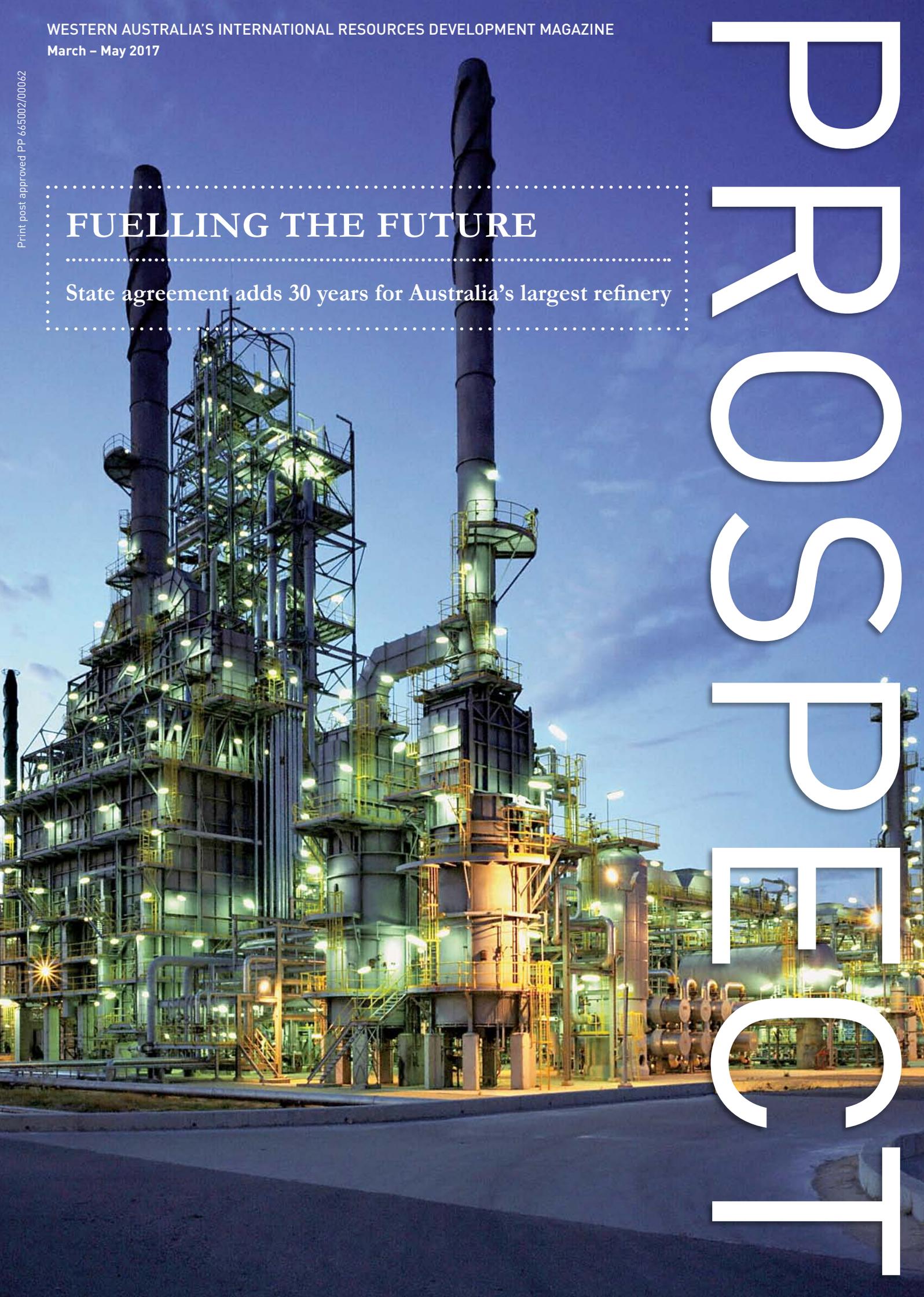


FUELLING THE FUTURE

State agreement adds 30 years for Australia's largest refinery

PROSPECT



This edition of Prospect magazine coincides with a Western Australian State General Election. In observance of the State General Election period (Caretaker Conventions), the Forewords for this edition are provided by the Directors General of the Departments of State Development and Mines and Petroleum.

Western Australia has recently expanded international trade and investment opportunities with our regional neighbours. New trade and cultural ties with India have been established under a formal sister state agreement with the Indian state of Andhra Pradesh (story page 6). Under the agreement, Western Australia as a world leading resources economy will share expertise in key economic growth areas, including mining, agriculture, energy and education.

This edition of *Prospect* covers the international launch of Western Australia Worth Sharing in Singapore (story page 4). Close to 70 Western Australian companies have signed on to the new export-focused agrifoods brand and Singapore was selected for the launch as one of the State's leading export markets. The branding campaign will also launch into China, Japan and other markets this year.

This edition also sees a new \$5.6 billion iron ore project in the Pilbara take a step forward with the execution of a State Agreement (page 22), as well an extension to the BP Kwinana oil refinery State Agreement to supply fuel to local industry for a further 30 years (page 2).

Western Australia's energy supply has been further secured with the first natural gas from the Gorgon Project flowing into the State's integrated domestic system (story page 11).

Steve Wood

DIRECTOR GENERAL, DEPARTMENT OF STATE DEVELOPMENT

2017 has started well for the mining and resources sector with investment and employment figures showing growth across the sector. In March 2017, the Fraser Institute Survey of Mining Companies ranked Western Australia among the world's top three attractive destinations for mining investment, and number one in Australia.

The new State Government brings with it new prospects and opportunities. We look forward to working with the new Minister and Government to ensure we take best advantage of the State's incredible resource base ensuring the sector is developed and managed responsibly and sustainably for the benefit of all Western Australians.

Some of our corporate executives have been supported to attend major conferences in Africa, India and Iran, sharing Western Australia's expertise in innovation, responsible resource management and the State's opportunities for international investment. This is testament to the Department of Mines and Petroleum's experience and success administering a highly successful resources sector.

For the first time, the department's Awards for Excellence 2017 will bring together the prestigious Golden Gecko environment awards, Community Partnership awards, and Safety and Health awards. These awards recognise excellence and innovation across the three categories, showcasing best practice projects to industry, the people of Western Australia and overseas. We look forward to sharing these projects at the awards ceremony in October.

Dr Tim Griffin

ACTING DIRECTOR GENERAL, DEPARTMENT OF MINES AND PETROLEUM

ISSN 1037-4590

Prospect

Western Australian Prospect magazine is published quarterly by the Western Australian Government's Department of Mines and Petroleum (DMP) and Department of State Development (DSD).

*DSD Editorial management: Rebecca Atkinson, DSD Communications and Marketing Division.
Tel: +61 08 9222 0417 • Fax: +61 08 9222 0505*

*DMP Editorial management: Beau Pearson, DMP Communications and Marketing Division.
Tel: +61 08 9222 3736 • Fax: +61 08 9222 3862*

Subscriptions: www.dmp.wa.gov.au/prospect. Tel: +61 08 9222 3333

Disclaimer

Prospect has been compiled in good faith by the Department of Mines and Petroleum (DMP) and Department of State Development (DSD). Opinions expressed in Prospect are those of the authors and do not necessarily represent the views, or have the endorsement of DMP and DSD. DMP and DSD has used all reasonable endeavours to ensure the material contained in this publication is correct, but it is intended to be general in nature. No representation is made with regard to the completeness or accuracy of the information contained herein. DMP and DSD disclaims any or all liability for loss or damage whatsoever suffered or incurred resulting from the use of or reliance on information contained herein. Readers of this publication should make and rely on their own enquiries, research and judgements in making decisions affecting their own or any other persons interest.

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



Cover photo: Australia's largest oil refinery, the BP Kwinana Refinery in Western Australia, is set to operate for a further 30 years (story page 2). Photo: BP Australia.

Scan this QR code to view links to all the department's publications

DEPARTMENT OF STATE DEVELOPMENT

International Trade and Investment

Level 6, 1 Adelaide Terrace
East Perth, Western Australia 6004 • AUSTRALIA
Tel: +61 8 9222 0555 • Fax: +61 8 9222 0505
Email: invest@dsd.wa.gov.au • www.dsd.wa.gov.au

INTERNATIONAL OFFICES

Europe — London

Government of Western Australian – European Office
5th floor, The Australia Centre
Corner of Strand and Melbourne Place
London WC2B 4LG • UNITED KINGDOM
Tel: +44 20 7240 2881 • Fax: +44 20 7240 6637
Email: agent_general@wago.co.uk • www.wago.co.uk
twitter.com/wagoEU

India — Mumbai

Western Australian Trade Office
93 Jolly Maker Chambers No 2
9th floor, Nariman Point • Mumbai 400 021 • INDIA
Tel: +91 22 6630 3973 • Fax: +91 22 6630 3977
Email: india@dsd.wa.gov.au • www.watoindia.in

Indonesia — Jakarta

Western Australia Trade Office
Level 48, Wisma 46, Jalan Jenderal Sudirman Kavling 1
Jakarta Pusat 10220 • INDONESIA
Tel: +62 21 574 8834 • Fax: +62 21 574 8888
Email: invest@dsd.wa.gov.au

Japan — Tokyo

Western Australian Government Office
14th floor, Imperial Tower
1-1-1 Uchisaiwai-cho Chiyoda-ku
Tokyo 100-0011 • JAPAN
Tel: +81 3 5157 8281 • Fax: +81 3 5157 8286
Email: wa.tokyo@wajapan.net • www.wajapan.net

Japan — Kobe

Western Australian Government Office
6th floor, Golden Sun Building 4-3-6 Nakayamate-dori
Chuo-Ku • Kobe 650-0004 • JAPAN
Tel: +81 78 242 7705 • Fax: +81 78 242 7707
Email: wa.kobe@wajapan.net • www.wajapan.net

Middle East — Dubai

Western Australian Trade Office
106, Emarat Atrium
PO Box 58007 • Dubai • UNITED ARAB EMIRATES
Tel: +971 4 343 3226 • Fax: +971 4 343 3238
Email: info@wato.ae • www.wato.ae

Kenya — Nairobi

Western Australian Trade Office
Kenya Representative Office
PO Box 25567
Nairobi 00603 • KENYA

People's Republic of China — Shanghai

Western Australian Trade and Investment Office
Level 22 • CITIC Square
1168 Nanjing Road West
Shanghai 200041 • PEOPLE'S REPUBLIC OF CHINA
Tel: +86 21 5292 5899 • Fax: +86 21 5292 5889
Email: invest@dsd.wa.gov.au • www.westernaustralia.cn

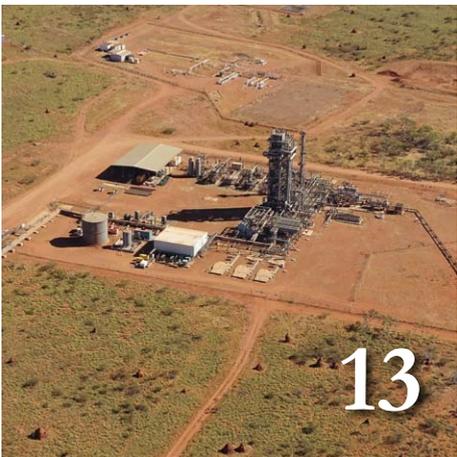
Singapore

Western Australian Trade and Investment Office
6 Temasek Boulevard #20-02
Suntec Tower Four
Singapore 038986 • SINGAPORE
Tel: +65 6836 5626 • Fax: +65 6836 5698
Email: invest@dsd.wa.gov.au

South Korea — Seoul

Western Australian Trade and Investment Office
Unit 702, 7th floor, Kwanghwamoon Building
149 Sejong-daero, Jongno-gu, Seoul, 110-730, KOREA
Tel: +82 2 722 1217 • Fax: +82 2 722 1218
Email: invest@dsd.wa.gov.au • www.westernaustralia.or.kr

In this issue



04 WA agrifoods go international

Western Australian produce is on Singapore's menu with the first international launch of export-focussed agrifoods brand WA Worth Sharing.

06 India links forged

Western Australia and Indian state Andhra Pradesh commit to working together in mining, agriculture, energy and education.

11 Gorgon Project boosts WA Domestic Gas Supplies

First natural gas from the Chevron operated Gorgon Project flows into Western Australia's domestic gas system.

13 New purpose

An extinguished gas reserve is set to become Western Australia's largest gas storage facility.

14 Lithium leader

Western Australia is poised to increase its prominence in the global lithium market.

20 Healthy minds

Department of Mines and Petroleum focuses on mental health and wellbeing of resources industry workers across WA.



Department of **Mines and Petroleum**
Department of **State Development**

Department of Mines and Petroleum
www.dmp.wa.gov.au

Department of State Development
www.dsd.wa.gov.au



BP KWINANA REFINERY ADDS 30 YEARS

For more than 60 years Australia's largest oil refinery – based in Kwinana, about 35 kilometres south-west of Perth – has supplied fuel to local industry and, following the extension of a State Agreement, is set to operate for another 30 years.

The BP Kwinana oil refinery is the only crude oil refinery in Western Australia and the nation's largest due to its capacity to refine 149,000 barrels of crude oil a day.

The refinery supplies more than five million tonnes of fuel each year to Western Australia, Tasmania and South Australia, to the mining, power, transport and agricultural industries.

It is currently the sole supplier of fuel to Tasmania and the largest supplier to South Australia.

Accounting for about 80 per cent of Western Australia's current fuel requirements for road, marine and aviation fuels, including aviation fuel to Perth Airport, the refinery is considered a vital strategic asset for the State.

In addition to aviation fuels, including jet fuel and aviation gasoline, the refinery manufactures three grades of unleaded petrol, diesel fuels, fuel oil, hydrogen, kerosene and autogas, including propane and butane, and low aromatic fuel used in remote communities.

When the Kwinana Refinery was developed in the 1950s, it was the foundation project in the Kwinana Industrial Area and comprised, under the original State Agreement:

- an oil refinery at Kwinana, located on a 250 hectare freehold site in the Kwinana Industrial Area;
- pipelines that transfer product to a terminal in Kewdale, which carry fuel for use in the Perth metropolitan area, the Wheatbelt and Kalgoorlie;
- aviation fuel, which is piped from the refinery to Perth Airport; and
- three jetties and a tug haven that are used to receive the crude oil and export the refined products interstate and to Fremantle Port.

BP's Western Australian downstream network also includes depots, truck stops, and a retail network of some 58 service

stations across the State, in addition to working with small business partners who own and operate some 85 BP-branded service stations.

The refinery is a significant local employer, with more than 700 people employed, including contractors.

Between 2013 and 2015, three refineries in Australia closed as the refining industry faced significant challenges nationally and Australia became more reliant on imported fuel.

With on-going investment in refining technology, the BP Kwinana refinery emerged as Australia's most flexible refinery capable of producing cleaner fuels.

The company also invested in growing its retail fuels business over recent years and has opened new retail sites and truck stops, refreshed existing sites, launched premium fuels and introduced new offers to customers, including a loyalty program and a smartphone payment app.

The original State Agreement covering the Kwinana Refinery was due to expire in 2020.



The extension was formally agreed between BP and the State Government in October and included the addition of 'modernised terms' with a focus on ensuring local businesses continue to have access to supply chain opportunities generated by the refinery.

The renewal of the State Agreement enables the ongoing operation of the Kwinana Refinery as a significant contributor to the local economy, while giving the company certainty over future investment decisions.

BP has invested more than \$80 million in upcoming planned maintenance and investment activities, including its 2017 'turnaround' event.

For approximately seven weeks BP intends to undertake a major scheduled maintenance event – termed a 'turnaround', during which the processing units of the refinery are taken offline to inspect, clean and maintain equipment.

More than 1,800 additional people have been employed to work around the clock on what is the largest undertaking in its operational history, work that will contribute to ensuring the refinery runs efficiently up until its next maintenance period in four years.

"BP is proud of its long history of more than 60 years as part of the Kwinana community and working with local businesses," BP's Kwinana Refinery Manager Des Gillen said.

"The refinery is a vital strategic asset for Western Australia and the introduction of this bill to Parliament is a sign of the Government's commitment to ongoing employment and energy security for the State and the country.

"With more than \$80 million in upcoming planned maintenance and investment activities, we are committed to ongoing investment in the refinery to provide competitively priced fuels across the country." ■



The BP Kwinana Refinery is set to operate for another 30 years with the extension of a State Agreement. Photo: BP Australia

PUTTING WESTERN AUSTRALIA ON THE GLOBAL MENU

Feeding the world's taste for Western Australian produce is proving appetising, with almost 70 Western Australian companies signing on to the new export-focused agrifoods brand – Western Australia Worth Sharing.

The new branding initiative promotes Western Australian agrifood to key international markets by increasing awareness of Western Australia and its status as a reliable source of premium and safe products. The initiative is funded by Royalties For Regions through the Seizing the Opportunity Agriculture initiative.

A domestic launch for the new brand was held in Perth last October and an international launch was held in Singapore in mid-December.

In a show of support for the new brand, more than 20 of the Western Australian companies on board sent representatives to Singapore for the launch, where they were joined by then Premier Colin Barnett, State Development Minister Bill Marmion and more than 60 representatives from the Singapore food and beverage industry.

Singapore was chosen as the location for the first international launch as it is one of Western Australia's leading export markets. Two-way trade between the State and Singapore was valued at \$4.2 billion in 2015–16.

The Singapore launch combined traditional and digital marketing of television commercials and an information video featuring the brand and Western Australian products, aired to audiences in Singapore.

Department of State Development Executive Director of International Trade and Investment Stuart Crockett said that the key objective of Western Australia Worth Sharing was to build on the strong foundations the State has with regional trade partners and increase the State's agricultural exports.

"The Singapore market is representative of the demand across regional markets for high quality, safe, premium agrifoods," Mr Crockett said.

"We want to increase awareness of Western Australia and its agrifoods and aquaculture products globally in order to help grow our industry locally."

Mr Crockett said a wide range of Western Australian producers had joined the initiative, including meat and livestock; dairy; fruits and vegetables; grains and cereals; fish and seafood; and wine and beverage producers.

"Artisan food and oil producers have also signed on, as well as luxury product producers, that include honey, flour, salt, vinegar, jams and chutneys; and chocolate, essential oils, pearls and truffles," he said.

"Our local industry ensures that exports are clean and safe – and in demand by overseas consumers, particularly in neighbouring countries like Singapore, China, Indonesia, Japan, South Korea and Vietnam."

Local agrifoods producers are profiled on the Western Australia Worth Sharing website (www.westernaustraliaworthsharing.com) where short videos tell each company's story and a directory provides company website and contact details.

This year the branding campaign will be launched into China, Japan and other markets. ■



Adam Wilson, Great Southern Truffles Managing Director.

Great Southern Truffles

Adam Wilson is the Managing Director of Great Southern Truffles and was positive about the Western Australia Worth Sharing initiative after its international launch.

"It's good to see the Government is doing something to help producers," he said.

Mr Wilson thought the Western Australia Worth Sharing branding filled a need for agrifood producers.

"Western Australia Worth Sharing is a strong name, it works as the idea behind it, because our produce is fantastic and should be shared. We've been doing trade shows for about 10 years and WA hasn't had a consistent brand image. We need a consistent brand like this," Mr Wilson said.

"It is a lot about finding the right contacts. Opening channels between distributors and WA producers through the website is a very smart strategy, it has good links back to the producers.

"The program has my full support, and we hope it will benefit, in some way, all producers who are highlighted by the website."

Great Southern Truffles is one of Australia's pioneers in hunting and grading truffles with more than 15 years' experience. Products include fresh truffles, truffle oil, truffle mustard, truffle honey, truffle salsa and truffle aioli mayonnaise. ■



David Hand, Chaceon Deep Sea Live Managing Director.

Chaceon Deep Sea Live

Managing Director of Chaceon Deep Sea Live, David Hand was appreciative of the opportunity to strengthen the international profile of Western Australian produce through the new campaign.

“The Western Australia Worth Sharing initiative fitted in well with what we can bring to the international markets,” he said.

Mr Hand said the Western Australia Worth Sharing launch events “help strengthen our relationships with distributors and improve the profile of our unique products like Crystal Crabs.”

“We aren’t expecting to fill order books at these events, but you never know what contacts you might find,” he said.

“Aussie seafood already has a high profile in Asia, so this campaign does well to build on that. Australia as a whole is well known as a safe source of agrifood products, and efforts to differentiate Western Australia will help all WA exporters.”

Mr Hand believes educating clients and potential clients about the advantages of WA will help improve the brand now and in the longer term.

“This hasn’t been done for WA before, so it will be beneficial,” Mr Hand said.

Established in 2007, Chaceon has multiple boats based along the Western Australian coast, as well as a processing facility located in the Perth suburb of Osborne Park.

About 70 per cent of West Coast Crystal crab quota is controlled by Chaceon. ■



West Australian Corn Growers Director Jim Trandos on location in Singapore.

Campaign helps WA corn get on Singapore market shelves

The Western Australia Worth Sharing campaign is adding some needed incentive for Western Australian producers trying to get into new markets. Jim Trandos is the Director of West Australian Corn Growers and said the Western Australia Worth Sharing Singapore launch event gave him a perfect opportunity to put his Certified Organic Western Australian corn in front of the right people. “The launch demonstrated how serious we were about having a long term commitment to the Singapore market,” he said.

Mr Trandos reconnected with a long term prospect at the event and, as a result, was able to get West Australian Corn Growers certified organic corn into three Singapore supermarkets.

To make their corn ready for Singapore shoppers, West Australian Corn Growers considered every aspect of their product, making sure it had everything needed for success. This included the logistics of getting it to stores in good condition, independent certification, consumer friendly packaging and labelling.

Mr Trandos’ advice for people thinking of getting into the market was to talk to store managers. “Many are long term employees with lots of information and are passionate about their stores,” he said.

“Their information really helps when trying to make a product that suits the market, with things like getting the right information on the label. But, producers have to be organised and ready to get into the market with sufficient volume of product.”

Mr Trandos thought the initiative had a lot going for it. “They’re doing all the right things,” he said.

Mr Trandos also said “Australia is already internationally well known for a clean environment with stringent certification processes, and the Western Australia Worth Sharing campaign promotes the extra benefits of trading with Western Australia.” ■

GROWING TIES WITH INDIA

Western Australia and Andhra Pradesh have cemented their recent sister state agreement at a high-profile partnership summit hosted by the Indian state, during which more than 600 investment-related agreements with hundreds of companies were signed.

The Confederation of Indian Industry (CII) Partnership Summit 2017 was held in Andhra Pradesh's largest city, Visakhapatnam (known as 'Vizag'), in January and was attended by a Western Australian delegation led by Department of State Development Director General Steve Wood.

The CII Summit is now in its 23rd year and has become one of the most important international business events in India, with this year's event attended by nearly 5000 delegates from 51 countries, including 10 overseas trade ministers.

The Western Australian delegation included representatives from Perth City Council, Curtin University, Perth-based resources companies, and staff from the Departments of State Development and Mines and Petroleum.

During the summit, the Andhra Pradesh Government signed Memoranda of Understanding (MOUs) with hundreds of

companies, including Perth-based iron ore company NSL Consolidated Limited and Australian Indian Resources – a Perth-based company with gold and base metal exploration projects in India.

Western Australia was the first Australian state to establish an official presence in India when it opened its international trade and investment office in Mumbai in 1996.

Following official visits to India by the Western Australian Government in 2015, the Department of State Development was tasked with identifying an Indian partner for a sister state relationship with Western Australia – with Western Australia having already established successful formal



L-R: Department of State Development Regional Director, India, Peter Baldwin; Andhra Pradesh Chief Minister Hon. N. Chandrababu Naidu; and Australian Consul General for South India, Sean Kelly at the Partnership Summit.

relationships with Hyōgo Prefecture in Japan (since 1981); Zhejiang Province in China (since 1987); and East Java in Indonesia (since 1990).

The historic agreement with Andhra Pradesh was signed on 9 December, 2016 with the purpose of promoting closer engagement in all aspects of public life.

Under the agreement, Western Australia and Andhra Pradesh have agreed to maintain regular contact, carry out cooperation in a number of fields, and undertake exchanges including delegations, interaction between institutions (particularly

tertiary institutions), and the sharing of experience—the CII Summit marked the first such event under the agreement.

Director General Steve Wood, who was invited as an official speaker at the CII Summit, said Andhra Pradesh, an emerging mining, technology and agricultural hub, and Western Australia shared significant economic complementarity.

“Andhra Pradesh and Western Australia are both blessed with rich mineral resources, arable land and a long coastline,” Mr Wood said.

“This means the resources, agriculture and aquaculture industries are economically important for both jurisdictions.

“Andhra Pradesh is also commencing major infrastructure projects, including building a new State capital, ‘smart cities’ and transport infrastructure, which align well with Western Australia’s capabilities and interests.”

Four key economic areas are included in the sister state agreement between Western Australia and Andhra Pradesh, including:

- mining and mining services
- agriculture and fisheries processes and systems
- energy production and distribution
- higher and vocational education and training.

Mr Wood said that the two States had agreed to a number of potential projects within the four fields, which would explore opportunities for collaboration and knowledge sharing, while the growing Indian economy could expand future opportunities in other fields.

Continued next page



L-R: Hon. N. Chandrababu Naidu, Chief Minister of Andhra Pradesh and Department of State Development Director General Steve Wood.

About Andhra Pradesh

Andhra Pradesh is located in south-east India and is the country’s eighth largest state by area (160,205km² or 5 per cent of India by area), and tenth largest in terms of population (49.5 million or 4 per cent).

Andhra Pradesh’s mineral resources, arable land and long coastline mean that mining, agriculture and fishing are important contributors to the economy.

At current prices, Andhra Pradesh’s gross state domestic product (GSDP) was estimated at more than US\$85 billion in 2014–15. Between 2004–05 and 2014–15, the average annual GSDP growth rate was 11 per cent.

The current de facto capital city is Vijayawada. A new capital, Amaravati, is being planned. ■



A new capital for Andhra Pradesh is to be built on a greenfields site on the banks of the Krishna River at Amaravati.

“India has one of the world’s fastest growing economies with a large and growing middle class,” Mr Wood said.

“A strong relationship between Andhra Pradesh and Western Australia will assist Western Australian business to access the opportunities that growth is creating.

“While the agreement has an initial focus on particular fields there is also scope to broaden cooperation to include science and technology, infrastructure, water management, manufacturing, sport and culture.”

Andhra Pradesh’s gross domestic product was more than US\$85 billion in 2014–15, and has grown at an average of 11 per cent in the 10 years to 2014–15.

The sister state agreement between Western Australia and Andhra Pradesh has an initial term of five years, however, both States have committed to developing the relationship for decades to come.

Projects under the agreement will be funded from the existing budgets of the Department of State Development and the Western Australian Government’s international trade and investment office in Mumbai, India.

For more information on trade and investment with Western Australia, visit www.dsd.wa.gov.au ■

SISTER STATE RELATIONSHIP WITH ANDHRA PRADESH

**Department of Mines and Petroleum
Acting Deputy Director General
Rick Rogerson was a key member
of the large Western Australian
delegation that attended the Andhra
Pradesh Partnership Summit 2017
in India in January.**

“The WA delegation led by Department of State Development Director General Steve Wood dominated the Australian presence at the summit,” Mr Rogerson said.

“We certainly had a high profile with Mr Wood delivering a speech and the WA delegation having a private meeting with the Chief Minister, who stressed the importance of the Sister State agreement.”

Mr Rogerson said that Mr Naidu had established an impressive record as Chief Minister that included Andhra Pradesh achieving India’s highest economic growth rate by attracting industrial investment and creating jobs.

“The statistics tell a story of dynamic growth in a State that has 27 cities with populations of more than one million,” Mr Rogerson said.

“In 2015–16, Andhra Pradesh had a Gross State Product of \$US100 billion and an economic growth rate of 11 per cent.”

During the summit, the Andhra Pradesh Government signed more than 600 investment-related Memoranda of Understanding with hundreds of companies, representing a total investment value of \$20 billion and the potential for 2.25 million jobs.

“Although the aim of the summit was to attract investment into Andhra Pradesh, I spoke to representatives of a number of medium to large Indian companies who expressed interest in either investing in iron ore, manganese and other metals projects in WA, or in securing product offtake,” Mr Rogerson said. ■



NSL Consolidated Managing Director/CEO Cedric Goode with AP Economic Development Board CEO J. Krishna Kishore following the signing of an MOU.

.....

WESTERN AUSTRALIA'S COMMITMENT TO AFRICA REINFORCED AT MINING INDABA 2017

.....

The Western Australian Government has had a presence at the world's largest mining investment conference, Mining African Indaba, for the past five years and has watched first hand as it has grown from strength to strength.

Dedicated to the capitalisation and development of mining in Africa, the conference attracts more than 6000 delegates from global mining and exploration companies.

Delegates include international investors, African and non-African governments and a wide range of service providers, including mining equipment companies, mining services providers, investment banks and financial services firms, engineering and research services and law firms.

Australia, Canada and the United Kingdom had the largest presence at the event this year and the Western Australian and Queensland governments were both represented.

Department of Mines and Petroleum (DMP) Executive Director Environment Dr Phil Gorey said attending Mining Indaba 2017 has continued to reinforce Western Australia's commitment to Africa, its commitment to supporting responsible resource development and has raised the State's profile as a key supplier of services in to Africa.

"Having a presence at the conference and contributing to the program has considerably strengthened the relationships we have in Africa and the consolidated exposure to senior African ministers, government officials and the Australian Heads of Missions was very productive," he said.

"The Western Australian Government's support for responsible resource development in Africa is coordinated as part

of a Memorandum of Understanding signed in 2014 between the Western Australian Government and the Common Market for Eastern and Southern Africa (COMESA).

"This agreement is to assist building Africa's capacity to deliver enhanced mineral exploration and mining regimes, and promote ongoing education and training in mineral policy governance.

"In recent years, DMP has been collaborating with the Department of Foreign Affairs and Trade to deliver two-day mining policy workshops in Africa. These have been very well-received by the host countries, and have generated other collaborative opportunities between Western Australia and Africa."

Dr Gorey said the workshops also fostered partnerships for knowledge sharing and skills transfer to help ensure leading practice in Africa.

"They cover a range of topics including legislation and administration of a sustainable mining sector, using transparency to prevent disputes, land use

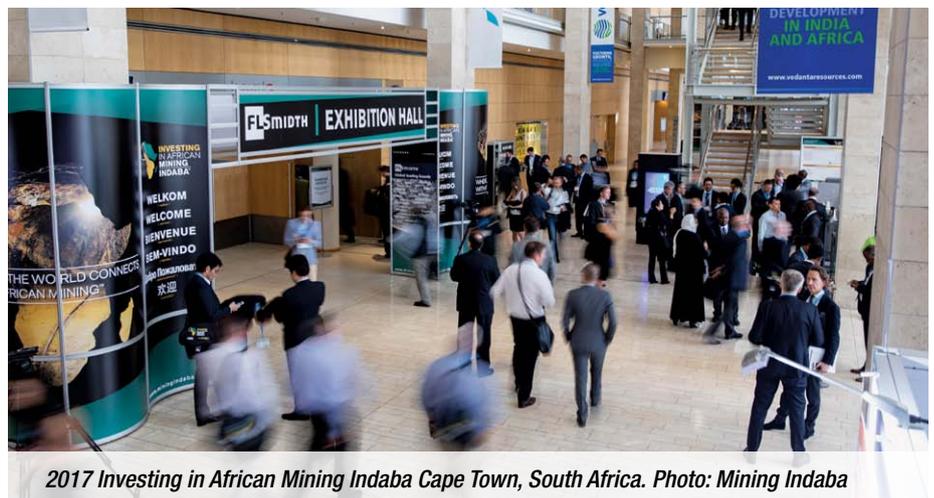
and land access, the use of geoscience information and royalties, revenue design and administration," he explained.

"The workshops give us the platform to share Western Australia's 120 years' experience in developing the mineral resources industry. We are encouraged that the African jurisdictions are keen to learn from us, and that the format of our presentations has been so well received to date."

Planning for further workshops in 2017 is now underway.

The presence of the Western Australian Government at Mining Indaba also provides continuity for the forums held by DMP and the Department of State Development at the Africa Down Under (ADU) forum.

Africa Down Under 2017, now in its 15th year, will run from Wednesday 6 to Friday 8 September 2017 at the Pan Pacific Hotel, in Perth. For more information, please visit: www.africadownunderconference.com. ■



2017 Investing in African Mining Indaba Cape Town, South Africa. Photo: Mining Indaba

FORGING THE WAY FOR IRANIAN INVESTMENT IN WESTERN AUSTRALIA

Iran ranks as one of the top 15 mineral rich countries in the world, and in addition to its large oil and gas resources, it has a wide range of commodities such as coal, iron ore, copper, lead and zinc.

According to one senior Western Australian Government official, however, Iran's magnetite iron ore reserves cannot meet future demand, and this will become a real issue for a country looking to increase its steel production by eight per cent per annum between now and 2020.

Department of Mines and Petroleum's (DMP) Environment Division Director of Operations Dr Marnie Leybourne, who recently delivered one of the key note speeches at the 2nd Iran Mines and Mining Industries (IMIS) conference, said it would be crucial for Iran to invest in other markets to meet its ambitious goals.

"With a large range of minerals and previous sanctions lifted in May last year, Iran is now in a position to engage with the rest of the world again and there is huge potential. Further development of the sector however, where investment in exploration is key, will not come without its challenges," Dr Leybourne explained.

"As I mentioned in my presentation, security of tenure, and quality and availability of information are a few areas that could relatively easily be improved."

Speaking to a large number of exploration and production companies, mining organisations, financial institutions and technology, as well as research bodies from government and industry, Dr Leybourne's presentation reached a wide, global audience.

It covered the similarities and opportunities between Western Australia and Iran, the possibilities of future partnerships to secure future iron ore sources and an overview of Western Australia's mining sector.

Dr Leybourne said DMP was encouraged by the opportunity to share Western Australia's expertise in innovation and responsible resource management that supports a vibrant mining sector here in WA.



Iranian delegation visits DMP. Back row: Tony Bullen, Shadi Sadegh, John Shute, Mr J.K Saclegh. Front row: Dr Tim Griffin, Mr M.V Sheikhzadeh, Dr Marnie Leybourne, Dr Sheikhz Adeh.

"The trip has been an unqualified success and, in our role to help international companies wanting to invest in WA, we have developed some really strong relationships with a broad range of organisations in Iran," Dr Leybourne said.

One such company, a major iron ore and steel provider, Fakoor Sanat Tehran (FST), is already maximising its new found partnership with Western Australia. One of the few privately owned resource companies in Iran, its directors visited Perth in February to explore the State's iron ore investment options.

FST Managing Director, Mr M.V. Sheikhzadeh, met with the department to explore ways in which to expand its operations and to better understand the ways in which the mining industry is regulated in Western Australia.

"Iran is aiming to produce 55 million tonnes of steel a year by 2020 and we are therefore very grateful for the opportunity to receive such an in depth overview of our options. We have been very impressed with the wealth of information provided by the Western Australian Government and Iran's interest in WA is now very high," he explained.

During the visit, the FST Directors were given training on the department's online database, which contains geological survey information for all the mines in the State.

Dr Leybourne said this would help them understand how much iron ore is available.

"We also gave the directors some training on DMP's mineral titles system, which provides extensive information on all mining tenements in the State, to enable the team to do further research on their return to Iran," she said.

Mr Sheikhzadeh advised that FST was also looking to assume a leadership role and facilitate other Iranian companies looking to invest in Western Australia in the future, in iron ore and other commodities. A senior level delegation hopes to visit Perth in a couple of months, including the Iranian Minister or Vice Minister for Mines.

With iron ore sales volumes reaching a record 757 million tonnes last year and WA confirmed as the world's largest exporter, now is the time for other jurisdictions to set their sights on the State. DMP will continue to do everything it can to highlight the economic benefits and to encourage international investment in the State. ■



Aerial view of the Chevron-operated Gorgon Project. Photo: Chevron Australia

GORGON PROJECT BOOSTS WA DOMESTIC GAS SUPPLIES

Western Australia's energy supply has been further secured with the first natural gas from the Chevron Australia operated Gorgon Project flowing into the State's integrated domestic system.

The important project milestone, announced in early December, saw Gorgon supply gas to the mainland. An initial 150 terajoules per day of gas is being supplied to customers under long-term contracts.

Foundation customer, Synergy has a long-term contract in place with the Gorgon Project for domestic gas supply for industrial, commercial and household use.

Combined with supply from domestic-only producers, natural gas accounts for 55 per cent of Western Australia's electricity generation and 40 per cent of industrial energy use.

Gas contributes to Western Australia's stationary energy mix along with coal, oil and renewables.

The State Government's domestic gas policy requires new gas developments to make available the equivalent of 15 per cent of their gas exports to the domestic gas market. Negotiation of domestic gas commitments is facilitated by the Department of State Development.

The department's Director General Steve Wood said successive governments have worked to ensure long-term security of domestic gas supply from liquefied natural gas (LNG) exporters since North West Shelf production commenced in 1984.

"The policy, which was formalised in 2006, means that, as a condition of project approval, LNG producers must reserve gas, develop and maintain access to supply infrastructure and market gas to domestic consumers," Mr Wood said.

"Western Australia is a large producer of gas, with around 90 per cent of Australia's estimated recoverable conventional gas reserves located in the Carnarvon and Browse Basins in the State's North West.

"These gas fields support Western Australia's LNG export industry, as well as the State's domestic gas market."

The Chevron-operated Gorgon Project is a joint venture between the Australian subsidiaries of Chevron (47.3 per cent), ExxonMobil (25 per cent), Shell (25 per cent), Osaka Gas (1.25 per cent), Tokyo Gas (1 per cent) and JERA (0.417 per cent).

Gorgon is one of the world's largest natural gas projects and the largest single-resource development in Australia.

Based on Barrow Island, 60 kilometres off the state's north west coast, the project comprises three LNG trains capable of producing 15.6 million tonnes of LNG a year, as well as a domestic gas plant.

Exports from the project are loaded via a 2.1 kilometre jetty while domestic gas is piped to the mainland via a 90km pipeline connecting the project to the Dampier to Bunbury Natural Gas Pipeline.

Along with the Gorgon Project, other LNG projects are supplying domestic gas.

Wheatstone's 200 terajoule a day domestic gas facility is scheduled to be finished in 2018 and new commitments agreed with the North West Shelf in 2015 will deliver around 100 terajoules a day over the next 20 years.

Domestic gas supply from LNG projects is expected to account for just over half of the State's domestic gas supply over the next decade. ■



The INPEX-led Ichthys Project. Photo: INPEX

Mega projects in WA

Shell is building the world's largest offshore floating liquefied natural gas (FLNG) facility, the Prelude Project, which will be located in the Browse Basin, off the coast of Western Australia.

The facility will be 488 metres long, 74 metres wide and weigh more than 600,000 tonnes. The company describes the facility as longer than four soccer fields and displacing six times as much water as the largest aircraft carrier.

The facility will produce, liquefy, store and transfer LNG (and potentially LPG and condensate) at sea before carriers ship it directly to markets.

Once complete, the facility will produce about 3.6 million tonnes per annum (Mtpa) of LNG, 1.3Mtpa of condensate, and 0.4Mtpa of LPG for export.

The facility will operate in the Browse Basin, more than 200 kilometres off the Kimberley coast, and remain moored for 25 years.

Also located in the Browse Basin, the Ichthys gas field is the largest discovery of hydrocarbon liquids in Australia in more than 40 years.

INPEX announced in January the successful installation completion of the subsea infrastructure and equipment for its Ichthys LNG Project.

Once complete, the INPEX-led Ichthys LNG project is expected to produce 8.9Mtpa of LNG and 1.6Mtpa of LPG, as well as 100,000 barrels of condensate a day at peak.

for use at sea, including hose-based solutions for the transfer of gas at sea.

Mr Holt said that Hoseco had continued to invest heavily each year in equipment, additional product ranges and employee training to meet the changing needs of industry.

"Hoseco has recently committed to an independent hose assembly factory designed to cater for growth in the oil and marine industry," he said.

"We have installed one of the largest pieces of external crimping equipment – up to 12 inch inside diameter hoses, as well as new testing equipment up to 65,000PSI to cater for the oil and marine industry.

"We are particularly proud to be a family-owned and operated WA business and grateful for the opportunities we have been given by some of the largest players in the oil and gas market worldwide." ■

WA'S HOSECO BECOMES AUSTRALIA'S LARGEST SUPPLIER

Western Australian owned company Hoseco has secured its lead as Australia's largest supplier of hose management, maintenance and supply services to the oil and gas industry thanks to recent supply contracts secured for big projects in the State.

In the past twelve months, Hoseco has secured major services and supply contracts with BHP Billiton Petroleum, Shell's Prelude FLNG project, the INPEX-led Ichthys LNG project, and the company recently signed an extension with ConocoPhillips's Australian Business Unit – West.

Hoseco Managing Director John Holt said that with these recent contracts to some of the world's leading gas producers, the WA company could now be recognised as the largest supplier of hose management services to the oil and gas industry nationally.

"It's a very exciting time for us in a difficult market but 2016 has seen the company secure significant long-term contracts in the oil, gas and marine space, and we have worked hard as a group to put ourselves in this position, so we are very proud of what we have achieved so far," Mr Holt said.

"We will now manage approximately 25,000 hose assemblies across the contracts which also include replacement assemblies."

Hoseco was established in Perth in 1999 and now operates from three locations across Australia.

The company services a wide range of markets including mining and mineral processing, agriculture, manufacturing and transport, as well as the oil and gas sector.

For oil and gas projects, the company has a range of specialist fluid handling products (more than 15,000 different hose and fitting solutions are available), including hoses for drilling applications and flexible pipelines and hoses for oil and gas transport, production and construction.

The production of liquefied natural gas (LNG) offshore presents gas companies with a unique set of challenges – with floating LNG facilities designed to produce, liquefy, store and transport LNG at sea, wave motion, as well as the effects of winds and currents, presents major challenges.

Large gas companies, including Shell, have addressed the challenges during the design process for their FLNG projects (see above right), adapting traditional technology used on land-based facilities

APPROVAL OF WA'S LARGEST GAS STORAGE FACILITY TO ENHANCE ENERGY SECURITY



Aerial view of the Tubridgi gas well site.

Western Australia's largest gas storage facility is expected to be operational by mid-2017 following the signing of an agreement in January between the State Government and DDG Tubridgi Pty Ltd.

With an expected total construction cost of \$69 million, the facility will utilise the company's depleted Tubridgi onshore gas reservoir about 30km from Onslow in the State's North West.

The project is strategically located in close proximity to the Chevron-operated Wheatstone and BHP-operated Macedon domestic gas production facilities, and will be connected to the Dampier to Bunbury Natural Gas Pipeline by existing gas transmission laterals.

The Department of Mines and Petroleum's (DMP) Executive Director Petroleum Jeff Haworth said the project would play an important role in enhancing energy security in Western Australia when fully operational.

"The Tubridgi facility will enable banking of unused gas to cover planned production facility outages," Mr Haworth said.

The agreement provides for effective regulation in respect of safety, environmental and resource management associated with injection, storage and recovery of petroleum.

CITIC Pacific, developer and operator of the Sino Iron magnetite project at Cape Preston, will be the foundation customer under a 10-year gas storage agreement with DDG, with options for a further five years.

DDG Tubridgi Pty Ltd is currently negotiating with other companies in the region to sign additional contracts.

The facility has a storage capacity of around 42 petajoules with daily injection and withdrawal rates of around 50 terrajoules a day.

One of the advantages of the project is that the reservoir is quite shallow at approximately 550 metres, which means the required injection pressures are low.

The reservoir has excellent permeability and pressure support through an active aquifer that ensures almost constant rates of deliverability when the field moves to production.

DDG Chief Executive Officer Stuart Johnston said the facility would benefit producers and customers requiring storage capacity to bank unused gas, smooth production profiles or to store gas to cover planned production outages.

"In developing the project to this stage we are very pleased with the support we received from the traditional owners, the Thalanyji people and local landowners," Mr Johnston said.

"Support from government agencies, particularly DMP, has also enabled DDG to quickly progress to a final investment decision."

An innovative approach in the project design involves the use of fibre optic cable in the Tubridgi wells which provides valuable well monitoring capability in realtime.

This provides an up to date view of the gas water contact, which is a key variable for determining reservoir performance during gas storage operations. Importantly the measurements can be made without interruption of operations as the fibre is installed in the casing string. ■

WESTERN AUSTRALIA POISED TO INCREASE PROMINENCE IN GLOBAL LITHIUM MARKET



Mt Cattlin. Photo courtesy Galaxy Resources

The Department of Mines and Petroleum (DMP) has been keeping a close watch on Western Australia's lithium industry. Already a key player in the global lithium industry, Western Australia appears set to increase its prominence.

Western Australia has the largest resources of pegmatite-hosted lithium in the world and in 2013 it became the world's largest producer of lithium. The State's share of lithium production increased from 27 per cent in 2006 to 45 per cent in 2015.

Demand for lithium continues to grow and explorers and investors have shown keen interest in the lithium market as supply shortages drive up prices.

Underscoring burgeoning interest in the State's lithium resources is a \$400 million lithium processing plant now under construction, two mines coming online, and renewed exploration activity in the Pilbara region.

Until recently, Talison Lithium's Greenbushes project 250km south of Perth, owned by China's Tianqi Lithium and US global specialty chemicals giant Abermarle Corporation, was Western Australia's sole producer.

Lithium bearing ore from Greenbushes is processed, upgraded and sold as spodumene concentrate with an average grade of around six per cent lithium oxide (Li₂O). It is exported to be converted into lithium carbonate and lithium hydroxide. However, Tianqi Lithium is now constructing a \$400 million lithium hydroxide plant at Kwinana, south of Perth, with plans to double the capacity of the Greenbushes mine to produce 24,000 tonnes a year of lithium hydroxide for export.

The Mount Cattlin project is about 2km north of Ravensthorpe and owned and operated by Galaxy Resources. Mount Cattlin previously produced spodumene concentrate between 2011 and 2013 and in December 2016 it restarted full-time production. The project made its first shipment to China in early January 2017, a major milestone in its plans to produce 160,000 tonnes for 2017.

WA's lithium industry is also expanding through the Mount Marion mine which achieved its first shipment on 7 February this year. Near the Goldfields town of Coolgardie and owned by Reed Industrial Minerals, the Mount Marion mine is a joint venture project between Neometals (13.8 per cent), Mineral Resources (43.1 per cent) and Jiangxi Ganfeng Lithium Co. (43.1 per cent).

In September last year, Neometals and Mineral Resources announced the signing of a Memorandum of Understanding to develop a lithium processing plant near the Mount Marion operation to produce battery-quality lithium hydroxide suitable for direct sales to the lithium ion battery industry.

There are another two advanced spodumene projects at Pilgangoora in the Pilbara region, owned by Pilbara Mining and Altura Mining.

These projects are expected to progress to a final investment decision, financing, and construction in early 2017 for production in late 2017 to early 2018. Altura Mining commenced construction in March 2017.

Projects in Western Australia face competition from a host of developments around the world with WA's main competitors being the low cost brine producers in Chile, China and Argentina. Brine processing operations involve evaporation techniques and as such are much less complex, less energy intensive and cheaper to operate.

However, WA's lithium deposits are at an advantage being of a higher grade and in a low sovereign risk and sound economic location meaning they are well positioned to fill rising demand in the next few years.



Ellendale Diamond mine pit.

.....

WA LEADS THE WAY IN MINE SITE REHABILITATION

.....

2016 has been deemed a year of success for the Department of Mines and Petroleum’s Abandoned Mines Program, all made possible thanks to the Mining Rehabilitation Fund.

The Department of Mines and Petroleum’s (DMP) vision to launch a pioneering initiative to address the potential increase in ‘unfunded’ rehabilitation liability for abandoned mine sites across the State became a reality almost three years ago after more than two years of extensive stakeholder consultation by DMP.

The Mining Rehabilitation Fund (MRF), launched in July 2013 with wide support from the mining and resources sector, is a pooled fund contributed to annually by Western Australian mining tenement holders granted under the *Mining Act 1978* (Mining Act).

The levy paid is determined by the different types and areas of ground and environmental disturbance present on each tenement. This information is outlined in a tenement holder report provided to DMP each levy period. The MRF contributions are then available to finance the rehabilitation of abandoned mines, after all other efforts to recover funds from the tenement holders have been exhausted.

The introduction of the MRF does not alter the requirement for tenement holders to continue to meet all required environmental and rehabilitation conditions of approval.

DMP’s Executive Director Environment Dr Phil Gorey said having access to this disturbance data is just one of the innovative outcomes of the MRF.

“Western Australia is the first jurisdiction in the world to have this sort of data to hand and we can now establish how much land across the State is disturbed and rehabilitated each year by exploration and mining activities. Gathering the disturbance data in this way has been invaluable, especially considering the size and scale of the industry in Western Australia,” Dr Gorey said.



In addition to generating yearly data, the MRF has also largely replaced Unconditional Performance Bonds (UPBs) which were previously in place as security to meet environmental conditions imposed on a mining tenement if the tenement holder failed to meet obligations.

“The majority of tenement holders have had their UPBs retired, however in some circumstances, where there is a high risk that the rehabilitation liability could revert to the State, the tenement holder has to contribute to the MRF and provide a bond. Nevertheless, since the introduction of the MRF, more than \$1 billion in UPBs has been returned to the mining sector, allowing companies to invest in progressive rehabilitation or develop projects.”

The interest generated from the MRF can also be used to rehabilitate legacy abandoned mine sites in Western Australia.

“This is an entirely unique situation for Government, as for the first time it has a dedicated, legislated, special purpose account where the funds are quarantined and can’t be used for any other purpose,” Dr Gorey explained.

The launch of the MRF has also allowed for the department’s Abandoned Mines Program to become a reality. Officially established last year, the program provides a whole-of-government framework for prioritising the management and rehabilitation of abandoned mines across the State. It currently consists of four pilot projects – Black Diamond Pit Lake in the

State’s South West, Pro-Force Plant Site and Bulong Nickel Tailings Storage Facility in the Goldfields, and Elverdton Dump located on WA’s South East coast. As historical abandoned mines sites, the rehabilitation of these projects is being funded from the interest generated by the MRF.

Black Diamond, located approximately five kilometres west of Collie in the South West of Western Australia, was chosen as the first of the four pilot sites to be rehabilitated as part of DMP’s Abandoned Mines Program due to the local community’s safety concerns, one fatality and a number of injuries at the site over the years. Black Diamond was mined for coal between

the late 1940s and early 1950s by Amalgamated Collieries Pty Ltd but since mining ceased there, the pit had filled with water creating a pit lake and had become an unmanaged recreation area.

Following six months’ extensive stakeholder consultation and engagement, works to batter the southern pit wall and manage erosion on the western end and southern side of the pit lake were carried out successfully and completed in October 2016.

The second of the four pilot sites to receive funding from the interest generated by the MRF was the Pro-Force site. Located approximately two kilometres south-east of Coolgardie in Western Australia, Pro-



Ellendale Diamond mine processing facility.

Force was a former gold processing site previously operated from 1996 to 2004.

The derelict processing plant and other site features had been in situ for more than a decade and were an ongoing public safety concern for the Shire of Coolgardie and the local community.

In consultation with the community and other key Pro-Force stakeholders, the rehabilitation works successfully removed the abandoned processing infrastructure and rubbish from the site, eliminating the immediate safety risk associated with these features. Earthworks were also undertaken to improve aesthetics and contribute to the environmental conditions.

Commenting on the success of the works on the first two pilot sites, Black Diamond and Pro-Force, Dr Gorey said early consultation with stakeholders had been key to the accomplishments so far.

“Through stakeholder identification workshops, DMP was able to approach representative regulatory bodies, interest groups, land owners and local government. Partnerships with the relevant Shires, other government departments and universities have also proved to be hugely beneficial.” Dr Gorey said.

“Regular and appropriate engagement with our partners and working groups has enabled DMP to ensure the community has had a direct say in the post mining land use, in spite of both sites having extremely different requirements.”

“The Black Diamond Working Group indicated a preference for a safe and managed recreation area, whereas Pro-Force is still available for future mining. Our approach to community engagement and consultation for these two very different proposals was proportional to the scale, nature and stakeholder interest.”

Dr Gorey advised that going forward in 2017, DMP will continue to support the Black Diamond Working Group to consider transitioning into a ‘Friends of Black Diamond’ community group, as well as identify an appropriate land manager and potential sources of funding to support the community finalise the development of the recreation area.

“Similarly, at Pro-Force we will work with stakeholders to finalise the revegetation this year, consistent with the communities’ views that the works undertaken do not affect future mining and exploration plans for the area,” he said.

This year will also herald the start of the planning for the two remaining pilot sites, Bulong and Elverdton.



Black Diamond pit wall before works commenced.



Black Diamond pit wall following works.



Black Diamond pit wall following works.

Bulong, an abandoned nickel mine, was forfeited in 2013 after the owners were put into administration in 2005. The biggest legacy left by this mine is its tailings storage facility (TSF), which is causing potential dust contamination to the surrounding environment.

Likewise with Elverdton, an abandoned copper mine at Ravensthorpe on the State's south coast, the operating company forfeited the mining lease in 1992. The company left behind a quantity of uncontained tailings on the site that have been eroding downstream into the Steere

River, which has long concerned the local community.

Dr Gorey commented that DMP representatives will be visiting both sites this year.

“Using our stakeholder identification and rating tool, firstly we will identify the key stakeholders for each site, just as we've done on previous projects. We will also be bringing our technical experts and carrying out feasibility studies to ensure we have all the baseline information and knowledge necessary to start stakeholder discussions,” he said.

“It’s crucial we present all the facts so that stakeholders can make an informed decision as to their preference for the post mining land use.”

“It’s hard work but post mining land use is definitely achievable. Occasionally though, we may make a decision like in the case of Pro-Force and Ellendale Diamond Mine, the fifth Abandoned Mines Program project, that the best outcome is to get the project back into an operational site,” he said.

Ellendale Diamond Mine in the Kimberley is the first project to be financed by the principal of the MRF. The previous operator had been paying into the MRF for two years when it was abandoned in 2015 and Dr Gorey said the project represents a real success story for the MRF and the Abandoned Mines program.

“The primary focus at Ellendale was to ensure the TSF was protected through some of the wettest conditions seen in December in Western Australia for many years,” he said.

Failure of the TSF would have meant a larger cost and clean-up operation for any potentially interested party and DMP had to take reasonable steps to protect the facility. Cyclone Yvette dumped a massive amount of rain but through the construction of 45 rock beds and the installation of 19 catchment baffles to reduce the size of water catchment areas across the top of the TSF, the department has promptly addressed these concerns.

“With the MRF in place, we were able to access the funds quickly and pull on our technical expertise to get the site back to one that is safe, stable and non-polluting. We’re hopeful Ellendale will be operational again in the near future,” Dr Gorey said.

More information on the MRF and the Abandoned Mines Program, including project timelines and updates, can be found at www.dmp.wa.gov.au/AbandonedMineProjects.

Alternatively send an email to: AbandonedMines@dmp.wa.gov.au or call +61 8 9222 3402. ■



Pro-force plant and scrap material before the rehabilitation works in February 2016.



Works removed 9.75 tonnes of miscellaneous scrap material from the site at Pro-force.



Bulong evaporation pond.



Internal road at the Bulong tailing storage facility.



LET'S TALK ABOUT MENTAL HEALTH AND WELLBEING



Tyler Van der Mewe and Amy Douglas-Martens.

The mental health of workers in the resources industry has been an important focus for the Department of Mines and Petroleum Resources Safety Division for a number of years. It is a topic that has been featured in the department's Mines Safety Roadshows and included in guidance material, such as codes of practice and guidelines.

Last year, the department released a psychosocial harm audit tool and guide, and conducted an audit of more than 140 companies. This included reviewing management systems, resourcing,

consultation and the preventative measures put in place to protect employees' mental health and wellbeing.

DMP Resources Safety Executive Director Simon Ridge said while the department acknowledged the complexity of psychosocial harms, it was important to address the risks within an overall safety and health management system.

"The objective of this initial audit program was to establish a baseline against which to measure future progress in mental health risk management in Western Australia's resources sector," Mr Ridge said.

"Risks to psychological and physical health due to work should be viewed in the same manner as other workplace risks. The results from this initial audit program have shown that there are areas for improvement across the four key criteria, however the most significant area for improvement is in the level of consultation with the workforce on mental health and wellbeing strategies".

The four criteria used to analyse the results were:

- management systems that address mental wellbeing

- resourcing of systems relating to mental wellbeing
- consultation with workforce on mental wellbeing strategies
- preventative and protective measures in place.

"It is important that the prevention of work related stressors is incorporated into all health and safety procedures and these results have shown that there is still much to be done in this space," Mr Ridge said.

The results of this baseline study were presented to the Mining Industry Advisory Committee (MIAC) Mental Health Strategies Working Group, which is tasked with identifying a framework to support good practice for managing mental health and wellbeing in resources sector workplaces.

While creating a mentally healthy workplace is everyone's responsibility, effective change in the right direction requires leadership. In line with this, the department is working closely with the MIAC Working Group to consolidate information and the tools currently available to industry operators to improve their planning and risk mitigation.

The department has also appointed its first Mental Health and Wellbeing Inspector of Mines.

Amy Douglas-Martens is a registered psychologist experienced in the application of psychology to clinical and industrial settings, including the resources sector.

Ms Douglas-Martens will work as a part of the mines inspectorate team to assist with the development of safety and health protocols designed to protect mental health and wellbeing, as well as physical safety.

“Our long-term goal is not only to give operators and their employees the necessary tools to manage mental health and the associated risks, but also to increase their confidence in putting the tools into action,” Ms Douglas-Martens said.

Protecting mental health is at the top of many agendas, however the saturation of information makes it difficult for operators to apply the learnings to their health and safety plans.

“One requirement is to make this information more accessible for the people who are developing workplace health and safety plans and to provide them with support in deciding where to begin,” Ms Douglas-Martens said.

“While our focus is on the mining and extractive resources industries directly, any good work that we do in this area represents a real opportunity to also impact positively on the mental health and lives of the broader WA community.”

As well as the recruitment of Ms Douglas-Martens, one of the department’s new graduate officers specialises in mental health and wellbeing.

Tyler van der Merwe joined the department in January this year and will focus on mental health and wellbeing in the resources sector.

“I’ve been given an opportunity to pursue my passion and turn it into a career,” Ms van der Merwe said.

Currently working with the Resources Safety Division, Ms van der Merwe said stigma appears to still be the number one barrier to people seeking help and she looks forward to influencing change.

“As a graduate, it’s exciting to be working for the department during a period of change, there is lots of work happening behind the scenes to consolidate the information that is available to operators and the creation of the new inspector role shows that DMP is dedicated to increasing resources in this area,” Ms van der Merwe said. ■

WA’s resources safety regulation gets tick of approval



The Mines Safety Branch of Western Australia’s regulatory body for the mining sector was recently given the tick of approval following an independent assessment.

Deloitte Consulting found that the Department of Mines and Petroleum is collegiate, focused on helping

industry and improving safety performance and appears to be more cost-effective than other safety jurisdictions in Australia.

A recommendation from the report has been implemented immediately to formalise the department’s information provided to Western Australian mine sites for risk assessment and management.

The department has undertaken analysis of injury reports from 2000 to 2015, for incidents which resulted in fatalities or serious injuries in the industry.

This data has been used to develop a Hazard Register, which identifies hazardous tasks and the occupational groups most at risk. It provides industry and inspectors with useful information to help prevent future incidents.

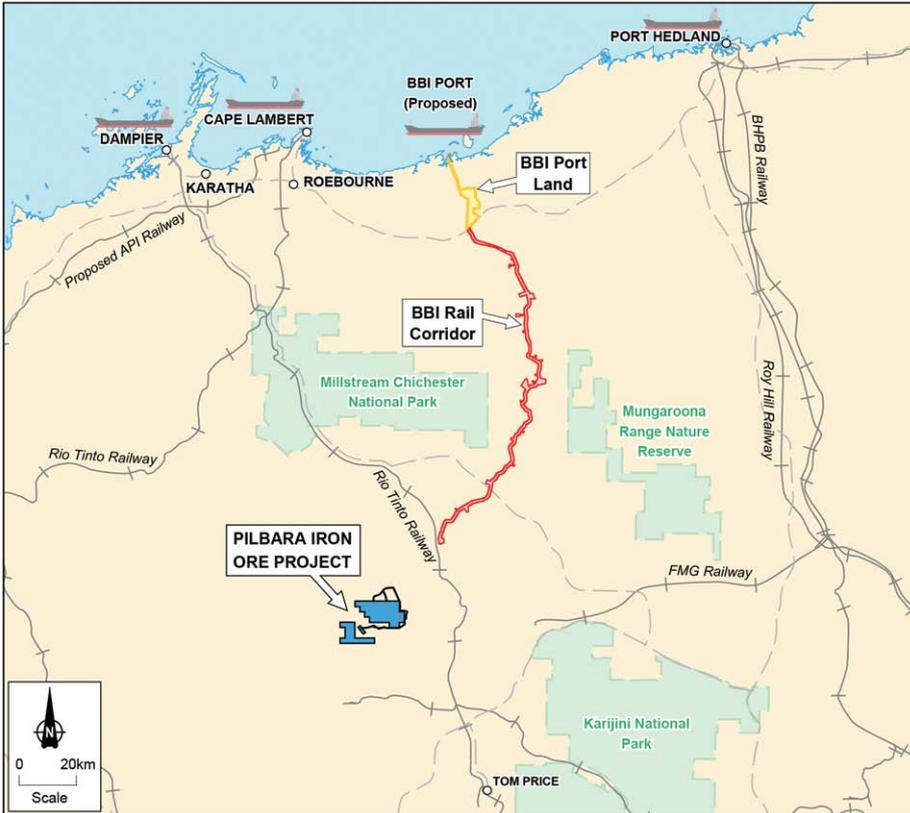
Mines Safety Director and State Mining Engineer Andrew Chaplyn said the register would give operators the

ability to better circumnavigate hazards associated with their site.

“By analysing and detailing the fatal and serious incidents that have occurred during the past 15 years, we are able to provide insights into the precautions or preventative measures that can avoid future incidents,” Mr Chaplyn said.

“We are committed to sharing any information that will eliminate the number of fatal and significant incidents that unfortunately continue to happen in the Western Australian mining industry.” ■

BILLION DOLLAR BALLA BALLA



Balla Balla BBI Project. Photo: BBI Group

A proposal to develop a new \$5.6 billion infrastructure and iron ore project in the Pilbara that includes railway and port facilities has taken a leap forward with the execution of a State Agreement by the Western Australian Government.

The Balla Balla Infrastructure Group Ltd (BBI Group) is proposing to develop its BBI Project that proposes to haul iron ore from a foundation customer, Flinders Mines Pilbara Iron Ore Project (PIO), located about 60 kilometres north-west of the town of Tom Price.

The project includes about 162 kilometres of new heavy haulage railway and a 38 kilometre conveyor, and will have an initial capacity of 50 million tonnes per annum of iron ore.

A ratified State Agreement for the new railway is required, as tenure for private railways in the Pilbara requires a special Act of Parliament.

The ratified State Agreement will provide tenure within the rail corridor and the granting of a special railway licence for the construction, operation and maintenance of the private railway.

The new transshipment port and stockyard facilities, to be located between existing facilities at Cape Lambert and Port Hedland, will be developed under the *Port Authorities Act 1999* and the mines associated with the project under the *Mining Act 1978*.

The State Agreement was negotiated and agreed by the Department of State Development in consultation with stakeholders and paves the way for development of the BBI Project, creating opportunities for companies to invest in the project.

BBI Group estimates that the project, including PIOP, will generate some 3400 jobs during construction and 915 jobs once operational.

Department of State Development Deputy Director General Resources and Industry Development, Geoffrey Wedgwood said the new export facilities, proposed to be located at Balla Balla, near Whim Creek on the Pilbara Coast, would bring future benefits.

“A dedicated railway for the transport and export of iron ore from the Pilbara Iron Ore Project mining areas to Balla Balla, will further facilitate the development of the resources sector,” Mr Wedgwood said.

“Provision for third-party access may provide future opportunities for other emerging mining companies to make use of the railway.

“The Agreement has a term of 20 years, with provision for two 10-year extensions. It also contains provisions for local content reporting and a community benefits package.”

BBI Group is majority-owned (88 per cent) by the Todd Corporation, a private New Zealand company. The remaining 12 per cent is owned by Australian private company NyCo. ■

THE WORLD OF MAPS IS BECOMING VIRTUALLY LIMITLESS



L-R: Senior Geoscientist Dr Tim Ivanic, Geologist Sarah Goss, Database Geologist Dr Terry Farrell and Acting Chief Geoscientist Dr Simon Johnson.

Map making has come a long way from the days when cartographers used illustrations of sea monsters and galleons to fill in unknown areas on a map.

Google Earth has turned maps into interactive adventures, inspiring a new generation of digital mapmakers like the Department of Mines and Petroleum (DMP) officers responsible for creating virtual tours through Western Australia's geological landscape.

Senior Geoscientist Dr Tim Ivanic views it as "The beginning of the end for traditional flat maps."

Dr Ivanic worked with Acting Chief Geoscientist Dr Simon Johnson, Database Geologist Dr Terry Farrell, and Geologist Sarah Goss to create one of the three virtual tours showcased at the Geological Survey of Western Australia's Open Day in February this year.

One of the tours – Discovery Trails to Early Earth – started the digital ball rolling in 2014 for a book on the geology of the East Pilbara region by Senior Editor Jean Johnston and former DMP officer Dr Martin Van Kranendonk.

Geoscience General Manager Stephen Bandy wrote scripts to run inside Google Earth, bringing the book to virtual life.

"This was our first attempt to use a web-based tour to allow people, particularly people overseas, to visualise the geology

and also be able to read the descriptions taken from extracts from the book," Mr Bandy said.

The East Pilbara tour was followed by a more technical effort created by Dr Ivanic and his colleagues billed as a 'Virtual tour of the mafic-ultramafic intrusions of the Youanmi Terrane' that focused on the Murchison region.

The approach differed, but the aim was the same – to boost interest in, and add value to, two-dimensional maps, field guides and paper publications.

Dr Ivanic was writing a field guide of the Youanmi project for a nickel conference when he realised it would be "fairly easy" to translate that report into a virtual tour using Google Earth.

"So we did it, and it was so much more interesting than a downloadable pdf," he said.

The team is now working on finishing a virtual tour of meteor impact craters across the State, which was previewed at the open day.

Dr Johnson is enthusiastic about the future of DMP's virtual tours.

"You can go out in the field and do a tour with a field guide booklet and when you get back to the office, you end up putting it on a shelf to gather dust," he said.

"That seems crazy when you could instead store that information as a virtual tour on

your computer and be able to relive the experience.

"Next up I think we'll be looking at traditional areas such as the Capricorn Orogen and the Kimberley and Pilbara."

Dr Johnson also believes the days of the paper map are numbered and he and the team are keen to further spice things up by adding video from a drone.

"By using a drone we could add an intermediary scale between Google Earth at 250 or so metres above and being on the ground, and that's something we're not seeing at the moment," he said.

"With drones we will be able to use photographic software to create beautiful high resolution images of a outcrop from, say, 5 to 10 metres above it.

"We will be able to use software to create complete, seamless images that can be rotated and viewed at different angles."

Dr Johnson said that images could also be perfectly spatially rectified, enabling the computer to run detailed statistical geological analyses.

"The ultimate aim is to deliver an automatic process that creates a field guide as a virtual tour using drone vision, and a publication all at the same time," he said.

"It would be the icing on the cake." ■



(L-R) Assistant Director, Don Flint, DMP Acting Director General Dr Tim Griffin, former Minister for Mines and Petroleum Sean L'Strange and DMP EIS coordinator Margaret Ellis.

CUTTING EDGE GEOSCIENCE DOMINATES 2017 GSWA OPEN DAY

The launch of two interactive virtual tours created by Department of Mines and Petroleum geoscientists was among the highlights of the 2017 Geological Survey of WA (GSWA) Open Day held in February.

The virtual tours included a journey from Marble Bar through the East Pilbara, taking in the remnants of gigantic volcanic eruptions, and a more technical tour of the Youanmi Terrane in the Yilgarn Craton based on a published field guide.

Held in Fremantle, the event also featured the formal announcement of Round 15 of the Exploration Incentive Scheme's (EIS) flagship Co-funded Drilling Program, which offers about \$5 million in co-funding for innovative drilling to be undertaken in the 2017–18 financial year.

As one of the most important events on the Western Australian resources industry calendar, the open day lived up to its reputation, showcasing the latest geological information and major activities undertaken by the Geological Survey.

Perth's geological community turned out in force for presentations on the latest results from GSWA's geoscience programs, including collaborative research with Geoscience Australia, CSIRO, the Centre for Exploration Targeting, Curtin University, and other partner organisations.

GSWA Acting Executive Director Dr Ian Tyler said the event also featured 11 presentations by experts in the associated areas of geology and geoscience, covering a range of areas including the Pilbara, Eastern Goldfields, Musgrave Province, northern Perth Basin, the Kimberley Basin and the east Albany-Fraser Orogen.

"Our annual Open Day provides the latest updates to geologists and companies in a relaxed setting that encourages questions and feedback along with the chance to network," he said.

"It is a tremendous way to increase the exploration industry's understanding of the geology of various parts of the State and it encourages continuing exploration success through innovative targeting using

new geoscience datasets funded through the Exploration Incentive Scheme.

"Thanks to funding through the EIS, GSWA has been able to make tremendous strides in recent years in geoscience and mapping, helping explorers to target new discoveries.

"Each round of the co-funded drilling program is keenly contested by explorers seeking funding and is one of the most visible components of the EIS.

"However, the breakthroughs and new developments in geoscience, mapping and our business systems owe a great debt to the scheme that we are acknowledging today by showcasing our achievements."

Dr Tyler said that \$130 million had been invested in the EIS since 2009 and now, with funding from July 2017, it would continue to receive \$10 million a year until June 2020.

Applications for Round 15 of the co-funded drilling program are open until 5pm on 7 April 2017.



Dr Michael Wingate presenting on Mafic dyke swarms across Western Australia.

Along with the annual extensive poster display as well as demonstrations of online systems to access data and information, other highlights included:

- New mapping releases including areas of the West Capricorn, Murchison, West Musgrave, South Yilgarn, Tanami–Arunta, Kimberley and East Yilgarn.
- The announcement of a seamless geological interpretation of the Eastern Goldfields between Leinster and Norseman, based on published 1: 100,000-scale mapping enhanced by EIS-funded geochronological, geochemical, isotopic and geophysical data.
- News of new digital products being compiled to cover the south-east Capricorn basins, and the Fortescue and Hamersley basins in the southern Pilbara.
- New geophysical survey products, including publicly accessible geophysical datasets.
- Updates on collaborative geoscience projects being carried out in Western Australia in cooperation with the Centre for Exploration Targeting (CET) at The University of Western Australia, Curtin University, CSIRO, and Geoscience Australia.



- A presentation of a collaborative project by CET, GSWA and the Minerals Research Institute of WA that identifies tools for discovering iron ore deposits in the Pilbara Craton.
- New business systems were demonstrated, including the latest updates for GeoVIEW.WA, GSWA's award-winning geoscientific web application, and a new version of the Western Australian Petroleum and Geothermal Information Management System (WAPIMS). ■



Department of Mines and Petroleum AWARDS FOR EXCELLENCE

Golden Gecko • Community Partnership • Safety & Health

AWARDS TO RECOGNISE EXCELLENCE IN WESTERN AUSTRALIA'S RESOURCES SECTOR

The Department of Mines and Petroleum's Awards for Excellence 2017 will incorporate for the first time three different areas recognising excellence in the resources industry.

The Safety and Health awards will join the prestigious Golden Gecko and second annual Community Partnership Awards, acknowledging innovation, outstanding performance and leadership.

Recognising excellence in environmental management and community partnerships that go above and beyond the norm, the two existing awards strive to ensure that the State's resources are developed in a responsible manner for the benefit of all Western Australians.

Promoting leadership and innovation, the new Safety and Health awards will encourage continuous improvement and solutions to workplace safety and health, pushing Western Australia's resources sector to be one of the safest on the world's stage.

DMP Acting Director General Dr Tim Griffin said the awards provided the perfect platform to showcase and celebrate industry advances and innovation.

"Striving for excellence in health, safety, social and environmental responsibility

is something the department strongly encourages, and helps to raise standards that benefit the community and industry," he said.

"The calibre of entries has demonstrated a determination to proactively advance and promote environmental excellence, and the importance of community partnerships in the resources sector. I am sure 2017 will be no different."

Midwest Economic and Employment Development Aboriginal Corporation (MEEDAC) and magnetite miner Karara Mining Limited won the inaugural Community Partnership award in 2016 for their commercial farm project, Innovation Park.

MEEDAC Midwest Business Development Manager, Milton Milloy said the Community Partnership Awards provided the perfect opportunity to share their passion and learnings, and proudly showcase their partnership with Karara Mining.

"Since winning the award we plan to expand on the current project by introducing indigenous food production, a native seed orchard, and we are also investigating other exciting projects to increase the farm's production and employment opportunities," Mr Milton said.

"The partnership with Karara Mining has helped us promote healthy eating within our community, grow employment skills and gave the participants a sense of self-worth."

Environment and communities manager for Karara Mining Rhys Houlihan echoed Mr Milloy's sentiments saying their partnership was "something really special in our community".

"This award has helped us to further connect with our community and to provide a wider range of potential employment opportunities – on the back of the initial success at Innovation Park, Karara Mining has secured two MEEDAC staff to work on a full-time basis with us," Mr Houlihan said.

Nominations for the Safety and Health Awards, Golden Gecko Awards for environmental excellence and the Community Partnership Awards close on Monday 10 April 2017.

Winners will be announced at the Awards for Excellence Ceremony in October.

More information on eligibility and the criteria for each of the awards can be found on DMP's website www.dmp.wa.gov.au/awardsforexcellence. ■



L-R: Dr Huaiyu Yuan, Dr Klaus Gessner and Dr Liang Zhao stand next to the monitoring station in Broome.

DMP TESTS EARTHQUAKE RECORDING SITE IN BROOME

As part of a joint project with China recording seismic data from distant earthquakes, the Department of Mines and Petroleum (DMP) has installed a temporary monitoring station at Broome in Western Australia's North West.

The project is the first stage of a joint project with Macquarie University, The University of Western Australia and the Chinese Academy of Sciences.

DMP 3D Geoscience Manager Dr Klaus Gessner, Dr Liang Zhao from the academy, and Dr Huaiyu Yuan from Macquarie are testing the temporary site as a precursor to a more widespread deployment of seismometers in the State's Kimberley and Pilbara regions in the future.

"Thanks to the Water Corporation granting access to its Broome North Wastewater Treatment Plant, scientists are now using a new site for seismic tomography to look deep inside the earth's crust," Dr Gessner said.

"This is the first stage of a joint project with Macquarie, and the Chinese Academy of Sciences will be providing seismometers worth up to \$30,000 each as part of a collaborative research arrangement under a Memorandum of Understanding with the Geological Survey of Western Australia (GSWA).

"At the moment we don't understand the deep crustal structure of the Canning Basin and seismic tomography will give us a clearer picture."

Dr Gessner said that the deployment would also provide better data on seismic activity across north-west Australia.

"The results will give GSWA a better understanding of WA's geological structure and seismicity that provide long-term

benefit to explorers and the community alike," he said.

The Broome monitoring station is a relatively simple setup that involves burying the seismometer in a large plastic vessel.

The seismometer and recording equipment are powered by a car battery charged by a solar panel installed above the equipment. ■



The seismometer inside a plastic vessel before being buried.



Department of Mines and Petroleum Mineral Titles Executive Director Dr Ivor Roberts tracks down a tenement with new TENGGRAPH web.

NEW MAPPING SYSTEM TRIALLED

A new online version of the Department of Mines and Petroleum's (DMP) highly popular TENGGRAPH mapping system is being tested before being rolled out in coming months.

TENGGRAPH displays the position of Western Australian mining tenements and petroleum titles, giving an accurate picture of land under mining activity, and is used to determine ground available for mineral exploration.

DMP Mineral Titles Executive Director Dr Ivor Roberts said TENGGRAPH has been a valuable and reliable resource for explorers since 1992 when it first functioned as a mainframe system, but was showing its age and had links to technology that is no longer supported.

"TENGGRAPH has served the department well over the years and we have had a great return on our investment, but it does

not provide the seamless coverage of the entire State that the new browser-based system does," he said.

"It also doesn't provide image data and all the other bells and whistles that the new system offers."

Dr Roberts said that the new TENGGRAPH Web is a more business oriented system with a strong focus on tenements, approvals and increased functionality.

"It is streets ahead of the old system, but it will not be a totally new experience for people using DMP's interactive geological mapping system, GeoVIEW.WA, because there are commonalities with the TENGGRAPH Web interface," he said.

"High quality maps can be produced with TENGGRAPH Web, it has a new interface that uses the same pan and zoom mouse commands as Google Maps and it has the ability for users to include overlays of geology and topography."

The new system will operate in tandem with the old TENGGRAPH to give people the ability to use both systems until they are comfortable with TENGGRAPH Web.

"Usage will be monitored and we expect most people to migrate to the new system within about a month of the roll out, but we will continue to provide access to the old TENGGRAPH for some time," Dr Roberts said.

"We are gathering feedback from selected external users during the testing period and will continue to seek feedback from all users after the new system is rolled out."

DMP will be providing opportunities for local users to register for training in Perth and Kalgoorlie, while how-to videos will be posted on the department's website for users further abroad. ■

TENGRAPH FACT FILE

- TENGRAPH Web provides links to other DMP systems including:
 - Mineral Titles Online.
 - Petroleum and Geothermal Register (PGR).
 - WAMEX (mining tenement open file exploration reports).
 - MINEDEX (mine site and mineral deposit information).
- TENGRAPH Online has about 12,000 registered users.
- Being solely web-based, users will access TENGRAPH Web directly through DMP's servers, rather than through a separate (CITRIX) platform.
- The new interface uses the same pan and zoom mouse commands as Google Maps and GeoVIEW.WA.
- The new system retains all existing TENGRAPH features such as links to Google Earth, Mineral Titles Online, WAMEX, MINEDEX and PGR, plotting tools and custom colouring objects.
- Layers are easier to turn on and off.
- High quality maps can be printed from the new system.
- Geology and topography overlays are included.
- Transparency slider bars can be used to change the visibility on the map.
- Users can save results from searches and selections to a CSV file or shapefile (geospatial vector data format) for use in other Geographic Information Systems (GIS).
- Users can add shapefiles by dragging a file directly onto the map display.
- Landgate aerial photography can be displayed.
- Users have easy access to scanned historical tenement maps.
- TENGRAPH Web will benefit external users through:
 - Improved access to DMP spatial and non-spatial information.
 - Better service delivery by enhanced functionality.
 - Improved appraisal processes integrated with eLodgement.
 - Ability to rapidly respond to industry or legislative change because TENGRAPH Web is consistent with the department's spatial data infrastructure.

AGRICULTURE

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

The State Government has invested \$322m to construct irrigation channels, roads and off-farm infrastructure to encourage private investment in irrigated agriculture on the Ord lands in the East Kimberley Region. Kimberley Agricultural Investment (KAI), a subsidiary of China's Shanghai Zhongfu Group, is developing leased farm land on the Goomig Plain, with a future option to lease and develop the Knox Plain, a total of 13,400ha. KAI is seeking to establish a sugar industry in the Kununurra region, subject to future land availability, and in the short term is producing chia and maize for export. The State has recently released a further 5,000ha of Ord West Bank and Mantinea lands to KAI and TFS Corp. Ltd, established producers of sandalwood.

Expenditure: \$322m.

IRON ORE

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

The Roy Hill Iron Ore Project is located 115km north of Newman and owned by Roy Hill Holdings Pty Ltd, a private company majority owned by Hancock Prospecting Pty Ltd, with key international investment partners. Capital expenditure for the project was \$10b. Roy Hill took operational control of the mine, rail and port infrastructure from EPC Contractor Samsung C&T in February 2016, and signed off on Project Practical Completion in May 2016. Roy Hill is currently ramping up to full name plate production capacity of 55Mtpa by Q2 2017. The project is planned to produce high grade ore for 20 years following ramp-up. The project consists of a multiple pit mining operation, mine processing infrastructure, a 344km heavy haul railway, and significant new port facilities at the Port Hedland inner harbour.

Expenditure: \$10b.

Employment: Construction: 5300; 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. The project will be the largest magnetite mining and processing development in Australia, with a mine life of more than 25 years. Six processing lines are now operational. The first shipment of magnetite concentrate to China occurred in late 2013. The project comprises in-pit crushers, a 29km slurry pipeline, a pellet plant and annual capacity to produce up to 24 million tonnes of magnetite concentrate. The downstream processing facility has required significant investment in dedicated supporting infrastructure including a new port facility, a 51 giga-litre desalination plant and a 450 megawatt combined cycle gas fired power station.

Expenditure: \$11.1b.

Employment: Construction: 4000; Operation: 1000

OIL & GAS DEVELOPMENTS

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

The Greater Western Flank Phase 1 Project to develop the Goodwyn GH and Tidepole fields, via a subsea tie-back to the existing Goodwyn A Platform has been successfully completed by Woodside Energy. First gas was produced from the Goodwyn GH field in late 2015 and production from the Tidepole field commenced in Q4 2016.

Expenditure: \$2.5b.

LITHIUM

Kwinana – Tianqi Lithium Processing Project**TIANQI LITHIUM AUSTRALIA PTY LTD**

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

Expenditure: \$608m.

Employment: Construction: 500; Operation: 115

OIL & GAS DEVELOPMENTS

Carnarvon Basin – Greater Western Flank Phase 2**WOODSIDE ENERGY**

The Greater Western Flank 2 Project was approved in December 2015 and will develop gas and condensate from the Keast, Dockrell, Sculptor, Rankin, Lady Nora and Pemberton fields via a subsea tieback to the existing Goodwyn platform. The project has awarded most major contracts and commenced manufacturing and fabricating key project infrastructure. The project is expecting start-up from the initial tranche of five wells in 2H 2019, with the remaining three wells expected in 1H 2020.

Expenditure: \$2.8b.

Carnarvon Basin – Persephone Project**WOODSIDE ENERGY**

Woodside Energy Ltd, as operator of the North West Shelf Joint Venture is developing the Persephone gas field. The development involves two subsea wells and an 8km subsea tieback to the existing North Rankin Complex. Fabrication activities and offshore brownfield work has commenced, with start-up expected in Q3 2017.

Expenditure: \$1.2b.

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

The Gorgon Foundation Project on Barrow Island, now in its eighth year of construction, is a three train LNG development with a nameplate capacity of 15.6Mtpa and includes a domestic gas plant capable of delivering at least 300TJ/d of gas to the mainland. Cost estimates for the project construction are expected to total more than A\$55b. The project involves the processing of gas from both the Gorgon and Jansz/lo gas fields and includes potentially the largest commercial CO₂ geosequestration project in the world. Train one start up and first shipment of LNG commenced in March 2016. Train two produced first LNG in October 2016 and train three is expected to be commissioned early in 2017.

Expenditure: \$55b.

Employment: Construction: 8000; Operation: 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 of LNG and have a 200TJ per day domestic gas plant connected to the Dampier-to-Bunbury Natural Gas Pipeline. The project is targeting first LNG by mid-year 2017.

Expenditure: \$40b.

Employment: Construction: 7200;

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, 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 activities are largely complete and the project has now moved into the commissioning phase with an expected completion of mid-2017.

Expenditure: \$570m.

Employment: Construction: 250; Operation: 20

AGRICULTURE

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

Seafarms Group is a Queensland based producer of farmed prawns. Seafarms proposes to invest up to US\$1.45b over the next eight years in Project Sea Dragon, a large scale, integrated, land based aquaculture project to produce black tiger prawns for export markets in Asia. The aquaculture component of the project will be located in the Northern Territory and is planned as a staged development commencing with Stage 1, 1,000 hectares of ponds and supporting infrastructure. In Western Australia a founder stock and quarantine centre is operational in Exmouth, a processing plant is proposed for Kununurra, and subject to competitive tender Wyndham port will be utilised for export and import. The project will create approximately 300 jobs in the Kimberley during construction, 150 direct jobs in the region at Stage 1 building to 700 direct jobs when fully operational. Seafarms Group expect to commence development during 2017.

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-leucoxene 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 interested in becoming a strategic partner in the project.

Expenditure: \$173m.

Employment: Construction: 170; Operation: 110

Thunderbird Mineral Sands Project SHEFFIELD RESOURCES

The Sheffield Resources' Thunderbird Mineral Sands Project is located in the Kimberley region on the Dampier Peninsula 70 kilometres west of Derby and 30km north of the sealed Great Northern Highway joining Derby and Broome. The Thunderbird deposit is one of the largest mineral sands discoveries of the last 30 years and the first major mineral sand deposit discovered in the Canning Basin. Thunderbird has an estimated 42 year mine life and will produce significant quantities of zircon and titanium mineral products, extracted from the mineral sands deposit during its long period of operation. Thunderbird's current valuable heavy mineral ore reserve is 5.92Mt Zircon, 1.84Mt HiTi Leucoxene, 1.77Mt Leucoxene and 21.10Mt Ilmenite. The deposit is zircon rich which is different to many other mineral sand deposits. Products will be transported in bulk and packaged formats by road to the ports of Derby and Broome respectively and exported by ship to customers. The company is planning to begin construction in the second half of 2017 and commence production in 2019. The environmental impact of the project is considered to be low as the mine will be progressively rehabilitated as the mineral sands are extracted from the ground

Expenditure: \$348m.

Employment: Construction: 300; Operation: 140

INFRASTRUCTURE

Bunbury – Multi-User Bulk Terminal Facility – Port of Bunbury

LANCO RESOURCES AUSTRALIA PTY LTD

Lanco Resources Australia Pty Ltd proposes to construct a 15Mtpa multi-user bulk terminal facility located at the Berth 14A site within the inner harbour of the Port of Bunbury. The facility will include ship loading for up to 85,000 tonnes, fully covered and dust suppressed conveyor galleries and storage shed with internal stacker reclaimer. The train unloading and rail loop load in facility will be able to accommodate coal, iron ore, bauxite and other bulk ore materials. The terminal will have capacity to expand. Environmental approvals have been obtained for the project.

Expenditure: \$400m.

Employment: Construction: 750; Operation: 100

West Kimberley – 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'.

IRON ORE

Pilbara – Balla Balla Infrastructure Project BALLA BALLA JOINT VENTURE

The Balla Balla Infrastructure project proposes to construct and operate a 165km railway connecting the Flinders Mines Ltd's Pilbara Iron Ore Project, located in the central Pilbara as its foundation customer, to a proposed transhipment and stockyard facility at Balla Balla, situated midway between Karratha and Port Hedland.

The Railway (BBI Rail Aus Pty Ltd) Agreement 2017 was executed between the State, the Company and the Guarantors on 23 January 2017. The State Agreement will now form part of a Bill to be introduced into Parliament before September 2017.

Expenditure: \$5.6b.

Employment: Construction: 3300; Operation: 900

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 is proposed to be transported by a 282km heavy haul railway for export via the proposed multi-user port at Anketell. State and Federal environmental approvals for the mine, rail and port elements of the project are in place. Subject to the successful completion of feasibility studies, and receipt of final regulatory approvals, the company anticipates construction to commence following a decision to proceed by the joint venturers and completion of funding arrangements.

Expenditure: \$6.8b.

Employment: Construction: 1500; Operational: 900

OIL & GAS DEVELOPMENTS

Canning Basin – Buru Canning Basin Tight Gas

BURU ENERGY

The Buru Energy/Mitsubishi joint venture (JV) is appraising the commercial potential of the Laurel Formation, a large onshore natural gas resource located in the Canning Basin. Following the successful completion of the 2015 tight gas stimulation program on and near Noonkanbah Station, Buru commissioned DeGolyer and MacNaughton, a specialist tight gas and unconventional resource assessment consulting group to undertake an independent assessment of the gas and liquids potential of the Laurel Formation in the Valhalla area. This independent assessment has confirmed that the region contains a significant wet gas accumulation. The JV recently executed native title Agreements with the Yungngora and Warlangurru people covering the recently tested Asgard and Valhalla wells. The agreements provide for, amongst other matters, the support of the Yungngora and Warlangurru people for the future grant of the tenure required for the further development of the gas resources in the area.

Expenditure: \$40m.

Employment: Construction: 100; 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 project received State environmental approval on 16 January 2017.

Cameco will advance the project at a pace aligned with market conditions.

Employment: Construction: 500; Operation: 225

Mulga Rock Project VIMY RESOURCES

The Vimy Resources Mulga Rock Project is located 240 km east-north-east of Kalgoorlie in Western Australia. The project will involve shallow open pit mining of four poly-metallic deposits with commercial grades of uranium. The project has a life of mine of 16 years and will produce 1,360t of uranium oxide concentrate (UOC) annually. The total Ore Reserve of 31.2Mlb of U3O8 underpins a +10 year mine life with additional six years mining inventory, with an associated Ore Resource of 76.8Mlb of U3O8. The Mulga Rock Project received State environmental approval on 16 December 2016 and Federal environmental approval on 2 March 2017. The Definitive Feasibility Study (DFS) for the Project will be completed at the end of March 2017. Pilot metallurgical testing of the orebody has produced a quantity of UOC which will be exported in Q2 2017 to selected converters to confirm ore specifications. Final Investment Decision (FID) for the project is expected in 2018, with an aim of targeting first production in 2019.

Expenditure: \$450m.

Employment: Construction: 550; Operation: 490

Wiluna Uranium Project TORO ENERGY

Toro's Wiluna Uranium Project is located 30km from the town of Wiluna in central Western Australia. Wiluna consists of four key deposits – the State and Federal environmentally approved deposits of Centipede and Lake Way and the State environmentally approved Millipede and Lake Maitland deposits – and two early stage development properties of Dawson-Hinkler and Nowthanna. Federal government environmental approval for mining the Millipede and Lake Maitland deposits is anticipated in Q2 2017.

Employment: Construction: 300; Operation: 170

Kintyre JOINT VENTURE CAMECO-MITSUBISHI DEVELOPMENT PTY LTD.

Kintyre is an advanced-stage, joint venture exploration project between Cameco and Mitsubishi Development Pty Ltd. Cameco owns 70 per cent of the project and is the operator. The project is located in the East Pilbara region of Western Australia, approximately 80km south of Telfer and 260km northeast of Newman at the western edge of the Great Sandy Desert. An Indigenous Land Use Agreement (ILUA) was signed with traditional owners, the Martu, in 2012 and the project received environmental approval in 2015. Cameco will advance the project at a pace aligned with market conditions.

Employment Construction: 400; Operation: 450

PROSPECT

Prospect ONLINE

Did you know you can register for the digital edition of *Prospect* for free by signing up to the RSS feed on the *Prospect* page of DMP's website? Once registered, you will receive notification as soon as a new edition of *Prospect* is available to view online.

Just go to:

www.dmp.wa.gov.au/prospect

to sign up.

You can also register and pay for hard copy subscriptions on the *Prospect* webpage.

Are your contact details up-to-date?

If your contact details are changing or have changed you can now update them online.

www.dmp.wa.gov.au/prospect

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\$130 billion worth of projects either committed or under consideration for the State during the next few years. These would create more than 27000 construction jobs and more than 5000 permanent jobs.

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

Significant Projects as at January 2017

	Project Value (estimated A\$m)	Employment	
		Construction	Permanent
Iron and Steel			
API Management Pty Ltd – West Pilbara Iron Ore Project	6800	1500	900
CITIC Pacific – Cape Preston Mine & Processing Projects	11100	4000	1000
Roy Hill Infrastructure Pty Ltd – Roy Hill Iron Ore Mine & Infrastructure	10000	5300	2000
Sub Total	27900	10800	3900
Oil, Gas and Condensate			
Browse LNG Precinct	n/a	n/a	n/a
Buru Energy – Buru Canning Basin Tight Gas	40	100	30
Chevron – Wheatstone LNG	40000	7200	400
Gorgon Joint Venture Gas Processing Project	55000	8000	300
Woodside Energy – Greater Western Flank Phase 1	2500	n/a	n/a
Woodside Energy – Greater Western Flank Phase 2	2800	n/a	n/a
Woodside Energy – Persephone	1200	n/a	n/a
Sub Total	101540	15300	730
Other			
Cameco Australia – Yeelirrie Uranium	n/a	500	225
Lanco Resources Australia Pty Ltd – Multi-User Bulk Terminal Facility – Port of Bunbury	400	750	100
Sheffield Resources – Thunderbird Mineral Sands Project	348	300	140
Vimy Resources – Mulga Rock Project	450	550	490
Toro Energy – Wiluna Uranium Project	n/a	300	170
Cameco – Mitsubishi Development Pty Ltd – Kintyre	n/a	400	450
Ord East Kimberley Expansion Project	322	n/a	n/a
TransAlta – South Hedland Power Station	570	250	20
Sub Total	2090	3050	1595
TOTAL	131530	29150	6225

All currency figures are in Australian dollars unless otherwise specified.

Abbreviations Key

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



Major Resource Projects

March 2017



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

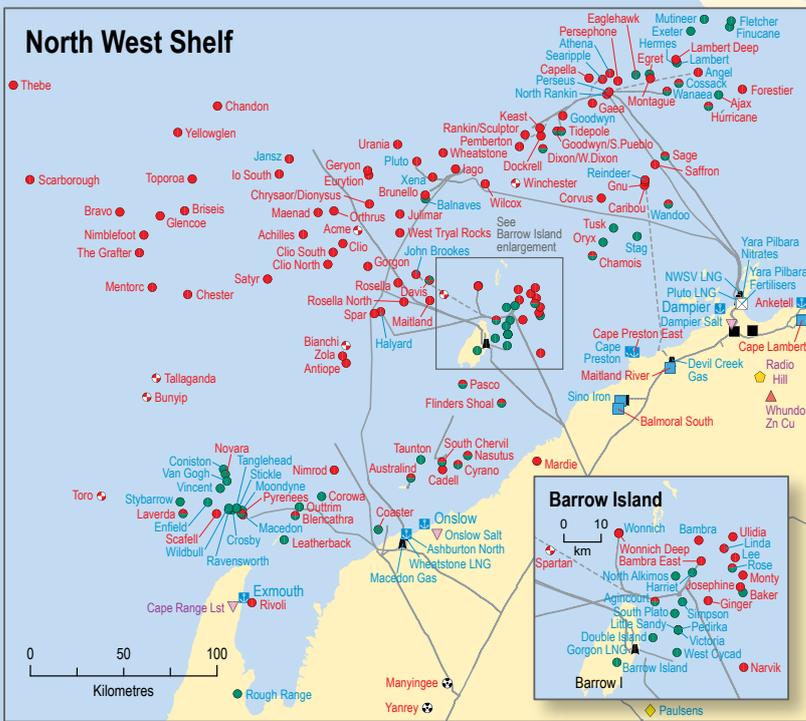
Enquiries for latest information for Commonwealth controlled waters is available from the National Offshore Petroleum Titles Administrator (NOPTA) at <info@nopta.gov.au>



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



North West Shelf



Major Resource Projects

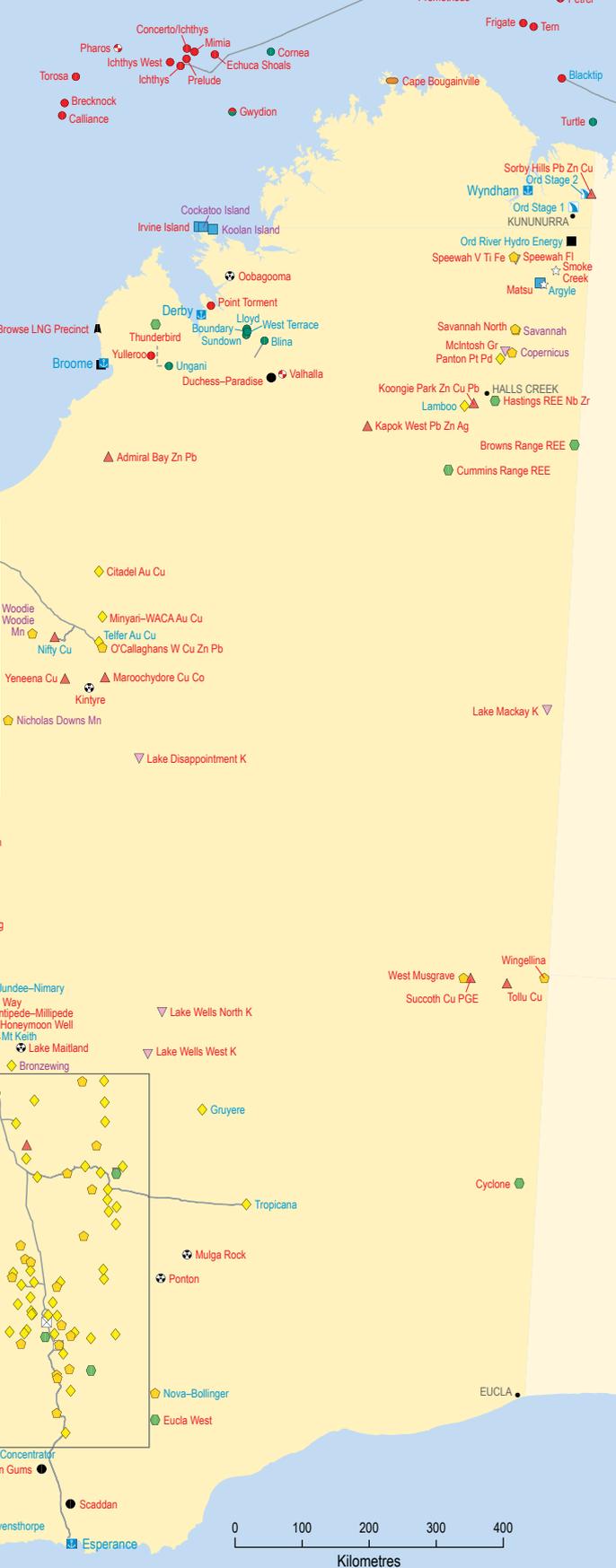
March 2017

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
- Kin..... Kaolin
- Li..... Lithium
- Lst..... Limestone
- LNG..... Liquefied natural gas
- Mag..... Magnetite
- Mn..... Manganese
- Nb..... Niobium
- Ni..... Nickel
- Pb..... Lead
- Pd..... Palladium
- PGE..... Platinum group elements
- Pt..... Platinum
- REE..... Rare earth elements
- Ta..... Tantalum
- Ti..... Titanium
- V..... Vanadium
- W..... Tungsten
- Zn..... Zinc
- Zr..... Zirconium

Mineral symbols

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

Petroleum symbols

- Gas field
- Oil field
- Oil and gas field
- Significant gas discovery
- Significant oil discovery
- Significant oil and gas discovery
- ▲ Processing plant
- Oil / gas pipeline, operating
- - - Oil / gas pipeline, proposed

Infrastructure

- Power plant
- ▵ Irrigation / water / desalination
- Port

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



Government of Western Australia
Department of Mines and Petroleum