELOPMENT

Bill Marmion
MINISTER FOR MINES AND PETROLEUM

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Cover photo: Australian energy company AWE's Waitsia gas field find could herald a new chapter for Western Australia's gas industry. Story page 2.

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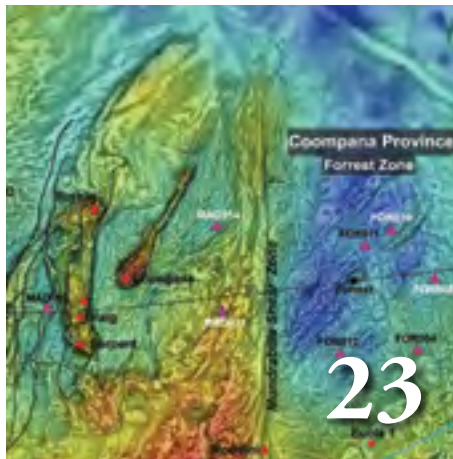
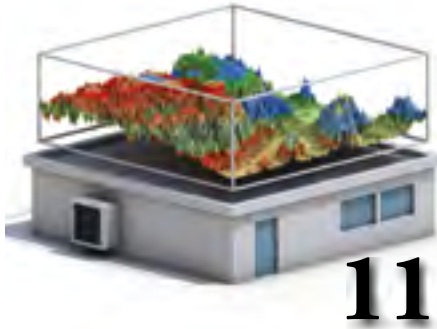
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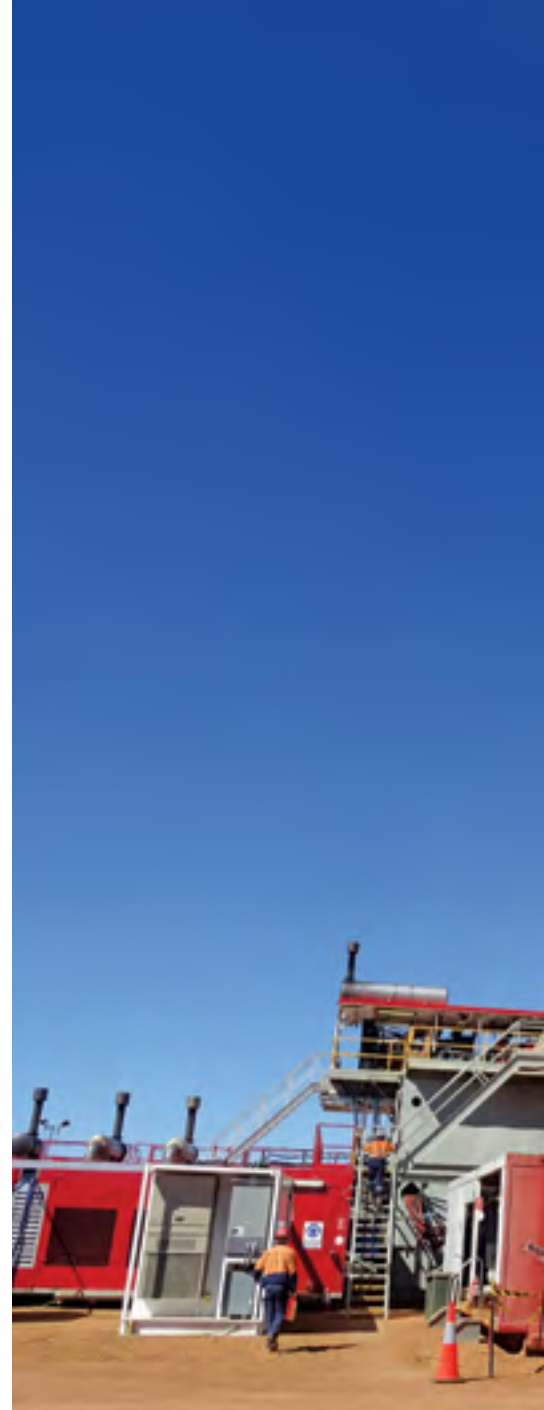
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AWE's Waitsia field discovery could herald a new chapter for WA's gas industry.



The AWE Irwin-1 Well, located in Western Australia's

NEW GAS FIELD FIND COULD RIVAL NORTH WEST SHELF: MINISTER

Western Australia's largest onshore gas field discovery in decades could reignite the heady days of the 1960-70s North West Shelf discovery.

Mines and Petroleum Minister Bill Marmion said the discovery last year by AWE at the Waitsia field in the Perth Basin, east of Dongara could herald a new chapter for the State's gas industry.

Mr Marmion said the company announced that production could commence as early as next year.

"In March, AWE made an announcement to ASX confirming that the Waitsia gas field was capable of producing gas at commercial rates with the potential for much-needed, low cost onshore production," Mr Marmion said.

"This is exciting news which will significantly help reinvigorate development in the Perth Basin and has the potential for an exciting new gas play in the region, not seen since the early days of the North West Shelf."

Mr Marmion said the company was already undertaking engineering studies on potential low cost, early stage development of the Waitsia gas field, using existing gas plants and pipeline infrastructure, to deliver a significant source of gas to the Western Australian domestic market.

"Importantly, because of its proximity to Perth, transport costs will be low, providing an economically viable source of gas for the domestic market," Mr Marmion said.



Mid West region.

The gas would be produced at the company's existing gas plant in Dongara from where it could be fed into the Parmelia or Dampier to Bunbury pipelines to supply WA's domestic gas market, with industry expectations that output could reach 100 million cubic feet a day at full production.

"With North West Shelf gas contracts, which supply more than half the State's gas requirements, due to come to an end by 2020, this is really good news," Mr Marmion said.

"It could also provide an opportunity for the mining sector to convert from diesel fuel and power to gas, providing energy security for the future."



Irwin-1 is the first well of a three-well drilling program planned for Perth Basin in 2015.

Chevron announces Carnarvon Basin gas discovery

At the end of April, Chevron Australia Pty Ltd announced further drilling success in the Greater Gorgon Area located in the Carnarvon Basin, a premier hydrocarbon basin offshore north west Western Australia.

The Isosceles-1 exploration discovery well encountered approximately 134 metres of net gas pay in the Triassic Mungaroo Sands in 968 metres of water.

It is located in the WA-392-P permit area approximately 95 kilometres (60 miles) northwest of Barrow Island, off the coast of Western Australia.

"This discovery is a continuation of our exploration success and further positions our company as a key supplier for future liquefied natural gas (LNG) demand in the Asia-Pacific region," Chevron Asia Pacific Exploration and Production Company President Melody Meyer said.

Chevron Australia Managing Director Roy Krzywosinski said: "This discovery in the Greater Gorgon Area is an important addition to our portfolio and highlights the industry-leading results of our exploration program in Australia."

Chevron Australia is the operator of WA-392-P with a 50 per cent interest while Shell Australia and Mobil Australia Resources each hold a 25 per cent interest.

Chevron's Gorgon project on Barrow Island is about 90 per cent complete and has a gas resource of about 40 trillion cubic feet.

Minister Marmion said the potential for cheap gas, onshore gas infrastructure, long-term job opportunities both directly and indirectly, and support to other industries was enormous.

New find

In April, AWE Managing Director Bruce Clement said the early results of the Irwin-1 well were very promising and further highlighted the exciting exploration potential of the Perth Basin.

The Irwin-1 exploration well was spudded on 25 March this year and has been drilled vertically to 4049 metres.

Irwin-1 is designed to test the gas potential to the east of the Senecio and Waitsia gas fields and has multiple reservoir objectives in the Dongara and Wagina sandstone formations, the Carynginia Shale and Irwin River Coal Measures, and the deeper Kingia and High Cliff Sandstones.

The Irwin-1 exploration well is located approximately 22.7 kilometres east of Dongara, Western Australia. Irwin-1 is the first well of a three-well drilling program planned for the Perth Basin in 2015. It will be followed by the Waitsia-1 and Waitsia-2 appraisal wells on the newly discovered Waitsia Gas Field. ■



SOLID FOUNDATIONS SET FOR NEW FRONTIER: INDIA AND WA

Indian Prime Minister Narendra Modi has been a vocal proponent of India and Australia as vital partners for progress and prosperity throughout his first year in office.

The Western Australian Government looks forward to deepening the State's bond with India and advancing trade links in particular.

Here, Prospect takes a look at the "Modi Effect" and its importance to Western Australia, from the perspective of Western Australian Indian Trade Office acting Regional Director, David McCulloch, who recently returned from a four-month stint in India.

With his election victory in May 2014, and his BJP Party's majority in the lower house, Narendra Modi is described as the best bet for India in generations, a sentiment echoed nationally and internationally. As Chief Minister of Gujarat from 2001 to 2014, he oversaw a rapid transformation of that State's economy and international profile, in what many saw as a blueprint for his Prime Ministership of India.

No one doubts the immensity of the task confronting Modi. India's history, politics, ethnic and religious diversity, social structures and mores, and bureaucracies serve to maintain the status quo rather than foster dynamic change. Achieving a consensus that accommodates India's plurality is both complex and time-consuming.

Modi is viewed as an agent of change, able to reshape key relationships and offer solutions to complex problems. He has some external factors working in his favour. One third of India's population is under 15 years of age (400 million), there is a growing middle class of over 250 million, and the demand for education is high. Modi is adept at communicating directly with these groups via social media. Further, India is a leader in many high value sectors (ICT, biotech,

pharmaceuticals, automotive, aerospace, manufacturing), while Indian corporations are increasingly active in global markets.

So what does Modi's accession mean for Australia and Western Australia in particular? Australia's total trade with India of A\$15 billion is dwarfed by our A\$160 billion trade with China (Western Australia's trade with India was A\$1.9 billion compared to A\$68.3 billion with China in 2014) - this is in spite of Australia's proximity to India and commonalities in language, government, law and sport.

Several factors are now realigning the relationship. Reciprocal visits by Australian Prime Minister Tony Abbott and Prime Minister Modi in the second half of 2014 helped define their areas of mutual interest and economic complementarity. Pre-eminent sectors where India looked specifically to Australia, and where opportunities will expand with the conclusion of a Free Trade Agreement currently in negotiation, included:

- Energy Security – coal, liquefied natural gas (LNG) and uranium, and related services
- Mining Capability – mining technologies, services, standards and training
- Agriculture/Fisheries – technologies and supply chain improvements
- Education/Training – education and training diversity, curricula and relevance
- Infrastructure – project, system and innovation expertise, including finance.

In April 2015, Western Australian Premier and State Development Minister Colin Barnett made his first official visit to India, spending four days in Mumbai and Delhi, during which he met more than 20 Indian and Australian companies, several Federal Ministers and with the University of Mumbai. It was apparent that Western Australia was aligned strongly with the sectors listed above, and indeed was the leading Australian jurisdiction in several.

As the Premier has noted: "Western Australia will play to its strengths, not just in resources but in agriculture, science and education."

By playing to its strengths, Western Australia will be well represented in specific priority areas, and not diluting its efforts and limited resources in areas where the State is not recognised.

Immediate outcomes for Western Australia will be challenging because India is in the process of addressing major internal issues (in the case of LNG imports, removing fuel subsidies and expanding pipeline networks); and Western Australian companies need to adapt in entering a market where personal relationships precede commercial ones, and where bureaucracies need to be understood fully.

However, through astute use of Western Australia's Mumbai trade office's expertise, networks and reputation (the first opened by any Australian state, in 1996) and working closely with key Western Australian and Indian companies and organisations, the State is putting in place solid foundations to build depth and breadth in its relationship with this new frontier.

Western Australia is looking to extend its relationship with India through partnering with the state of Andhra Pradesh. With a population of about 49 billion people, the south east coastal state has a diverse geography and a diverse economy. There are opportunities for Western Australia to explore further partnerships with Andhra Pradesh in the resources sector – in oil and gas infrastructure and in the METS sector – and in other areas including agriculture, IT and biotechnology, research partnerships, architecture and design services, and corporate training and skills development.

For more information on the India offices of the Western Australian Government, visit www.watoindia.in/ ■



SHARED PROSPERITY: WESTERN AUSTRALIA AND INDIA



Western Australian Premier and State Development Minister Colin Barnett in Mumbai, India.

Western Australian Premier and State Development Minister Colin Barnett travelled to India in April as part of a move to strengthen ties with the South Asian republic.

In his first official visit to India as Premier, Mr Barnett travelled to Mumbai and New Delhi for meetings with senior national and provincial government officials, and leading Indian resource companies such as petroleum company Tata Petrodyne and the National Mineral Development Corporation, India's biggest iron ore producer.

The visit aimed to promote increased collaboration and trade and investment opportunities between the two countries.

"India is the world's second-most populous country and the tenth-biggest national economy," Mr Barnett said.

"Western Australia was the first Australian State to open a trade office in India — in 1996 — and yet our trade with the country is still small relative to the size of the market.

"There is huge potential to grow our relationship with India as a significant trade and investment partner in the long-term."

The Premier said India's rapid development presented opportunities for Western Australia to develop export links across various industries.

"This visit was focussed on gaining a better understanding of India's economy and exploring opportunities to export commodities, mining expertise, agricultural techniques, fishing practices, storage and handling of food produce practices, research, and education," the Premier said.

The trip was also an opportunity to explore investment opportunities in natural resource projects, specifically liquefied natural gas (LNG), nickel, copper, alumina, gold and rare earths.

"There are numerous opportunities for Western Australian companies, particularly in liquefied natural gas, mining services, fishing and agriculture," Mr Barnett said.

"As India rapidly develops, it is in search of new, cleaner fuels. Most energy is still generated through coal, but LNG imports have been growing at an annual average rate of 22 per cent a year.

"With Western Australia poised to become one of the world's biggest exporters of LNG, I hope to see India play a growing role in that sector's future."

"The opportunities in India are many, but there are challenges," Mr Barnett said.

"Western Australia will play to its strengths, not just in resources but in agriculture, science and education, as we seek to build this relationship." ■

"With Western Australia poised to become one of the world's biggest exporters of LNG, I hope to see India play a growing role in that sector's future."

WA WORKING WITH INDIA



Western Australian company acQuire Technology Solutions provides mining software to the resources industry around the world, including in India.

With an expansive landscape of about three million square kilometres, covering diverse geographical regions endowed with vast resources and minerals, India and Western Australia have much in common.

For both economies, the resources sector plays a significant role.

Like Western Australia, India has diverse natural resources that include iron ore, coal, bauxite, natural gas and oil, cultivable land for agriculture and large marine resources.

India is the world's third-largest coal producer and the country is also a significant producer of iron ore, lignite, copper ore, manganese ore and chromite.

In 2012, India's mineral production was valued at over A\$36 billion, with the country producing about 87 different minerals - made up of 4 fuels, 10 metallic, 47 non-metallic, 3 atomic and 23 minor minerals, including building and other materials.

The Indian mining sector has become more structured in recent years with increased focus on incorporating the latest international mining equipment, technology and services (METS) into the sector, coupled with an increased willingness to outsource services.

Western Australian METS companies are active in the Indian market having successfully introduced their expertise - in mining and processing equipment, general equipment and components, information technology and related services, and consulting services - to the Indian mining sector.

One such company is acQuire Technology Solutions, which provides mining software to the resources industry and created a strategic way to manage drillhole data, which has become a critical tool for the global exploration and mining industry.

The company's GIM (geoscientific information management) Solution software is currently used in 45 different countries, including India.

The company was founded in Perth in 1996 and has focused on developing strong partnerships in new markets.

"The nature of software development requires cross-collaborative efforts in all aspects of the process," Global Manager Business Development Neil Quin said.

"Looking at new offerings, being innovative and assessing new markets is something we're very focused on."

"Retaining and growing significant technology partnerships has positioned us as a leader in geoscientific information management solutions."

Mr Quin said both India and Western Australia had business environments that required efficiency and a strong work ethic.

"India is an attractive market to us right now," he said.

"We have a team that speaks 24 languages from 26 nations, so we never see the difference of one culture to another as a barrier.

"Finding trusted partners with matching business values is important to our business and operational strategy.

"We have had promising results and good feedback reinforcing our desire to remain focussed on our growth in India."

India is Western Australia's 19th largest import market, accounting for one per cent (A\$340 million) of the State's total imports in 2014.

India's high economic growth during the past two decades has led to increased demand for minerals from around the world and demand is predicted to continue.

The Department of State Development supports a Western Australian trade office in Mumbai and provides information on trade and investment between India and Western Australia. For more information visit: www.watoindia.in/ ■

NEW WA INDIA OFFICE HEAD

A new Regional Director for Western Australia's India Trade and Investment Office, Peter Baldwin, was appointed in early June.

Mr Baldwin was employed with the Department of State Development in 2009 as General Manager, Environment, and was appointed as Director, Project Approvals Strategy, three years ago.

He has previously worked in the Solomon Islands, as advisor to the Forestry Department in the late 2000s, and in Vanuatu, Sri Lanka, India and Nepal, and was previously employed with the Western Australian Conservation Commission, as well as in the Queensland and Victorian public service.

The Western Australian Government's India office is located in Mumbai, for more information visit: www.watoindia.in/ ■



New India trade office Regional Director Peter Baldwin.

PROMOTING WESTERN AUSTRALIA'S RESOURCES TO THE WORLD



Mines and Petroleum Minister Bill Marmion, Shandong Vice Governor Wang Shujian and Department of Mines and Petroleum Director General Richard Sellers.

The message that Western Australia is the world's destination of choice for responsible resources exploration and development has been spread around the globe in the past 12 months.

Mines and Petroleum Minister Bill Marmion's East Asia visit in late May and early June this year has capped off an impressive list that includes missions to promote investment in WA's resources sector to the United States, Canada, China, Hong Kong, Korea, Singapore and South Africa.

Department of Mines and Petroleum (DMP) Director General Richard Sellers, who accompanied the Minister on the 10-day trade mission to Singapore, South Korea and China, said that the visit highlighted WA as being open for business during a period when global investment was tight.

"DMP officers visit Asia from time to time, but having the Minister spearhead a State delegation added considerable weight to our efforts to attract investment," Mr Sellers said.

Minister Marmion spoke at the Asia Mining Congress in Singapore, opened the third annual WA-Korea Energy and Resources Forum in Seoul, and held high-level talks with government and industry leaders in China's Shandong Province and Beijing.

In Shandong, Mr Marmion witnessed the signing of a conditional iron ore offtake agreement between the Shandong Iron Ore Group and Todd Corporation for their Pilbara iron ore project.

"Our key message during the mission was that the time is right for Asian investors to put money into projects in Western Australia's resources sector," Mr Sellers said.

"Labour costs are down, we have a stable political environment, transparent and streamlined regulatory processes, and very low levels of sovereign risk.

"When you combine those factors with our close proximity to Asian markets and the fact that we are consistently in the world's top 10 jurisdictions for investment attractiveness, Western Australia is a compelling choice for market entrants seeking sustainable, long-term returns.

"And when it comes to iron ore, we made it clear that Western Australian producers are among the lowest cost producers in the world, and that this cost advantage should ensure we stay competitive in the global iron ore market."

Mr Sellers said that the Minister had focused on the State Government's efforts to help industry through challenging post-boom conditions.

In speeches and at meetings, Mr Marmion emphasised the importance of the Government's decision not to change royalty rates, its decision to offer one off royalty rebates of up to 50 per cent on new magnetite production, and continuing support for the Exploration Incentive Scheme (EIS).

The EIS took centre stage in March at the annual Prospectors and Developers Association of Canada (PDAC) Conference.

During his keynote address, Mr Sellers told the audience that the State Government was committed to attracting investment in Western Australia through programs and policies that provided a secure and attractive destination for resources investment.

The Director General's presentation looked at many of the success stories since 2009 as a result of the State Government's continuing commitment to the Exploration Incentive Scheme that now totals about A\$130 million.

"The strong message was that drilling in under-explored areas is the key to new discoveries, which create new projects – like the A\$440 million Sirius Resources' Nova nickel project now under construction – and create much need employment opportunities," Mr Sellers said.

"I also stressed the importance of EIS funding for geophysical and geochemical surveys, 3D prospectivity mapping, exploration facilitation and strategy research with industry."

DMP Deputy Director General Tim Griffin was also busy promoting Western Australia. In March he took part in the Singapore Mining Investment Asia Conference, followed by the Mines and Money 2015 Conference in Hong Kong.

DMP Petroleum Division Executive Director Jeff Haworth flew the flag for Western Australia in Houston during January and February at the 7th Annual Australian – American Chamber Energy Conference and the North American Prospecting Expo. In November last year, he took part in the 5th World Shale Oil and Gas Summit in Dallas.

The Department's Geological Survey of Western Australia (GSWA) has a targeted overseas schedule and Executive Director Rick Rogerson and other senior Survey members have attended key events in Canada, China, India, Japan, Korea and Singapore.

Dr Rogerson led a senior delegation late last year to mark the end of the main phase of geological mapping in China's Gansu Province in collaboration with the China Geological Survey.

"It is extremely important for GSWA to maintain and develop its international network of contacts and partnerships around the world, particularly through our regular trade missions to Asia," Dr Rogerson said.

"Apart from renewing and establishing new relationships, we also provide information on prospectivity and policies, gather market intelligence, and make sure that any negative perceptions of Western Australia are corrected." ■



Mines and Petroleum Minister Bill Marmion and Premier Colin Barnett (centre left and right) with COMESA Secretariat and ministers from member countries who attended 2014's Africa Down Under event.

SHOWCASING AFRICA

Mining opportunities in Africa will be under the spotlight in September when Perth hosts the 13th Africa Down Under conference and exhibition.

Held annually, the conference will run for three days this year from 2-4 September, at the Pan Pacific Perth and Novotel Perth Langley hotels.

Africa Down Under (ADU) has long acted as a barometer of the market's attitudes towards mining opportunities in Africa.

It offers a stage for African mining states to promote investment in their resources sectors and showcase improved mining policies and good governance to their counterparts in Australia and, in particular, Western Australia.

Western Australian mining equipment, technology and services companies, many of which are world leaders in their sectors, have used Africa Down Under as a platform to engage with African governments keen to develop their mining sector.

The Common Market of Eastern and Southern Africa (COMESA) is expected to participate in the event for the second year.

Last year, the Western Australian Government and COMESA booths, which were adjacent to each other, attracted a great deal of interest from visitors.

Sixteen African ministerial delegations participated in ADU 2014. Also in attendance were key members of the COMESA Secretariat, including Secretary General Sindiso Ngwenya.

East Africa is the most rapidly developing region in Africa, with recent discoveries of oil and gas, while several COMESA member countries are also rich in mineral reserves.

The African continent holds about 30 per cent of the world's total mineral reserves and an even higher share of deposits such as diamonds, vanadium, manganese, platinum, cobalt and gold.

Western Australian mining companies have been active in Africa for decades.

According to international financial analysis firm, SNL Metals & Mining, 122 ASX-listed Western Australian mining companies were involved in 442 projects in 30 African countries in May 2015. This represented 77 per cent of Australian mining companies operating 575 projects in 46 African countries.

The Western Australian Government Departments of State Development (DSD) and Mines and Petroleum are teaming up again for 2015's Africa Down Under.

As in previous years, DSD will work closely with its Africa-based Commercial Manager, Filippo Raggi, to facilitate meetings between visiting African delegations and Western Australian Government agencies.

For more information on the conference visit www.africadownunderconference.com

For information on trade and investment in Africa contact the Department of State Development www.dsd.wa.gov.au ■



ZONING IN ON REGIONAL OPPORTUNITIES



Western Australian Premier Colin Barnett speaking at the In the Zone event held in Singapore.

Western Australia's resources sector, the State's research and development expertise, strong relationships with Asia and future opportunities were all in the spotlight at the first international event in the In the Zone series.

Held in Singapore in April, the 2015 'In the Zone Venture Asia' conference saw prominent business, government and academic leaders convene at the headquarters of Google Asia Pacific to hear a keynote address by Premier and State Development Minister Colin Barnett.

The Premier acknowledged the special relationship Western Australia shared with its Asian neighbours and spoke about the State's close ties with Singapore and the unique opportunities that existed between the two economies.

Mr Barnett said the differences between the economies of Singapore and Western Australia provided significant trade and investment opportunities.

"Singapore and Australia share much in their history, in their closeness, and Western Australia is a part of that – Singapore is our entry point, the nearest part of Asia to Australia," he said.

"Singapore is a vibrant economy; it takes maximum advantage of its unique geo-political position with its economy of people; their flair and expertise and a huge amount of energy. Singapore maximises what it has in its strategic location and does that without natural resources.

"We see a special link with Singapore because it is so different yet so close."

Mr Barnett outlined Western Australia's strategic global influence in mining and petroleum, science and technology, agriculture, and medicine and the linkages and opportunities between Western Australia and Asia.

"Western Australia has the most sophisticated and advanced mining and petroleum industry in the world. It has one of the most advanced agricultural industries and it's got new growth in other areas to come," the Premier said.

"In the mining industry, 60 per cent of the world's mining software is produced in Perth and sold throughout the world.

"If you look at the iron ore industry, it's very sophisticated mining. The key is not the ore or the mine, it's transport logistics, the rail operations, the port operations.

"The automation in the mining industry is probably the most advanced technology in Australia outside of the defence forces.

"We've seen some of the world's major companies develop research, science and technology global facilities in Western Australia to service the world – Chevron, Shell, General Electric and other major mining companies."

Mr Barnett also outlined developments in agriculture, including biosecurity, food security and safety, animal welfare and breeding, and in medicine, education and research, as areas offering opportunity for further collaboration with Asia.

"Singapore has been a leader in those areas and I think there's great opportunity for collaboration between Western Australia and Singapore particularly in the area of health and health care," he said.

The State Government established a trade and investment office in Singapore in 2012 and the island state is Western Australia's fourth-biggest trading partner, with total trade valued at nearly A\$10 billion in 2014.

The In the Zone conference series first launched in 2009 and was developed by the University of Western Australia as a forum for business and government leaders to focus on economic and strategic issues in a shared time zone.

Western Australia shares the same four-hour time zone with Asia – a region that encompasses about 60 per cent of the world's population, represents one third of the world economy and has a Gross Domestic Product output of A\$23 trillion. ■

"Western Australia has the most sophisticated and advanced mining and petroleum industry in the world. It has one of the most advanced agricultural industries and it's got new growth in other areas to come."



Mines and Petroleum Minister Bill Marmion.

BEYOND CONSTRUCTION: NEW OPPORTUNITIES

Western Australia's resources sector is currently transitioning from high rates of capital investment in new projects and expansion of existing projects, to a period of higher levels of production and export.

However, while the State transitions through this phase against the backdrop of lower commodity prices, the longer-term outlook for WA's resources sector remains positive.

Mines and Petroleum Minister Bill Marmion said WA's resources sector had shown itself to be resilient through previous downturns, and he expected it would continue to do so with high quality jobs and business opportunities beyond the resource construction boom.

During 2013-14, Western Australia had a record A\$121.6 billion in sales from the minerals and petroleum extractive industries. The petroleum sector alone was valued at A\$26.5 billion, an increase of nine per cent on the previous year.

"This represents 22 per cent of the total value of resource industry sales for Western Australia, placing petroleum as the second most valuable resource after iron ore," Mr Marmion said.

"There are also ongoing capital investment commitments in the State's petroleum sector and as at February 2015, it was estimated that more than A\$130 billion worth of petroleum projects were either under construction or otherwise committed."

A further A\$75 billion is identified as being allocated to planned or possible projects in the coming years.

"The economic benefits to the State do not end there. Strong growth in Western Australia's resources sector is set to continue as more liquefied natural gas (LNG) projects come online," Mr Marmion said.

Among these, the Gorgon LNG project is scheduled to commence production later this year, to be followed by the Wheatstone, Ichthys and Prelude projects in the next couple of years.

Mr Marmion said that as these projects move from the construction phase to the operational phase, skilled workers will be required for the new gas plants at Barrow Island and Ashburton North.

"This is part of the transition from the construction to the operational phase of the investment cycle with the focus moving to more highly skilled, long-term jobs in operations, maintenance, and logistics support. Additionally, further opportunities will be available in research, training and development," he said.

The Minister said operational expenditure was set to increase rapidly as these projects commence production. An added benefit is that operational expenditures generally have significantly higher local content in comparison to capital expenditure on these projects.

"The industry is supporting and working with educational providers and universities in Western Australia to improve research and education in offshore engineering," Mr Marmion said.

"For example, the Global FLNG Training Consortium in Western Australia is a partnership between Shell, the Challenger Institute and Curtin University.

"One of the State Government's highest priorities remains, however, to encourage exploration and promote opportunities for energy investment in Western Australia, as the State continues to attract the highest levels of exploration expenditure in Australia."

A preference for brownfield projects over greenfield projects is expected in coming years as project proponents look to expand their LNG production capacity and seek to improve their economic returns by constructing additional LNG trains at existing facilities.

Mr Marmion said these petroleum projects would continue to make substantial investments in Western Australia for many decades to come.

"There is no doubt that underlying long-term market conditions remain robust, and the State is well-positioned to attract a new wave of investment in the resources sector," he said.

"While the resources industry has been facing challenging times, the fundamental strengths of the State's resources sector remain the same.

"Western Australia has world-class petroleum resources and our proximity to the world's fastest-growing markets provides a unique cost advantage." ■

MINING THE MIND IN WA

Did you know that Western Australia's resource sector was valued at more than A\$114 billion last year? Or that, in 2013-14 Western Australia contributed 51 per cent of Australia's merchandise exports?

With huge numbers and fascinating figures, Western Australia is a dynamic state on the move with many asking what's the next chapter in the State's success story?

A new publication by the University of Western Australia's Energy and Minerals Institute and Knowledge Society – Australia's first 'public knowledge society' – presents an overview of Western Australia's resources sector, including possibilities for the State moving forward.

"State of Mind: Western Australia's new landscape of innovation and opportunity", was launched by Premier and State Development Minister Colin Barnett in

April at Google's Asia Pacific headquarters in Singapore, as part of the In the Zone conference.

The report examines opportunities for Western Australia to capitalise on its wealth of technical, design and engineering skills that are a result of the State's rapid growth in the mining and energy sectors.

"This report shows Western Australia's connections into global supply chains, capital raising networks and how Perth is emerging as the soft-power capital of the Indo-Pacific," Mr Barnett said.

"It puts Western Australia's achievement as the world's number one diversified minerals and energy province in a global context."

For more details and to view the full report, visit: www.emi.uwa.edu.au/reports

The State of Mind web story can be viewed at: www.stateofmind.vision ■



Cover excerpt from the "State of Mind" report, published April 2015, courtesy of Knowledge Society and the University of Western Australia.



WESTERN AUSTRALIA LAUDED AS GLOBAL OIL AND GAS HUB AT MAJOR OIL AND GAS CONFERENCE

Western Australia has been hailed as a major destination for the future of the world's supply of oil and gas by the Western Australian Minister for Commerce Michael Mischin.

Speaking at the Australasian Oil and Gas (AOG) conference in Perth in March, Mr Mischin said Western Australia's plentiful natural resources, technological expertise and stable investment environment provided "a case for optimism", despite the recent collapse in commodity prices.

Minister Mischin said the Chevron Global Technology Centre, GE Oil and Gas' Skills Development Centre in Perth and a major research alliance between the Western Australian universities, the State Government and multinational resources companies, including

Shell and Woodside, provided strong foundations for industry longevity and future prosperity.

He said liquefied natural gas (LNG) exports were the second most valuable commodity to the State Government last year and continued investment and sustained growth from India and China will bolster market fundamentals in the long-term.

Chevron Global Technology Centre manager for Perth, Richard Hinkley, a keynote speaker at AOG 2015, echoed the minister's call for optimism – suggesting Western Australia can become a global LNG centre for excellence.

"We believe the fundamentals will remain strong," he said.

Mr Hinkley said that while Western Australia "struggles to compete on costs" he suggested that the oil and gas expertise available locally offered innovations that could support the industry.

He said Chevron has committed approximately A\$50 million in research and development with Australian universities since 2007, adding that, "the quality of education in Western Australia is very high". ■



WA ON GLOBAL GAS STAGE

LNG 18

Registrations are now open for the liquefied natural gas (LNG) industry's biggest global event – LNG 18 – to be hosted in Perth from 11-15 April 2016.

Held every three years, the International Conference & Exhibition on Liquefied Natural Gas attracts industry experts and sector enthusiasts from around the world.

With universal acknowledgement of Western Australia's capital as a dynamic global LNG city, Perth secured hosting duties following LNG 17, which was held in Houston, in the United States of America.

Australia is currently the world's fourth largest LNG exporter and the third largest in the Asia Pacific region, a region with which Perth shares a strong bond and common time-zone.

Two thirds of Australia's gas reserves are located in three basins off the Western Australian coast.

Major resource companies have heavily invested in Western Australia to increase production of LNG for Asian markets.

Western Australia currently has more than A\$222 billion worth of LNG projects either under construction or under consideration (as at March 2015).

The State's LNG export capacity nearly doubled during the past decade, rising from 11.9 million tonnes in 2004 to 20.6 million in 2014.

Major LNG projects under construction in Western Australia include Gorgon, Wheatstone and the Prelude floating LNG project – these projects will contribute an additional 28.1 million tonnes to capacity by 2017. Capital expenditure committed to these projects totals A\$97 billion.

As LNG 18 National Organising Committee chairman Grant King stated, "Western Australia's capital is the ideal location for LNG 18."

"With abundant reserves, a strong and stable industry based on existing, committed and proposed projects, Australia will be one of the leading LNG producers in the world," Mr King said.

LNG 18 promises an exciting program with the conference theme - 'Redrawing the Global Map of Gas' - highlighting the changing world of natural gas and covering a wealth of topics pertinent to the sector, including reserves, trade, geopolitics, technological developments, regulation and pricing and investment.

Leading global experts in the LNG sector will feature at the conference as guest speakers with the world's major LNG companies well represented.

Confirmed speakers currently include the chief executive officers of Woodside, ConocoPhillips, RasGas, Qatargas and Royal Dutch Shell, with many other key industry leaders and government officials on the speakers list.

More than 250 exhibitors from 60 countries will be showcased at the conference, which is expected to attract more than 5000 participants and inject more than A\$45 million into the State's economy.

Perth is gearing up for what promises to be a remarkable line-up of top industry leaders and a spectacular global LNG event.

For more information or to register for LNG 18 visit www.lng18.org ■



Confirmed speakers

LNG 18 will feature an exciting and highly informative program with confirmed guest speakers including:

Mr Hamad Rashid Al Mohannadi
Chief Executive Officer RasGas

Mr Khalid Bin Khalifa Bin Al-Thani
Chief Executive Officer Qatargas

Dr Nirmal (Chat) Chatterjee
Chair, LNG 18 Program Committee & Corporate Vice President (Retired) Engineering and EH&S Air Products and Chemicals

Mr Peter Coleman
Chief Executive Officer, Woodside

Mr Bill Dudley
Chief Executive Officer, Bechtel Group

Mr Jérôme Ferrier
President, IGU & Chair, LNGX Steering Committee

Mr Grant King
Managing Director, Origin Energy & Chair, LNG 18 National Organising Committee

Mr Toshiaki Kitamura
Representative Director, President & Chief Executive Officer, INPEX

Mr Ryan Lance
Chairman and Chief Executive Office, ConocoPhillips

Mr Helge Lund
Chief Executive Officer, BG Group

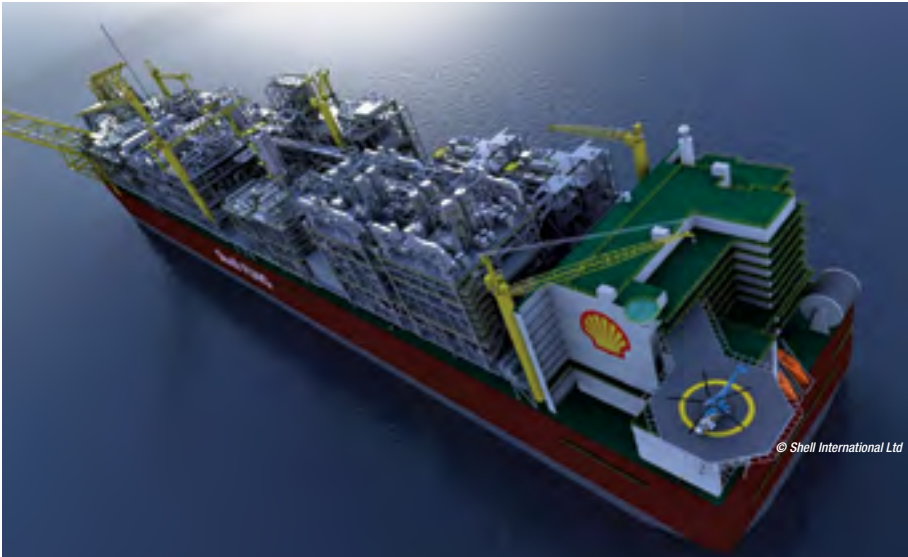
Mr Michael Stoppard
Chief Strategist Global Gas, IHS Energy

Mr Michael Utsler
Chief Operating Officer, Woodside

Mr Ben van Beurden
Chief Executive Office, Royal Dutch Shell plc

WINNING WAY TO WORK

ASSESSING MAJOR PROJECTS



Shell Australia's Prelude FLNG project.

Western Australia is a big state with big projects commencing and others well under way. Big projects come with big impacts – many positive and others to be overcome. A successful collaboration between the Western Australian Government and private companies undertaking big projects in the State is ensuring the impacts of these projects are well-managed.

Developed by the Department of State Development, the Infrastructure and Services Assessment (ISA) is a flexible framework to assist in improved planning and coordination between private sector parties and State Government agencies ahead of major resource project developments.

Along with the significant benefits that major projects bring there are often unintended impacts on neighbouring or nearby community and government-provided infrastructure and services.

The ISA focuses on areas of critical importance in communities, including the use of existing transport networks, workforce accommodation during construction and operation phases of the project, utilities, health care and education, and any areas identified by individual communities as being of high significance.

The ISA provides the government and private sector parties with a guiding framework for identifying any likely impacts – positive or adverse – that may accompany the proposed development.

Once potential benefits and impacts that may accompany the project are identified, the proponent produces an ISA report to be shared with relevant State Government agencies.

The report ensures that government planning is aligned with project development, as well as any funding that may be required to support community infrastructure and services, and demonstrates how the private sector proponent will manage any impacts.

Department of State Development Executive Director Tim Fraser said the ISA enabled information to be shared effectively between government and the private sector.

“The ISA has been developed to ensure that the information and work that is undertaken by the private proponent is shared with government in a meaningful manner,” Mr Fraser said.

“The key to ensuring the ISA is successful is the coordination between private industry, State Government agencies,

local government authorities and community members.”

Assessments are underway currently between the Department of State Development and several oil and gas proponents establishing offshore projects in Western Australia, including Shell Australia, INPEX and Woodside Energy.

Each company has submitted an ISA to the department identifying potential impacts and issues that may prove significant with the cumulative development of the projects.

This engagement has been recognised as a positive step to ensuring that community services and infrastructure will cope with any additional demand in the future.

As part of its project development, Shell will be operating drilling rigs about 460 kilometres from Broome, establishing supply and helicopter facilities onshore.

Shell Australia Government Relations Adviser John Dagostino said the company was supportive of the ISA process.

“Shell is very supportive of working with the department on the ISA process as we construct our Prelude FLNG project and move to operations,” he said.

“Prelude will operate 475 kilometres NNE of Broome employing around 350 people over a project life of 25 years.

“Western Australia is the key to the supply chain arrangements and we appreciate working with the department to better define the long term benefits for Western Australia,” Mr Dagostino said.

Demonstrating its success as a collaborative process between government and private companies, the ISA initiative was recently acknowledged nationally when it was shortlisted in the Institute of Public Administration Australia Achievement Awards, in the category of ‘Best Practice in Collaboration between Government and Non-Government organisations’.

For more information on the ISA, visit www.dsd.wa.gov.au (What we do/Offer Project Support/Infrastructure and Services Agreement) or contact Executive Director Tim Fraser +61 8 9222 0555. ■



ANKETELL PILBARA PORT PROJECT PROCEEDS

Premier and State Development Minister Colin Barnett (centre) with Ngarluma Aboriginal Corporation Traditional Owners Violet Samson and Pansy Hicks.

The development of Anketell Port – potentially the last major port to be built in Western Australia’s Pilbara region – has reached a significant milestone with acquisition of land for the project to go ahead.

Anketell, located about 30 kilometres east of Karratha, is planned to be a multi-user, deepwater port and associated strategic industrial area, which will include an iron ore export facility with a capacity of at least 350 million tonnes at full development.

The State Government started the formal acquisition of land process for the Anketell Port project in May.

Premier and State Development Minister Colin Barnett and Minister for Lands Terry Redman jointly announced the acquisition milestone as a vital step forward for the development of the port that also delivers certainty for future port users.

“Last year, the Government signed an A\$20 million native title agreement with the Ngarluma people over 4300 hectares of land covering the planned Anketell site,” Mr Barnett said.

“Now, the State Government is ready to proceed with the next step of the agreement by acquiring this land, providing further certainty to port proponents and interested parties.”

Mr Redman said the Anketell Port was intended to unlock the potential of the West Pilbara by providing port space for new and emerging mining companies.

“The development of the Anketell Port will significantly strengthen Western Australia’s position in global energy and resource markets by providing world-class project ready infrastructure and serviced land with capacity to meet demand from various markets,” he said.

“Acquiring the land for Anketell Port is a significant step for the Government’s plans to provide valuable port space for small and mid-sized mining companies.”

In September 2014, a consortium of major companies including Aurizon, AMCI, Baosteel and POSCO announced their intentions to proceed with a feasibility study for a port and rail development at Anketell, with an initial capacity of 40 million tonnes.

“Conditions are very challenging in the iron ore market at the moment, but Aurizon and its partners remain committed to progressing the initial planning and study phases for this important project,” the Premier said.

The State Government is working currently with Aurizon and its partners on a State Agreement for the rail component of the project.

A master plan for the Anketell Port and associated infrastructure corridor was released in June 2014. For more information on the Anketell Project or to view the Master Plan visit www.dsd.wa.gov.au ■

“Acquiring the land for Anketell Port is a significant step for the Government’s plans to provide valuable port space for small and mid-sized mining companies.”



ROY HILL PROJECT ON TRACK

The Roy Hill iron ore mine is on track to deliver its first shipload of ore in September this year, with the project more than 80 per cent complete.

Company Chief Executive Officer Barry Fitzgerald said contract mining had already commenced in April last year, with Roy Hill already stockpiling more than eight million tonnes of high grade ore in preparation for commissioning of the mine processing plant.

Mr Fitzgerald said owner/operator mining using the company's mining fleet commenced at the beginning of September 2014.

"Overall the construction of the project is progressing well. We are now more than 82 per cent complete and confident we will deliver first ore on ship within the scheduled timeframe of September 2015," he said.

There are currently about 200 contractors and more than 7000 personnel working on the project. Once fully operational, Roy Hill will employ a permanent workforce of more than 2000 workers.

The company took delivery of the first parts of its Pilbara train fleet, built by US-based GE Transportation, in February with the first 14 out of a total of 21 locomotives unloaded in Port Hedland.

All nine long-lead items, including stackers, reclaimers, rail car dumper and shiploader, have been delivered and are currently being installed, significantly de-risking the project.

The locomotives will haul up to 55 million tonnes of iron ore a year along the line, which has already seen more than 340 kilometres, or more than 99 per cent, of the total train track laid.

"The port operations team has already moved into the recently completed Port

Administration Centre, while the mine operations team are utilising the completed Mine Services Area," Mr Fitzgerald said.

"Additionally, all the deck modules for the South West Creek Wharf in Port Hedland have been installed."

The A\$10 billion project will make Roy Hill Australia's fourth-biggest iron ore producer after BHP Billiton, Rio Tinto and Fortescue Metals Group.

"At full production we estimate export revenue of approximately US\$4 billion, and expect the project to deliver A\$17 billion in taxes and royalties over the project life," Mr Fitzgerald said.

Hancock Prospecting and their minority partners in Roy Hill, Korea's POSCO, Japan's Marubeni and Taiwan's China Steel Corporation, have poured more than A\$3 billion into the project, which has secured \$US 7.2 billion in debt funding. ■



CAPE PRESTON RACES TOWARDS THE FINISHING LINE

A dump truck at the Cape Preston Magnetite mine.

Australia's largest magnetite mine is a hive of activity.

Final construction work is forging ahead to complete the six giant, seven-storey grinding mills in the crushing circuit at CITIC Pacific's Cape Preston site in the Pilbara. At the same time the operation is producing iron for export to China.

The hectic pace impressed Mines and Petroleum Minister Bill Marmion and Department of Mines and Petroleum Director General Richard Sellers when they visited the Cape Preston site in March.

The Minister and Mr Sellers toured the mammoth site with CITIC CEO Chen Zeng.

"It was an excellent opportunity for the Minister to get an update on the progress of the Sino Iron Project," Mr Sellers said.

Mr Sellers said it was fascinating to be able to go down into the site's mining pit and see the various processes in operation.

"We watched all the operations, from mining and crushing to magnetite separation and dewatering and then transfer of the ore to huge barges moved by tugs to 115,000 tonne capacity bulk carriers purpose-built by CITIC to carry the ore to China," he said.

Mr Sellers emphasised the scale and scope of Cape Preston by describing how cyclone hawsers are kept in readiness at the site's port, even though they may never see service.

"Those massive orange ropes cost A\$1 million each and need to be replaced every two years," he said.

Cape Preston is the largest magnetite mining and processing operation in Australia, with more than two billion tonnes of identified magnetite resources, and an expected mine life of 25 years.

CAPE PRESTON PROJECT: FAST FACTS

- The port at Cape Preston is the first port to be built in the Pilbara in 40 years.
- The breakwater extends 2.6 metres offshore from the tip of Cape Preston.
- The site's desalination plant is about the same size as the Perth-Kwinana plant.
- The plant is producing 70 megalitres of water per day, with a final capacity of 140 megalitres per day, or 51 gigalitres per year.
- The reservoir capacity is 15 megalitres, or the equivalent of six Olympic-size swimming pools.
- The power station that will primarily power the concentrator circuit will generate electricity equal to the Pilbara's entire capacity.



The 980-tonne Terex RH400 hydraulic excavator.

When fully developed, the mine open pit will be about 5.5 kilometres long, two kilometres wide and 600 metres deep.

The mine is a drill-and-blast, load-and-haul, operation using some of the biggest mining equipment in the world.

During the peak construction period, 4000 people were employed in building the project and about 1000 workers will be permanently employed when the site is fully operational.

The Sino Iron Project is estimated to generate around A\$111 billion in direct revenue to the Australian economy, and A\$5.5 billion in royalties for Western Australia.

The company started producing magnetite in July 2013, with the first shipment sent to China in December of that year. ■

MEGA MACHINE

Mines and Petroleum Minister Bill Marmion and Director General Richard Sellers came face to face with a monster machine during the Cape Preston visit.

The 980-tonne Terex RH400 hydraulic excavator (pictured above) is famous for its appearance as the "Decepticon Demolisher" in the second *Transformers* movie.

The machine has one of the biggest shovels in the world, with a bucket that is capable of scooping up 80 tonnes of magnetite ore.



Construction continues on the crushing circuit.



Mines and Petroleum Minister Bill Marmion and Director General Richard Sellers with CITIC CEO Chen Zeng and staff in the control room.

POSITIVE RESULTS FOR KEY PROJECTS



Above: Derby Port. Left: Sheffield tenement location.

Despite still being several years away from production, two of Western Australia's lead agency projects, Thunderbird Mineral Sands and Gruyere Gold, have recently achieved significant milestones.

Sheffield Resources Limited announced on 14 May, the completion of the pre-feasibility study (PFS) for their Thunderbird Mineral Sands Project in the Kimberley.

A week earlier, Gold Road Resources Limited announced the completion of a comminution and gold metallurgical extraction test program on a selection of mineralised rock samples from Gruyere.

These early, positive results are good news for the projects' owners and operators and the Western Australians who will benefit from the future jobs, opportunities and revenue they will create.

Sheffield Managing Director Bruce McQuitty said the PFS results confirm the company will deliver strong financial returns over an initial 32 year mine life.

"Thunderbird is located in a stable jurisdiction, has an export solution and is well placed to take advantage of expected product supply gaps that are aligned with the initial planned production profile," Mr McQuitty said.

"One of the aspects that sets Thunderbird apart from other mineral sands projects globally is the substantial projected annual production of zircon.

"The project is highly leveraged to the zircon price and with few major new zircon projects in the global development pipeline, Sheffield is well placed to meet future demand."

Thunderbird is 100 per cent owned by Sheffield Resources Limited, a Western Australian mineral sands explorer and developer with headquarters in Perth.

The deposit is located about 60 kilometres west of Derby and 30 kilometres north of the sealed Broome-Derby Highway within the Canning Basin. It is the first major mineral sand deposit discovery in the Canning Basin.

Gold Road Chairman Ian Murray said the Gruyere test program results confirm the assumptions used during the initial scoping study.

"The latest results continue to grow our confidence that mineralisation at the 3.8 million ounce Gruyere deposit is amenable to conventional processing methods with no major flaws," Mr Murray said.

"We will continue to build on this work as we progress the ongoing PFS and move into the Definitive Feasibility Study."

Gold Road Resources has a dominant tenement holding in the underexplored Yamarna Greenstone Belt, a recently discovered gold region 150 kilometres east of Laverton on the Yilgarn Craton.

NEW PILBARA PIPELINE

The longest pipeline to be constructed in Western Australia for more than a decade has reached completion and will provide new energy supply options in the Pilbara region.

Premier and State Development Minister Colin Barnett announced in May the completion of a 270 kilometre gas pipeline supplying gas to Fortescue Metals Group's Solomon mining hub.

The Fortescue River Gas Pipeline connects the Solomon operations near Tom Price to the Dampier to Bunbury Natural Gas Pipeline.

The pipeline project was a joint venture between the Dampier Bunbury Pipeline Development Group (DDG), owned by the DUET Group, and TEC Pilbara. TEC Pilbara is owned by TransAlta Corporation, which owns and operates the power station at the Solomon hub.

Mr Barnett said the new pipeline was a significant addition to energy supply in the Pilbara and created further opportunities for major energy consumers in the resources sector.

"This A\$183 million project allows Fortescue Metals Group to cut costs by converting the power station at its Solomon hub from diesel to gas, saving about US\$20 million (A\$25 million) per year," the Premier said.

"The conversion from diesel to gas will increase domestic gas usage, and will reduce the carbon footprint at Fortescue's operations at Solomon, with natural gas a cleaner burning fuel than diesel.

"With an ultimate capacity of 300 terajoules per day, the pipeline represents a significant addition to gas supply in the Pilbara, and opens up new opportunities for energy suppliers and consumers."

The 16 inch diameter, 270 kilometre buried pipeline runs from the Dampier to Bunbury pipeline compressor station south of Karratha, through to the Solomon mine operations.

The Dampier to Bunbury Natural Gas Pipeline has been in operation since 1984, and today DBP is ultimately owned by DUET Group (80%) an ASX listed owner/operator of energy and utility businesses and Alcoa of Australia (20%). ■



© DBP Development group and Fortescue Metals Group

The new pipeline under construction.

The Yamarna Belt is historically underexplored and highly prospective for gold mineralisation and Gold Roads is prioritising six of its 10 identified Gold Camp Targets.

The Gruyere discovery was made on the first Gold Camp Target, South Dorothy Hills.

Due to their significant and complex nature, lead agency projects receive a higher level of service from the Department of Mines and Petroleum (DMP) to coordinate approvals across government.

Lead agency project proposals are listed on the DMP website at www.dmp.wa.gov.au/leadagency ■



© Sheffield Resources Limited

Thunderbird Technical Director David Archer with panned drill sample.



DMP Environment Executive Director
Dr Phil Gorey.



The Mining Legislation Amendment Bill 2015 was introduced to the Western Australian Parliament on 22 April 2015.

The Bill will amend the *Mining Act 1978* to allow for the final stage of environmental reform that the Department of Mines and Petroleum (DMP) committed to in 2012 as part of the Reforming Environmental Regulation program.

DMP Executive Director Environment Dr Phil Gorey said the amendment Bill modernises environmental regulation and will simplify the environmental approvals and compliance processes.

“The amendment Bill will remove the separate requirement for native vegetation clearing permits under the *Mining Act*, consolidate multiple site approvals and create a new notification system for low impact activities,” he said.

The introduction of the low impact notification process has been the most high profile of these proposed amendments.

“Once introduced, the low impact notification system will mean that exploration and prospecting activities deemed to have a low environmental

impact will receive an automatic environmental assessment by the department,” Dr Gorey said.

“Low impact exploration and prospecting activity will be subject to prescribed environmental standards and the activity will be able to commence as soon as the department has been notified of the nature of the activity and its start and finish date.

“As the department will not undertake individual assessment there will be no delays in approval for tenement holders. ■

NEW ONLINE TOOL ESTIMATES REHABILITATION LIABILITY

A new online calculator has been developed that allows tenement holders to estimate their rehabilitation costs and the Mining Rehabilitation Fund (MRF) levy payable on disturbed mining tenements.

Mines and Petroleum Minister Bill Marmion announced the innovation in May and said the Department of Mines and Petroleum (DMP) had developed the tool in response to industry requests.

“Streamlining resources industry regulation has been at the heart of the MRF reforms,” Mr Marmion said.

“This tool not only allows tenement holders to calculate the MRF levies payable at different levels of disturbance, it also shows how much can be saved by early rehabilitation.”

DMP Executive Director Environment Dr Phil Gorey said the calculator provides a liability estimate based on the level and type of disturbance and amount of rehabilitation that has been conducted on a tenement.

“As the MRF levy is only calculated on disturbed areas of a tenement, the best way to reduce your future levy payments is through progressive rehabilitation,” Dr Gorey said.

“The new calculator should also assist with the purchase and transfer of liabilities and assets.”

The calculator allows tenement holders to enter individual activity types, for example roads or tailings storage facilities, or combine multiple activities into a single Mine Activity Type.

Tenement holders who use the new calculator must still submit their annual MRF disturbance report.

“The calculator does not enter data into an MRF report; it is only intended to be used for illustrative purposes,” Dr Gorey said.

The calculator can be accessed via the Mining Rehabilitation Fund webpage under "Environment" on the DMP website. Go to www.dmp.wa.gov.au ■

WAY FORWARD FOR KIMBERLEY NATIONAL PARK



Premier and State Development Minister Colin Barnett and Rio Tinto Chief Executive Sam Walsh at the announcement.

A new National Park in Western Australia's Kimberley region is now a step closer, with a historic State Agreement for the development of an alumina refinery and bauxite mine to be terminated.

Premier and State Development Minister Colin Barnett announced in March that, after successful negotiation, the *Alumina Refinery (Mitchell Plateau) Agreement 1971* would be terminated.

"The Mitchell Plateau is a spectacular and unique landscape and I am delighted that thanks to this agreement, it will now be conserved," Mr Barnett said.

The Premier said the termination of the *Alumina Refinery (Mitchell Plateau) Agreement 1971* would allow more

than 175,000 hectares of land on the Mitchell Plateau to be included in the proposed Kimberley National Park, which would extend over more than two million hectares and be surrounded on its coastal boundary by new marine parks.

"I would like to extend Western Australia's sincere thanks to the proponents Rio Tinto and Alcoa for their close and co-operative work with Government, and for their efforts to aid conservation of the Kimberley," Mr Barnett said.

The State Agreement was intended to facilitate the development of bauxite mining and an alumina refinery on the Mitchell Plateau, when economic conditions were favourable.

Rio Tinto Chief Executive Sam Walsh said the company was very proud to be able to assist the Government's efforts to establish a new National Park in the Kimberley region.

"Rio Tinto has made this decision around the conservation of Mitchell Plateau as part of its long-standing and ongoing commitment as a member of the West Australian community," Mr Walsh said.

"While the Mitchell Plateau bauxite resource is likely to hold value in the future, the State Agreement required the development of an alumina refinery which has always proven to be economically challenging."

Environment Minister Albert Jacob said the State Government's Kimberley Science and Conservation Strategy was delivering more resources for the protection of the Kimberley.

"The strategy involves the creation of almost five million hectares of marine and national parks across the Kimberley, which will support the delivery of research and on ground conservation work to protect the region's unique plants and animals," Mr Jacob said.

Legislation to terminate the agreement was introduced into the Western Australian Parliament in March, and is expected to pass in coming months.

The termination legislation will also prevent the making or granting of any mining or exploration tenement applications over the Mitchell Plateau area until the area has become a Class 'A' National Park.

The Government has also acted to protect adjacent areas from mining tenement applications through the creation of an exemption under section 19 of the *Mining Act 1978*.

The Western Australian Government will continue to work with the Traditional Owners in the area, the Dambimangari, Wunambal-Gaambera and Wilinggin, to create and jointly manage the proposed Kimberley National Park. ■

MAKING AUTOMATION SAFE AND PRODUCTIVE



Autonomous haul trucks in operation at Rio Tinto's West Angelas mine site.

Western Australia is one of the world's leading mining jurisdictions and is home to about 1000 operating mines and exports more than 50 commodities.

The State exports almost 30 per cent of the world's iron ore, 14 per cent of its alumina and 12 per cent of its nickel.

While Western Australia's diversity of mineral wealth presents significant opportunities, it also presents challenges – particularly regarding safety.

Department of Mines and Petroleum State Mining Engineer Andrew Chaplyn said that the ways in which these minerals are mined and processed have changed significantly over the years.

"This has largely been driven by technological advances," Mr Chaplyn said.

Just as the size and diversity of Western Australia's mining industry are recognised around the world, so too is the use of cutting-edge technology.

"Nowhere is this more evident than in the growing use of autonomous mining equipment in Western Australia," Mr Chaplyn said.

"Iron ore miners including Rio Tinto, BHP Billiton, Fortescue Metals Group and Hancock Prospecting are implementing or using autonomous mining equipment on mine sites across the State."

While autonomous mining systems are not specifically covered in the *Mine Safety and Inspection Act 1994* and its associated regulations, the department sought to develop specific guidance for autonomous mining operators to understand their roles and responsibilities.

"One of the first steps taken by the department was to ensure operators developed project management plans specific to autonomous mining systems," Mr Chaplyn said.

"We also formed an Automation Focus Group, conducted site visits, developed a discussion paper, and held a series of workshops."

A code of practice was developed by a team comprising representatives from equipment manufacturers, mining companies, technology experts and the department.

"The code of practice promotes the proactive design, development, installation, testing, operation and monitoring of mobile autonomous and semi-autonomous operations in Western Australia," Mr Chaplyn said.

"This is in the process of being endorsed by the Mining Industry Advisory Committee prior to Ministerial approval to release."

The committee was established in 2005 to provide independent advice to the

Mines and Petroleum Minister regarding occupational safety and health in the industry.

As highlighted in the December 2014 edition of *Prospect*, the department met with international experts leading the development of global safety standards for autonomous mining machinery.

"The International Organization for Standardization technical committee on mobile autonomous mining systems came to Perth in September to hold a working group meeting," Mr Chaplyn said.

Members of the committee also attended an automation workshop hosted by the department and the Chamber of Minerals and Energy WA.

"The workshop provided a good opportunity for input from an Australian perspective as the organisation develops global safety standards," Mr Chaplyn said.

"The technical committee also recognised Western Australia's leading role in the use and regulation of autonomous mining equipment."

Western Australia is the first jurisdiction in the world to develop a code of practice specifically covering autonomous equipment in the mining industry.

"The code of practice aims to ensure companies are able to safely introduce autonomous mobile mining systems into their operations," Mr Chaplyn said.

Like with any operation in the resources industry, there is an expectation that the risks will be understood and minimised to ensure workers are protected.

"Operations should aspire to develop resilient safety cultures in which the responsibility for safety is shared across the organisation," Mr Chaplyn said.

"Similarly, as a regulator, the department has committed to working with industry to reduce serious accidents and incidents, and provide tangible support in achieving a positive cultural change.

"That way, regardless of future technological developments, we can continue to ensure that safety is our number one priority." ■

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EXPLORATION INCENTIVE SCHEME EARNING MILLIONS FOR WA

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Exploration is the lifeblood of Western Australia's resources sector and that is why the State Government has been investing strongly in the Exploration Incentive Scheme (EIS) since it started in 2009.

The scheme's flagship Co-funded Drilling Program that refunds up to 50 per cent of costs in drilling in greenfields areas has attracted the lion's share of publicity – until now.

A comprehensive economic impact study into the EIS conducted by ACIL Allen Consulting for the Department of Mines and Petroleum has produced some startling facts and figures.

"We now know that every A\$1 million invested in the EIS stimulates exploration activity which generates A\$10.3 million in benefits for Western Australia," Geological Survey of Western Australia (GSWA) Executive Director Dr Rick Rogerson said.

"However, we have also discovered that new pre-competitive geoscience had been highlighted by the impact study as the main driver of exploration investment by the private sector.

"We've known for some time that the EIS has been having a strong multiplier effect on Western Australia's economy, and that has now been confirmed, but everyone was taken by surprise by the influence of pre-competitive geoscience."

Dr Rogerson pointed out that the multiplier factor of roughly one to 10 was actually a conservative estimate based only on the direct effects of increased exploration activity and associated employment stimulated by the scheme.

"Modelling that assesses the economic impact of discovery and commercialisation of new mines as a result of increased exploration predicts considerably higher returns," Dr Rogerson said.

"Under this scenario, the modelling results in a further A\$13.4 million of benefits for every A\$1 million invested, bringing the total impact figure to A\$23.7 million."

Dr Rogerson said that the impact study had also revealed that each data release from the Geological Survey stimulated exploration activity.

An A\$33 million EIS commitment made in 2009 to geophysical and geochemical surveys had resulted in nearly the whole State now being covered by airborne magnetic and radiometric survey data that is available to explorers and academic researchers at no cost.

New data has led to innovative mineral system studies in a number of areas, including most recently the Gascoyne Province, the Edmund Basin in the Capricorn Orogen, the Speewah Basin in the East Kimberley, and the Yilgarn Craton.

Western Australia is now covered with publicly available magnetic and radiometric data at a line spacing of 400 metres or less, and work has begun on a program of 100-metre surveys over selected areas of high exploration potential.

"About one-third of the State is now covered by gravity surveys at a resolution of four kilometres or better," Dr Rogerson said.

"And last year, the department completed one of the largest reconnaissance surveys in Australia—some 30,000 line-kilometres of airborne electromagnetic survey lines over an area of 145,000 square kilometres in the Capricorn region in the State's North West."

The State Government has renewed its commitment to the EIS by approving annual funding of A\$10 million over three financial years from July 2014 until June 2017, bringing the total funding for the scheme to more than A\$130 million dollars. ■

"We now know that every A\$1 million invested in the EIS stimulates exploration activity which generates A\$10.3 million in benefits for Western Australia."



A seismic convoy on the road.



STRONG OUTLOOK FOR WA URANIUM INDUSTRY

© Cameco Australia

Cameco Australia's Kintyre Project.

The Australian Federal Government's decision in April this year to provide environmental approval for the Kintyre Uranium Project was welcomed by many in the minerals and energy industry.

The decision was described by the Western Australian Government as, "another important step forward for Western Australia's emerging uranium industry."

Kintyre is the second Western Australian uranium project to receive federal environmental approval, following the approval of Toro Energy's Wiluna Uranium Project in November 2012.

Minerals Council of Australia Executive Director Uranium David Zavattiero said this was the first major environmental approval of a uranium project by this Federal Government.

"This decision follows on from the four projects approved during the previous Labor Government of 2007-2013," Mr Zavattiero said.

"It confirms bilateral support at the federal level for the responsible development of Australia's uranium industry."

Mines and Petroleum Minister Bill Marmion said that the State now had four uranium projects in the advanced stages of development.

"More than A\$300 million has been invested in WA uranium exploration since the Liberal National Government lifted the mining ban in 2008," Mr Marmion said.

Kintyre's operator, Cameco Australia, has advised that the project will proceed when market conditions are favourable.

Toro Energy

Four years ago, Toro received federal environmental approval to establish a processing facility and commence mining at two of Wiluna's deposits – Centipede and Lake Way. Toro now plans to integrate two additional deposits at Millipede and Lake Maitland into an expanded Wiluna Project.

The Wiluna Expansion Project is one of three uranium projects currently being considered by the Western Australian Government.

Also under consideration, are the Mulga Rock Uranium Project, owned and operated by Vimy Resources, and the Yeelirrie Uranium Project, owned and operated by Cameco.

"With positive signs for a price recovery, including recent progress on an export agreement between Australia and India, these mines could be exporting A\$1 billion worth of uranium by 2020," Mr Marmion said.

"Importantly, they will generate more than 1500 jobs during the construction phases and 500 jobs once in production."

The Minerals Council of Australia recently released a report titled *Uranium: Natural Energy*. The report stated that a uranium boom is on the horizon, with the Bureau of Resources and Energy Economics forecasting that uranium will be a billion dollar Australia export industry by 2018-19 and Australia well placed to capitalise on the growing demand. ■

Western Australian uranium projects

All uranium mining project proposals are designated Level 3 lead agency projects. This means the Department of Mines and Petroleum (DMP) and Department of State Development (DSD) appoint a case manager or project officer to assist with project approval coordination across government. Current uranium mining project proposals can be found on the DMP website at www.dmp.wa.gov.au/leadagency



**DMP Petroleum Executive Director
Jeff Haworth.**

Western Australia will have the most stringent well integrity and resource management conditions in the country for its emerging shale and tight gas industry when new regulations for the petroleum and geothermal industries come into effect from 1 July this year.

Department of Mines and Petroleum executive Director of Petroleum Division Jeff Haworth said these regulations complement the existing safety and environmental regulations.

“While WA’s natural gas from shale and tight rocks industry is in the early stages of exploration, with any significant commercial production predicted to be about five to ten years away, it is important that a robust regulatory framework is in place,” Mr Haworth said.

“The State Government understands community concerns associated with hydraulic fracturing, so strengthening regulations and ensuring best practices are implemented are critical to addressing these concerns.”

Before drilling operations are approved, DMP assesses applications to ensure work will be conducted in accordance with good oil field practices and in a way that reduces the risk to the environment.

“The department will ensure any future projects are assessed on a site-by-site, project-by-project basis with safety and environment auditors conducting inspections to check compliance with safety and environmental standards,” Mr Haworth said.

“As part of the approvals process, companies are legally required to provide an environment plan that assesses the potential impacts on groundwater, as well as flora and fauna.

NEW PETROLEUM AND GEOTHERMAL REGULATIONS

“All companies are required to submit a list of all chemicals to be used in all well operations. This information is available on the DMP website. WA is the only jurisdiction in Australia requiring full public disclosure of chemicals.”

Mr Haworth said the State is well positioned to learn from experiences in other jurisdictions and to adopt international best practice standards to further strengthen its robust regulatory system ensuring the environment and communities are protected as this new industry is developed.

“With the new regulations now in place DMP is confident it can strictly regulate a shale and tight gas industry without compromising the environment or safety to successfully maximise possible future economic opportunities for all Western Australians,” he said.

DMP received significant input on the consultation draft of the regulations and supporting guideline documents, and many of these have been incorporated into the regulations.

“Further to this, DMP hosts the Shale and Tight Gas Inter-Agency Working Group, comprising representatives from the Departments of Water, Health, Environment Regulation, Agriculture and Food, Parks and Wildlife and State Development that has discussed the changes to petroleum and geothermal resource management and administration regulations.”

A regulatory framework for shale and tight gas is also being developed by the inter-agency group to assist industry and broaden community understanding of how this industry is regulated.

Community consultation

In response to community requests for information on hydraulic fracture stimulation DMP’s Petroleum Division has held a number of community information sessions throughout the State during the year.

DMP officers met with various local government, business and community groups in the Kimberley, Pilbara, Mid-West and Gascoyne regions which has facilitated better planned and more informed policies, programs, projects and services.

As well as public meetings, consultation occurred with shire representatives, non-government organisations, regional development authorities, Aboriginal groups, and agricultural representatives, with additional attendance at booths at regional expos and agricultural shows.

Further public and stakeholder consultation sessions will be held throughout the State during the year.

As part of the approvals process, companies will be required to consult early with communities where exploration licences have been granted. ■

Petroleum and Geothermal Energy regulations

- The changes to the *Petroleum and Geothermal Energy Resources (Resource Management and Administration) Regulations 2014* follow extensive consultation by DMP with industry stakeholders and the public.
- The draft *Petroleum and Geothermal Energy Resources (Resource Management and Administration) Regulations 2014* cover the WA State petroleum sector onshore and State waters, and will provide a risk-based management scheme for the exploration for, and production of, petroleum and geothermal energy resources.
- The onshore resource management and administration regulations will form the third and final part of the suite of regulations that commenced in 2010 with the introduction of two onshore safety regulations - *Petroleum and Geothermal Energy Resources (Occupational Safety and Health) Regulations 2010* and the *Petroleum and Geothermal Energy Resources (Management of Safety) Regulations 2010*.
- In 2012, onshore environment regulations commenced with *Petroleum and Geothermal Energy Resources (Environment) Regulations 2012*.

2015 MRIWA MINERALS RESEARCH SCHOLARSHIPS



Mines and Petroleum Minister Bill Marmion (centre) with the successful students.

Ten promising undergraduate and postgraduate students have received almost A\$500,000 over three years in scholarships from the Minerals Institute of Western Australia (MRIWA) to assist with research projects that benefit the State's minerals sector.

The five PhD scholarships were the first to be granted under MRIWA's expanded postgraduate scholarship program.

Four scholarships, worth A\$30,000 each year for three years, were awarded for 2015 with a fifth PhD student awarded the first MRIWA Directors' scholarship, funded through the donation of board members

sitting fees and valued at A\$40,000 a year for three years.

The MRIWA Directors' scholarship is given to a PhD student undertaking a project in an area considered to be strategic research.

"These scholarships directly assist research that will advance the State's minerals industry, contribute to future innovation and enable projects that, in turn, will benefit Western Australians," MRIWA CEO Mark Woffenden said.

Mines and Petroleum Minister Bill Marmion said the scholarships were part of the State Government's commitment to science.

"Good science means more jobs and a smarter State, and our MRIWA investment has Western Australia well-placed to engage with national and international research," Mr Marmion said.

Another five undergraduate students commencing fourth year projects in minerals research were awarded Odwyn Jones Awards, worth A\$5000 each. The prize for the best thesis from the 2014 Odwyn Jones award winners was also presented.

For more information on the scholarships and a list of winners, visit www.mriwa.wa.gov.au/scholarships ■

MRIWA tracking well against research targets

Since it was established in February 2014, the Minerals Research Institute of Western Australia (MRIWA) has injected substantial funds into many promising Western Australian research projects, achieving several significant research targets in its first 18 months of operation.

MRIWA CEO Mark Woffenden said that since commencement, MRIWA has committed A\$4.1 million to minerals research projects for Western Australia and A\$600,000 to postgraduate and undergraduate scholarships for students in minerals research.

"MRIWA was established to promote minerals research that will encourage investment and help stimulate a globally competitive minerals industry in Western Australia," Mr Woffenden said.

"The institute's increasing research investment has seen A\$2.6 million committed to the Distal Footprints of Giant Ore Systems project that will identify prospective areas for mineral exploration in the Capricorn area of Western Australia.

"This A\$16 million project is a collaboration between the Science and Industry Endowment Fund, CSIRO, Curtin University, the University of Western Australia and industry groups."

MRIWA is engaging in major national research initiatives including partnering with the CRC ORE II project. It was announced on 26 May that this project will receive A\$34 million in Commonwealth Government funding.

The total cash value of MRIWA's portfolio of active research projects is now A\$23.5 million.

Of MRIWA's research project investments, around 40 per cent is committed to exploration, 30 per cent to mineral processing, and 20 per cent to mining. ■



An update to the Department of Mines and Petroleum's (DMP) online tenement system is addressing concerns about access to surrendered tenements.

Earlier this year, concerns were raised about some companies using special software to 'crunch' DMP online systems.

The department's Mineral Titles Division Executive Director Dr Ivor Roberts said the issue could disrupt the department's online systems.

"To ensure equity, the department has upgraded its online system to ensure that once a tenement has been surrendered the details are freely available online," Dr Roberts said.

This free information is visible to everyone at the same time through the department's website and is also distributed by an RSS feed.

Additionally, detailed and costfree tenement information from the department's systems will be available for download the following day.

Mines and Petroleum Minister Bill Marmion announced the upgrade earlier this year and said the upgrades ensure information is now available to everyone, at the same time.

"A number of prospectors expressed concern to me that some large companies were using special software to 'crunch' DMP online systems," Mr Marmion said.

"I raised these concerns with the department, which has moved quickly to address the issues in consultation with industry.

"These changes ensure information about tenement availability is provided free of

charge as soon as a tenement has been surrendered."

The Minister said the upgrades would also help companies audit and manage their tenements for compliance, as well as determine when ground was available.

"This ensures equity and provides a level playing field for anyone who wants to pick up surrendered tenements," Mr Marmion said.

The department plans to introduce a training program on using the upgraded system as a part of the regular online training courses available to the public.

Companies using software to 'crunch' DMP's tenement data can be in breach of the terms and conditions of using the department's online system. ■

THE POWER OF CHANGE

Leaders cannot afford to be complacent in a fast-changing business world.

This was Department of Mines and Petroleum (DMP) Director General Richard Sellers' message to the National Public Sector Managers and Leaders Conference in Melbourne in April this year.

"The development of smart phones is a prime example of the power of change," Mr Sellers told delegates to Australia's peak public sector leadership event.

"They have become ubiquitous across the developed world, yet the first iPhone was only released in 2007," he said.

"There is more power in one of these small devices than all the computing power NASA required for the Apollo 11 mission."

Mr Sellers said that smart phones and tablets had changed the way DMP did business.

"We are redesigning our website and enhancing how the site displays on tablets and smartphones," he said.

"Our Geological Survey of Western Australia has also recently released tablet and handheld-friendly versions of its popular online interactive geology mapping tool, GeoVIEW.WA, and the new WAGeology app."

GeoVIEW.WA, which allows users to view, query, and map geoscientific datasets, won the Spatial Enablement category at the 2013 WA Spatial Excellence Awards. WAGeology displays geoscience maps, mining and petroleum tenements, mineral deposits and petroleum information.

Mr Sellers said that another challenge that must be accepted and met by leaders is the way organisations interact with stakeholders and the community.

"Engagement is a critical part of our business – whether it's industry, other government agencies, NGOs or community groups, as organisations are expected to be increasingly transparent," he said.

The Director General said that community engagement was being embedded in all DMP processes.

He also pointed to the need for organisations to have a comprehensive and continuing program of improvement for staff to make sure their skills and training kept pace with change.

"Change is inevitable," he said. "We must ensure that our organisations have a workplace culture that not only embraces change, but fosters a desire for change.

"You cannot afford to be complacent. The way we do things today will not be the way we do things in the future." ■

DIVING INTO SPATIAL SCIENCE

The crystal blue waters of Truk Lagoon in Micronesia are recognised as a diver's paradise, with the lagoon home to a vast graveyard of military wrecks – more than 100 ships, planes and submarines.

Department of Mines and Petroleum Senior Geospatial Officer Carolyn Martin visited the lagoon having recently completed her Masters' degree in Geospatial Science.

"Late last year I was awarded the 2014 Education Award and grant by the Australasian Hydrographic Society," Ms Martin said.

"It was this grant that gave me the opportunity to travel to Micronesia and visit one of the world's great wreck-diving sites."

Ms Martin used her skills to capture image datasets of several submerged Japanese WWII aircraft wrecks.

In 2014, she was recognised with a Postgraduate Student Award at the WA Regional Spatial Excellence Awards, and received the 2015 Best Masters Student in Geospatial Science award from Curtin University.

"I won the awards for my research on photogrammetric mapping of underwater shipwrecks," she said.

As part of the project, Ms Martin proved that the popular GoPro camera provided comparable photogrammetric results to the more expensive and bulky Digital Single Lens Reflex (DSLR) cameras. This project led to an exciting invitation from the Western Australian Museum for Ms Martin to join the "Two Lost Ships" project.

Ms Martin was part of the team on board the Skandi Singapore vessel (previously used in the search for MH370) documenting the HMAS Sydney and HSK Kormoran off the coast of Geraldton.

"I helped supervise the incoming datastream from the camera array on one of the Remote Operated Vehicles (ROVs) that was capturing images and data of the two wrecks," Ms Martin said.

"It was an incredible opportunity to be a part of a scientific expedition using modern technology to capture the past."

The project aims to help bring the wrecks 'back to life', making them accessible in 3D digital format to the wider public in a new exhibition at the museum.

Ms Martin joined a skilled team of hydrographic surveyors, historians, academics and engineers for the expedition.

"We collected over 50 terabytes of image data which will be used to build the 3D digital reconstructions of the wrecks," Ms Martin said.

Curtin University will utilise the supercomputer at the PAWSI centre to reconstruct the data and the Western Australian Museum hopes to create an exhibition based on the two ships in time for the 75th anniversary of their battle next year. ■



Carolyn Martin (centre) receiving her grant from the Australasian Hydrographic Society.

NORTHERN EXPOSURE ATTRACTS DMP TALENT



Geologist Julie Hollis.

Geology often takes people from one extreme to another. But perhaps not as regularly as former Department of Mines and Petroleum (DMP) officer Julie Hollis who has moved between the tropical heat of Australia's north and the icy fjords of Greenland.

Dr Hollis's connection with Greenland, where she is now the country's Chief Geologist, goes back 12 years to when she

first arrived in Copenhagen to do regional geological mapping for the Geological Survey of Denmark and Greenland.

It was the first step in her career as a geologist after a strong academic performance that included first class honours from the University of Sydney, a PhD from the University of Edinburgh, and post-doctoral research at the Australian National Science and Technology Organisation and the University of Sydney.

Dr Hollis moved back to Australia in 2006, to become a project manager for the Northern Territory Geological Survey in Darwin.

"I worked on regional mapping projects in Amhem Land and in central Australia – a very different, tropical environment, and in my opinion a much more challenging environment to work in than the arctic," she said.

In 2011, Ms Hollis accepted a position with the Geological Survey of Western Australia (GSWA), working in the tropical north – this time in the Kimberley.

"Regional scale mapping was last done in the Kimberley more than 20 years before GSWA started new work in 2012," she said.

"The Kimberley is a truly spectacular part of Western Australia – certainly scenically, also culturally, and not least geologically.

"My work in the Kimberley involved considerable interaction with Traditional Owners, which is invariably a fascinating aspect of the work."

Dr Hollis said GSWA was one of the best survey organisations in the world.

"GSWA has a very strong group of geoscientists, who publish prolifically, not just maps and reports, but also in academic journals," she said.

"GSWA also has a very strong focus on getting products out – geophysics, geochemistry, geochronology, maps, reports, presentations, digital datasets – as soon as possible, free or at a nominal charge, to a very high standard, to support the exploration and mining community." ■

AGRICULTURE

East Kimberley - Ord - Ord/East Kimberley Expansion Project**WA STATE GOVERNMENT**

The Ord East Kimberley Expansion Project is a good example of the Commonwealth and State Government working closely together with the local community to deliver economic, social and common use infrastructure to the East Kimberley region of Western Australia. The State Government has invested \$322m to construct irrigation channels, roads and off-farm infrastructure on the Ord lands. A Development Agreement has been signed with Kimberley Agricultural Investment (KAI) for the lease and development of 13,400ha of irrigation land in the Goomig and Knox Plain areas. KAI, a subsidiary of China's Shanghai Zhongfu Group, proposes to establish a sugar industry in the Kununurra region. The State is currently working towards the release of approximately 5,000ha of Ord West Bank and Mantinea lands via a Request for Proposal process. The Commonwealth Government invested \$195m for construction of social and common use infrastructure in the East Kimberley region through the East Kimberley Development Package (EKDP) National Partnership Agreement (NPA). Twenty nine infrastructure projects were delivered over a three year period in health, housing, transport, education and community services. The Yawoorroong Miriung Gajerrong Yirrbeg Noong Dawang Aboriginal Corporation (MG Corporation) building and the Department of Housing transitional housing projects were successful nominations for the Australian Institute of Architects 2013 Western Australian Architectural Awards. The transitional housing project has also achieved a 2013 Premier's Award for Improving Indigenous Outcomes.

Expenditure: \$517m.

AMMONIUM NITRATE

Pilbara - Burrup Industrial Estate Site D - Yara Pilbara Nitrates**YARA INTERNATIONAL ASA**

Yara Pilbara Nitrates Pty Ltd (YPNPL) is an incorporated joint venture between Yara International ASA (Yara), Orica Limited (Orica) and Apache Corporation (Apache). YPNPL has executed an Engineering, Procurement and Construction (EPC) contract for the construction of a world class circa 350,000tpa Technical Ammonium Nitrate (TAN) plant to be located on the Burrup Peninsula. Ammonia feedstock will be supplied from Yara Pilbara Fertilisers Pty Ltd (YPFPL), which operates its facility directly adjacent to the proposed location for the new TAN plant. Yara will be the operator of the TAN plant and Orica will manage the product sales and distribution of the TAN product. Yara and Orica each have a 45 per cent interest in the joint venture and Apache the remaining 10 per cent. It is intended that all manufactured product will be sold into the Pilbara region. Work on the project has commenced and it is expected that the new plant will be commissioned in late 2015, with nameplate capacity production rates expected by the end of 2016.

Expenditure: \$800m.

Employment: Construction: 500; Operation: 65

HEAVY MINERAL SANDS

Keysbrook - Heavy Mineral Sands Mine**MZI RESOURCES LTD**

MZI has commenced the development of the Keysbrook Mineral Sands Project, located near the township of Keysbrook approximately 70km south of Perth. The project comprises a new mine and wet concentration plant, and upgrades to the existing mineral separation plant owned by Doral Mineral Sands in Picton, near Bunbury. MZI has obtained environmental approval from the Minister for Environment, and development approval and extractive industry licenses from the Shires of Murray and Serpentine-Jarrahdale. Keysbrook has a mineral resource of 78.9Mt at an average grade of 2.5 per cent total heavy mineral (THM) and an ore reserve of 670,000t THM, which underpins the first 5.5 years of operations. Based on the total mineral resource estimate, the potential mine life could be more than 15 years. Approximately 110,000tpa of heavy mineral concentrate from Keysbrook will be trucked 120km south to Doral's mineral separation plant in Picton where it will be toll treated under a processing agreement. The project is expected to produce 67,500tpa of leucoxene products and 28,700tpa of zircon concentrate, which will be exported from the Bunbury Port. The project has a capital cost of approximately \$70m and will employ up to 100 people during the construction and commissioning phase, with 50 permanent jobs created for operational activities. MZI plan to commence production in the Q4 of 2015.

Expenditure: \$70m.

Employment: Construction: 100; Operation: 50

INFRASTRUCTURE

Pilbara - Ashburton North Strategic Industrial Area**WA STATE GOVERNMENT**

The State Government is developing the Ashburton North Strategic Industrial Area (ANSIA) as a hydrocarbon precinct 11km south west of Onslow. The ANSIA includes three sites for major gas processing proponents, sites for downstream processing, areas for general support industries and supply base operations, infrastructure corridors, and a port with common user facilities to be managed by the Pilbara Ports Authority. Two foundation proponents, BHP Billiton Petroleum (Macedon Project) and Chevron Australia (Wheatstone Project) have taken up land allocations within the ANSIA. BHP Billiton Petroleum is operating a domestic gas plant with a production capacity of 200TJ per day. Wheatstone's construction schedule is approximately 60 per cent completed with first LNG export scheduled for late 2016.

IRON ORE

Pilbara - BHP Billiton Iron Ore - Shiploaders 1 and 2**BHP BILLITON IRON ORE PTY LTD**

During the December 2013 quarter, BHP Billiton approved an investment of approximately US\$300m (BHP Billiton share) to replace shiploaders 1 and 2 at the company's Nelson Point operations in Port Hedland. The two new shiploaders will increase the reliability of its inner harbour port facilities and create additional port capacity that will be utilised as a series of

debottlenecking initiatives to increase the capacity of BHP's supply chain to approximately 270Mtpa to 290Mtpa

(100% basis), at a low capital cost.

Expenditure: \$407m.

Employment: Construction: 500

Pilbara - Roy Hill Iron Ore Mine & Infrastructure**ROY HILL HOLDINGS PTY LTD**

Roy Hill Holdings is a private company which is majority-owned by Hancock Prospecting Pty Ltd, and also has key international investment partners with strategic steel-making interests. It is developing the Roy Hill iron ore project located 115km north of Newman. This project is expected to come into production in 2015 and will produce 55Mtpa of iron ore for 20 years following ramp-up. The project includes mine development, mine processing infrastructure, a new heavy-haul railway, and significant new port facilities at Port Hedland's inner harbour. All primary environmental and other approvals have been secured and major project works commenced in 2012. Dredging, the airstrip and internal mine roads have been completed, the rail construction, mine and port accommodation villages are being utilised. Considerable works are already underway on port, rail and mine construction with the project passing the 78 per cent completion in late March 2015. Roy Hill secured the world's largest ever debt financing package for a mining project of US\$7.2b in March 2014.

Expenditure: \$10b.

Employment: Construction: 4200;

Operation: 2000

IRON ORE PROCESSING

Pilbara - Cape Preston - Sino Iron**CITIC PACIFIC**

The Sino Iron project is located at Cape Preston, 100km south west of Karratha. Construction of the largest magnetite mining and processing project in Australia is at an advanced stage, with limited production from the first and second of six lines commencing in 2013. On completion, the project will comprise of in-pit crushers, six autogenous and six ball mills, concentrators, 6Mtpa pellet plant, 25km slurry pipeline, combined cycle 450MW power station, new port and trans-shipment facilities, and a 51GL desalination plant. At full production the project will export up to 21.6Mtpa of magnetite concentrate and 6Mtpa of high grade pellets. The first shipment of ore occurred on 2 December 2013.

Expenditure: \$5.2b.

Employment: Construction: 4000; Operation: 500

OIL & GAS DEVELOPMENTS

Carnarvon Basin - Greater Western Flank Phase 1**WOODSIDE ENERGY**

The Greater Western Flank Phase 1 Project will develop the Goodwyn GH and Tidepole fields, via a subsea tie-back to the existing Goodwyn A Platform. The project remains on schedule for start-up expected in early 2016.

Expenditure: \$2.5b.

Carnarvon Basin - Persephone Project

WOODSIDE ENERGY

Woodside Energy Ltd, as operator of the North West Shelf Joint Venture, proposes to develop the Persephone gas field. The development involves two subsea wells and an 8km subsea tieback from the Persephone field to the existing North Rankin Complex. Project start-up is expected in early 2018.

Expenditure: \$1.2b.

Carnarvon Offshore Basin - Barrow Island - Gorgon Project

GORGON JOINT VENTURE

The Gorgon Joint Venture (GJV) made its final investment decision on the Gorgon Project in mid-September 2009. The 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 have been reassessed at A\$55b (US\$54b) following a cost and schedule review conducted by Chevron in December 2013. 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. The project obtained State and Commonwealth environmental approvals in August 2009. On-island activity started in late 2009 and the major construction work for the processing plant commenced in 2011. Plant start-up and first gas is planned for mid-2015, with the provision of domestic gas by 31 December 2015.

Expenditure: \$55b.

Employment: Construction: 8000; Operation: 300

Kalgoorlie - Tropicana Gas Pipeline Project

ANGLOGOLD ASHANTI/APA GROUP JOINT VENTURE

APA Operations Pty Ltd, a subsidiary company within the APA Group (APA), plan to construct and operate a 294km high pressure natural gas pipeline to convey gas from the Murrin Murrin gas lateral pipeline (licence PL 36) to the Sunrise Dam Gold Mine and to the Tropicana Gold Mine. Both gold mines are operated by AngloGold Ashanti Australia (AGA). The pipeline is called the Eastern Goldfields Gas Pipeline (EGP). Construction works for the pipeline and associated facilities are on site, scheduled work has commenced with first gas delivery planned for early 2016.

Expenditure: \$140m

Employment: Construction: 300

Pilbara - Wheatstone LNG Development

CHEVRON AUSTRALIA PTY LTD

Chevron Australia Pty Ltd as operator of the Wheatstone Project is currently working towards the construction of two LNG trains, a domestic gas plant and port facilities at the Ashburton North Strategic Industrial Area near Onslow. The project will initially produce 8.9Mtpa and have a 200TJ per day domestic gas plant connected to the Dampier-to-Bunbury Natural Gas Pipeline. The construction schedule is approximately 60 per cent completed. The first export of LNG is scheduled for late 2016.

Expenditure: \$29b.

Employment: Construction: 6500; Operation: 400

POWER STATIONS

Boodarie Industrial Estate - South Hedland Power Station

TRANSALTA

In July 2014, TransAlta Energy (Australia) Pty Ltd announced it will build, own and operate a 150 megawatt power station in South Hedland's Boodarie Industrial Estate. The plant will consist of a combined cycle gas plant, which is a reliable, highly-efficient, low-cost and clean process of generating electricity, featuring both natural gas and steam turbines. The A\$570m investment will help meet the future energy needs of the region through a 25-year agreement with both Horizon Power and Fortescue Metals Group. The plant is being designed to allow for expansion and there is a possibility that other customers may be added in the future. Construction commenced in February 2015 and is expected to create up to 250 jobs. Full commissioning is expected to be complete in 2017.

Expenditure: \$570m.

Employment: Construction: 250; Operation: 20

AMMONIA/UREA

Shotts Industrial Park - Collie Coal to Urea PERDAMAN CHEMICALS AND FERTILISERS PTY LTD

Perdaman Chemical and Fertilisers Pty Ltd is proposing to develop an \$3.5b coal to urea plant at the new Shotts Industrial Park, near Collie. The plant will use proven coal gasification and fertiliser production technologies. Around 2.7Mtpa of coal will be used to produce approximately 2Mtpa of urea, primarily for export. The urea will be transported to Bunbury Port by rail. The company has received all its environmental and all other approvals from both the Western Australian and Commonwealth Governments. The project is on hold as the company is still seeking to finalise a suitable domestic coal supply arrangement prior to achieving its financial investment decision.

Expenditure: \$3.9b.

Employment: Construction: 2000; Operation: 200

HEAVY MINERAL SANDS

Shark Bay - Coburn Zircon Project

STRANDLINE RESOURCES LIMITED

Strandline proposes to develop the Coburn zircon project, located south of Shark Bay and approximately 250km north of Geraldton. It contains total ore reserves of 308Mt at an average grade of 1.2 per cent heavy minerals, all of which lie within the portion of the project area that has received government environmental approvals for mining. 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-leucosene over its 19 year mine life. The company has secured all of the approvals required to commence mining and processing operations at Coburn, and is continuing to pursue discussions with parties having a potential interest in acquiring a major stake in the project.

Expenditure: \$202m.

Employment: Construction: 170; Operation: 110

INFRASTRUCTURE

Dampier Peninsula - Browse LNG Precinct WA STATE GOVERNMENT

The State Government is developing the Browse Liquefied Natural Gas (LNG) Precinct approximately 60km north of Broome. By focussing development at a suitable location, the Precinct will minimise the environmental footprint of gas processing and any social impacts in the region while maximising opportunities for the local community to benefit from development of the Browse Basin gas fields. The Precinct will have the capacity to accommodate at least two LNG processing operations, with a combined capacity of up to 50Mtpa. The State Government has acquired the land for the Precinct and will secure all relevant approvals to ensure the Precinct is 'project ready.'

Pilbara - Anketell - Anketell Port and SIA (Strategic Industrial Area)

WA STATE GOVERNMENT

The Anketell project involves the establishment of a multi-user, multi-commodity deep water port and associated strategic industrial area (SIA) at Anketell, located 30km east of Karratha on the Pilbara coast. The port and associated infrastructure will be a proponent-funded but State controlled Port which will be managed and operated under the *Port Authorities Act 1999*. The strategic industrial land will fall under the jurisdiction of the Western Australian Land Authority (LandCorp). During its initial phase, it is expected that Anketell will be an iron ore export facility and that, at its peak capacity, not less than 350Mtpa will be exported to customers, mainly in Asia. A number of iron ore producers with mining assets in the Pilbara have expressed interest in using the planned facilities at Anketell. It is likely that the Port will be developed in stages to accord with the development of the various mining operations which are located throughout the Pilbara. The Anketell Port Master Plan was released in June 2014 and a downloadable copy can be obtained from the DSD website: www.dsd.wa.gov.au

IRON ORE

Pilbara - West Pilbara Iron Ore Project

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 will be transported by a new heavy haul railway for export via the proposed multi-user 350Mtpa port at Anketell. Subject to the successful completion of feasibility and environmental studies, and receipt of government regulatory approvals, the company anticipates construction to commence following a decision to proceed by the joint venturers and completion of funding arrangements. Primary State and Federal environmental approvals for the mine and rail elements of the project were received in December 2011, and for the first stage of Anketell Port in the first half of 2013.

Expenditure: \$7b.

Employment: Construction: 3500; Operation: 1000

Yilgarn – Deception Iron Ore Deposit

CLIFFS ASIA PACIFIC IRON ORE PTY LTD

Cliffs proposes to expand its Koolyanobbing Operation to include an additional iron ore mining area at the Deception Deposit, located approximately 150km north of Southern Cross. The Deception Deposit contains an estimated 7.1Mt of iron ore and is expected to have a mine life of around 5 years. Mining of the Deception Deposit has environmental approval with first production expected in first half of 2018.

Expenditure: \$35m

NICKEL

Mt Windarra - Windarra Nickel

POSEIDON NICKEL NL

Poseidon Nickel Ltd has submitted a project development proposal for assessment for the redevelopment of the Mt Windarra underground nickel mine and associated project infrastructure at Mt Windarra. Subject to obtaining all relevant approvals Poseidon is forecast to commence mining in 2016.

Expenditure: \$12m

Employment: Construction: 50;
Operation: 100

OIL AND GAS DEVELOPMENT

Canning Basin - Buru Canning Basin Tight Gas

BURU ENERGY

The Buru Energy/Mitsubishi joint venture (JV) is undertaking the Laurel Formation Tight Gas Pilot Exploration (TGS) Program to test the commercial potential of the Laurel Formation, a large onshore natural gas resource located in the Canning Basin. Phase 1 of the TGS Program has recently been completed at the Company's eastern well sites. These works included completing well site preparation and civil works, well conditioning, cement bond logging and conducting mini fracs or diagnostic fracture injection tests (DFITs). The next operational phase of the TGS program will occur in the 2015 dry season to determine gas flows from the target reservoir. In preparation, the JV is continuing with a baseline groundwater monitoring program to detect any effect of activities on groundwater. Should the resource prove to be commercially viable, gas from the Canning Basin will provide energy security to WA domestic and industrial markets. Under a State Agreement the JV, upon proving up sufficient reserves, is obligated to supply into the WA domestic market at least 1,500 petajoules of gas.

Expenditure: \$40m.

Employment: Operation: 30

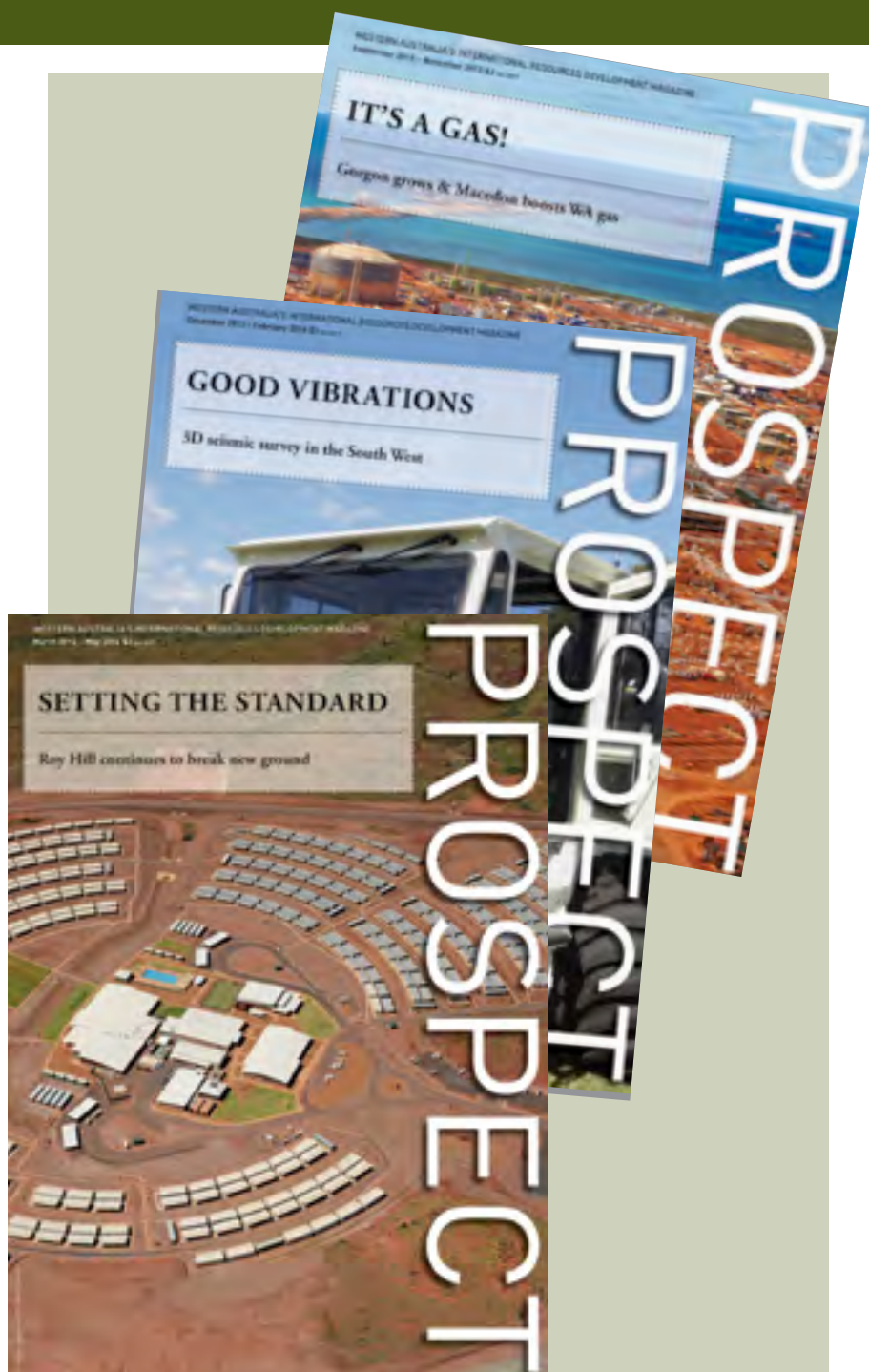
URANIUM

Northern Goldfields - Yeelirrie - Yeelirrie Uranium

CAMECO AUSTRALIA PTY LTD

Cameco Australia proposes to develop the Yeelirrie project in the North-eastern Goldfields, near Wiluna. The project entails open cut mining of shallow deposits of uranium ore, treatment in a plant to be established at the site, and development of associated infrastructure. The project will process up to 2.4Mtpa of uranium ore over about 17 years. The resultant uranium oxide will be transported to South Australia by road for export to overseas markets. The environmental approval process has commenced. Cameco will advance the project at a pace aligned with market conditions.

Employment: Construction: 500;
Operation: 225



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Significant resource projects in Western Australia

Western Australia continues to lead the way as Australia's premier resources investment destination. There are more than A\$122 billion worth of projects either committed or under consideration for the State during the next few years. These would create more than 29,000 construction jobs and more than 4700 permanent jobs.

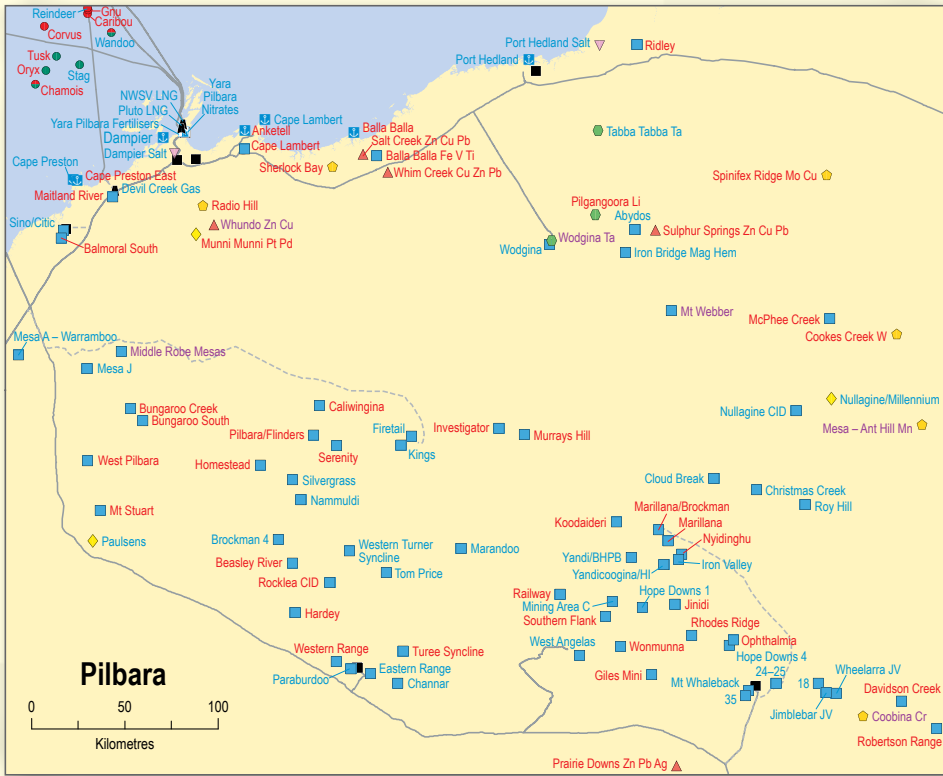
This section is intended as an overview and does not constitute an exhaustive list of projects within the Western Australian resources industry. Based on company announcements.

	Project Value (estimated A\$m)		Employment	
			Construction	Permanent
Iron and Steel				
API Management Pty Ltd - West Pilbara Iron Ore Project	7000		3500	1000
BHP Billiton Iron Ore - Shiploaders 1 and 2 Replacement	407		500	n/a
CITIC Pacific - Cape Preston Mine & Processing Projects	11100		4000	500
Roy Hill Holdings Pty Ltd - Roy Hill Iron Ore Mine & Infrastructure	10000		4200	2000
Sub Total	28507		12200	3500
Oil, Gas and Condensate				
Browse LNG Precinct	n/a		n/a	n/a
Buru Energy - Buru Canning Basin Tight Gas	40		n/a	30
Chevron - Wheatstone LNG	29000		6500	400
Gorgon Joint Venture Gas Processing Project	55000		8000 up 1750	300
Woodside Energy - Greater Western Flank Phase 1	2500		n/a	n/a
Woodside Energy - Persephone	1200		n/a	n/a
Sub Total	87740		14500	730
Other				
Ashburton North Strategic Industrial Area	n/a		n/a	n/a
Cameco Australia - Yeelirrie Uranium	n/a		500	225
Ord East Kimberley Expansion Project	517		n/a	n/a
Perdaman Chemicals & Fertilisers - Coal-to-Urea Plant	3900		2000	200
TransAlta - South Hedland Power Station	570		250	20
Yara International ASA - Yara Pilbara Nitrates	800		500	65
Sub Total	5787		3250	510
TOTAL	122034		29950	4740

All currency figures are in Australian dollars unless otherwise specified.

Abbreviations Key

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



Mineral symbols		Commodities	
◆ Precious metal	Au (or as shown)	Ag.....Silver	Al.....Alumina
◆ Steel alloy metal	Ni (or as shown)	Au.....Gold	Cr.....Chromium
◆ Speciality metal	Ti-Zr (or as shown)	Cu.....Copper	Fe.....Iron
▲ Base metal		Hem.....Hematite	K.....Potassium
■ Iron		Li.....Lithium	LNG.....Liquefied natural gas
■ Alumina	All sites are bauxite	LPG.....Liquefied petroleum gas	Mag.....Magnetite
● Coal and lignite		MgCO ₃Magnesite	Mica.....Mica
▼ Industrial mineral		Mn.....Manganese	Mo.....Molybdenum
⊠ Processing plant		Ni.....Nickel	Pb.....Lead
Petroleum symbols		Pd.....Palladium	Phos.....Phosphate
● Gas field		Pl.....Platinum	REE.....Rare earth elements
● Oil field		Sid.....Silica sand	Ta.....Tantalum
● Oil and gas field		Tc.....Talc	Ti.....Titanium
● Significant gas discovery		V.....Vanadium	W.....Tungsten
▲ Processing plant		Zn.....Zinc	Zr.....Zirconium
— Oil / gas pipeline, operating			
- - - Oil / gas pipeline, proposed			
Infrastructure			
■ Power plant			
■ Irrigation / water / desalination			
■ Port			

Data for offshore Commonwealth controlled waters is up-to-date as of December 2013. Enquiries for latest information for Commonwealth controlled waters is available from the National Offshore Petroleum Titles Administrator (NOPTA) at <info@nopta.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

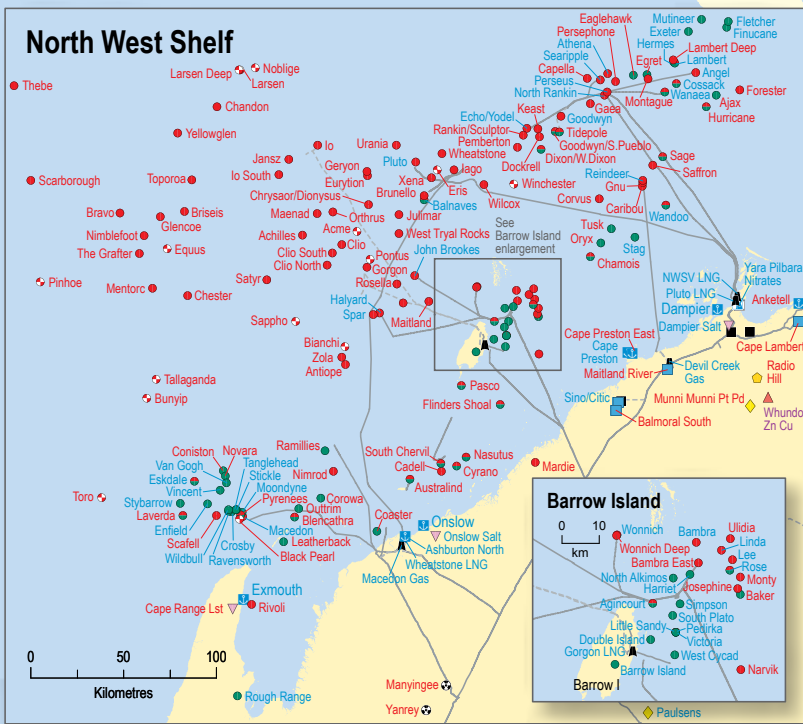
Proposed or potential projects with a capital expenditure greater than A\$20 Million are shown in red

Projects under care and maintenance are shown in purple



Kwinana-Rockingham	
⊠ Alumina refinery	
⊠ Ammonium nitrate	
⊠ Bulk terminal	
⊠ Cement and lime	
⊠ Chlor alkali	
⊠ Desalination	
⊠ Fused alumina	
⊠ Fused zirconia	
▲ LNG	
▲ LPG	
⊠ Nickel refinery	
▲ Oil refinery	
⊠ Power station	
⊠ Sodium cyanide	
⊠ Titanium pigment	
⊠ Zirconia	

North West Shelf



Major Resource Projects

July 2015

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

Projects under care and maintenance are shown in purple



Commodities

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

Mineral symbols

- ☆ Precious mineral
- ◇ Precious metal
- ◇ Steel alloy metal
- ◇ Speciality metal
- ▲ Base metal
- Iron
- Alumina
- Coal and lignite
- Uranium
- ▽ Industrial mineral
- ⊠ Processing plant

Petroleum symbols

- Gas field
- Oil field
- Oil and gas field
- Significant gas 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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