

Extraordinary demand

Western Australia's resources sector surges ahead

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An optimistic future

This year has seen huge investment in Western Australia's resources sector with new capital growth in the State totalling more than A\$30billion in the 2009-10 financial year. During the same period, Western Australia's exports exceeded A\$83billion.

Currently, private investment in LNG and natural gas projects, underway, committed or close to commitment, totals more than A\$140billion. Across the whole resources sector, the figure totals A\$176billion.

With an A\$170billion pipeline of projects underway or likely to get underway in this State over the next five years, Western Australia is establishing itself as a significant investment destination.

Massive investment in our resources sector is generating powerful economic and employment growth in our State while underpinning our growing importance to the national economy.

It's also creating exciting new opportunities for Western Australian businesses and industries.

The Western Australian Government welcomes investment in our State and is working to ensure that appropriate industrial infrastructure is available to attract and support investment in WA.

There is currently an enormous amount of activity taking place across the state and, as we sit on the cusp of a multi-billion dollar investment cycle in our resources sector, 2011 promises strong future growth for the resources industry in Western Australia.

Colin Barnett
PREMIER OF WESTERN AUSTRALIA & MINISTER FOR STATE DEVELOPMENT

Norman Moore
MINISTER FOR MINES AND PETROLEUM

Prospect

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Cover photo: Hydrogeology Superintendent Damon Greenhalgh monitoring flow and water levels into an injection bore at Fortescue Metals Group's Cloudbreak iron ore mine in Western Australia's Pilbara region. Photo courtesy of Fortescue Metals Group.

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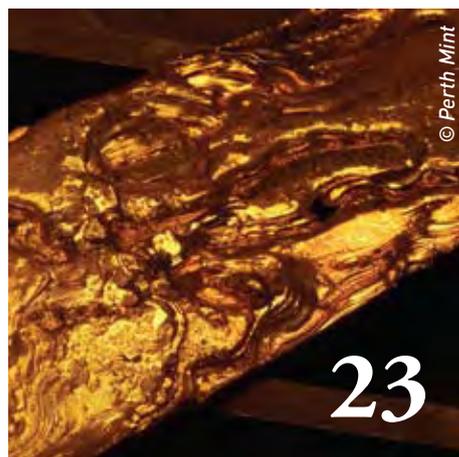
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KING SOLOMON

BIG PLANS FOR FORTESCUE METALS GROUP



To the west of Fortescue Metal Groups' Chichester Hub, north of the Karijini National Park border and about 70 kilometres from Tom Price, sits the company's Solomon project – a planned 60 million tonnes per annum iron ore project consisting of two large open-pit mines and supporting infrastructure.

Fortescue is looking to expand the company's mining operations in the Pilbara through the development of Solomon's two mines – Firetail and Kings.

The Firetail and Kings deposits are expected to produce a combined total of up to 60 million tonnes per annum (Mtpa) of iron ore.

Firetail will launch the company's operations at Solomon, with the deposit consisting of high grade bedded ore.

Overall, the Solomon ore body is more than 65 kilometres long, making it one of the longest iron ore deposits in the world.

The project will have a big impact on the Pilbara region, with infrastructure expansions to open access to Solomon and the greater Western Pilbara.

"The decision to go ahead with the Solomon Hub will enable Fortescue to leverage its existing infrastructure and its massive land holding across the Pilbara to exponentially increase product sales within key markets of Asia, Europe and Australia," Fortescue Chief Executive Officer Andrew Forrest said.

Ore from the two mines will be loaded onto the heavy haul rail network direct to market. Fortescue's current rail lines comprise the fastest, heaviest haul rail network in the world.

The Solomon Hub is the company's key to ongoing expansion plans, with the project initially providing 60Mtpa to Asian markets.

The Firetail and Kings mines form Stage One of the project, with a second stage planned which has identified resources of 1.1 billion tonnes of iron ore to date.

Start up production from the second stage of Solomon of 20Mtpa is scheduled for 2014, with aspirations to expand the entire Solomon Hub, stages one and two to approximately 160Mtpa by 2017.



Ore from Solomon's two mines will be loaded onto the heavy haul rail network direct to market - Fortescue's current rail lines comprise the fastest, heaviest haul rail network in the world. Image courtesy of Fortescue.

The second stage of the Solomon project will include a new 250 kilometre railway linking the mines to berths and ship loading facilities at the multi-user deepwater port to be built at Anketell.

The Fortescue Board approved plans for the development of the initial stage of the Solomon Hub in late November and, subject to Government approvals, a two year construction period will commence in 2011.

"After years of planning for the next phase of development, the depth of management experience and breadth of construction and operational expertise will enable Fortescue to rapidly achieve its growth ambitions within a sector that is underpinned by an extraordinary demand profile," Mr Forrest said. ■



Fortescue Metals Groups' three hub strategy.

AWARD WINNING WATER PROJECT SEES FMG TREADING LIGHTLY

In a NASA image showing the top half of Western Australia from outer space, a green area can clearly be seen reaching out across the central Pilbara region in stark contrast to the surrounding landscape.

This is the Fortescue Marshes, a 100,000 hectare wetland system stretching 200 kilometres in length and up to 10 kilometres wide.

The extensive wetlands are considered nationally significant – the area is an important breeding site for native bird populations and is on the National Wetland Register.

On the northern edge of the Fortescue Marsh sits Fortescue Metals Group's Cloudbreak iron ore mine, one of the largest single iron ore mines in the world.

Cloudbreak is part of FMG's Chichester Hub, an A\$3.2 billion iron ore mine, rail and port development with a 20 year life span that will include a 90 million tonnes per annum iron ore mining project at Cloudbreak and Christmas Creek, located in the Chichester Ranges.

The Chichester project is serviced by a multi-user railway and port facilities at Port Hedland and is fully contracted to supply to China.

Currently operating at 40Mtpa, the Cloudbreak mining area will eventually extend over a strike length of 40 kilometres.

The Cloudbreak mine is hosted by the Marra Mamba Formation aquifer, a groundwater system that extends beneath the Fortescue Marshes.

With 90 per cent of the ore body located below the water table, effective water

management is integral to the success of the Cloudbreak operation and to ensuring that the equilibrium of the surrounding eco-system is maintained well into the future.

The award-winning water team for the Cloudbreak project are working to do just that.

The FMG water team have implemented a Managed Aquifer Recharge (MAR) approach, designed to mitigate the environmental impacts of dewatering and process water supply, while conserving water resources for future use.

The system has been running successfully for the past two years and, at its current capacity of 25 gigalitres per year, it is one of the largest and most complex MAR schemes in Australia.

"The scale of the current operation establishes the Cloudbreak MAR scheme as one of the largest successfully operating schemes of its kind in Australia, and certainly the largest MAR project for a mining operation," FMG Principal Hydrogeologist Jed Youngs said.

"The system is a first of its kind in a variable density groundwater setting and it's located within a complex and sensitive groundwater environment.

"The Marra Mamba Formation aquifer contains a lens of fresh to brackish groundwater underlain by a hypersaline groundwater system that extends beneath the Fortescue Marsh – an internally-draining wetland.

"While ninety per cent of the ore body is below the water table, the dewatering

yields are very high and far exceed site requirements.

"We're using the MAR scheme as our primary water management tool to bank fresher waters for future use and to maintain ecological water requirements."

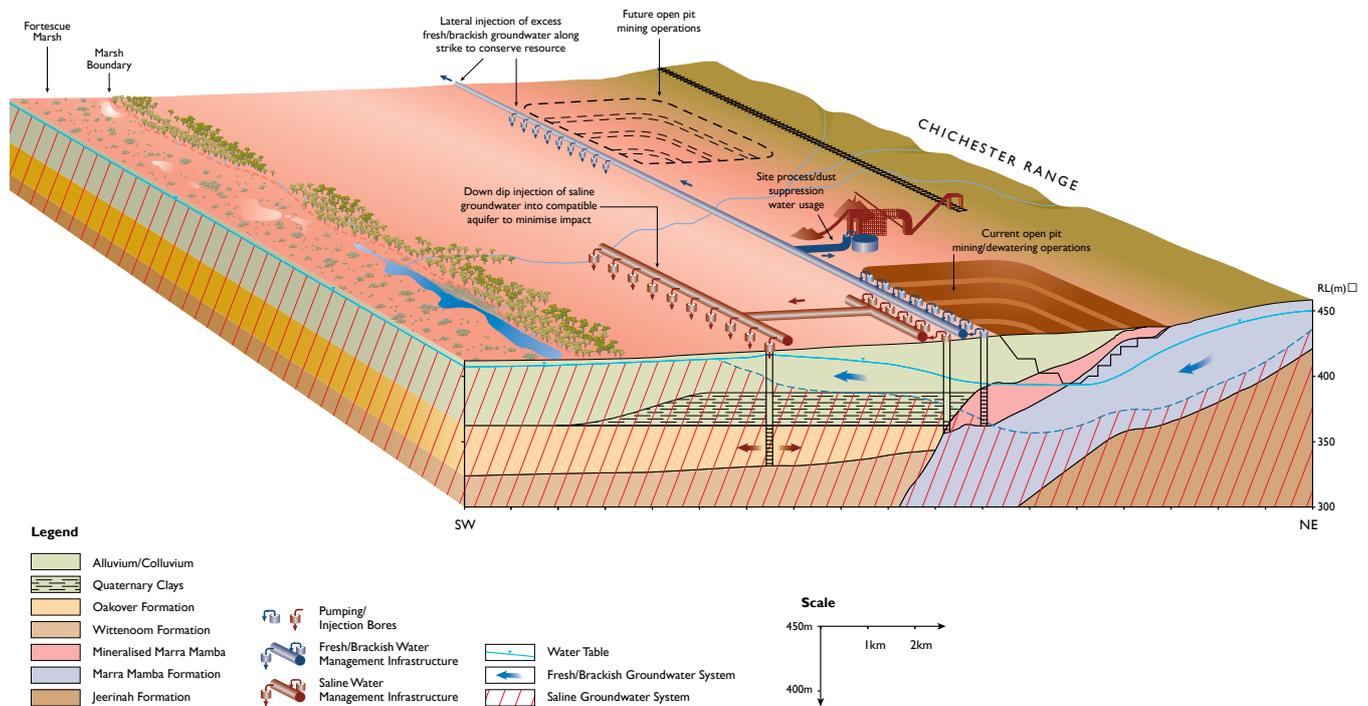
Mr Youngs said that the scale and complexity of the Cloudbreak MAR scheme meant that there are unique operational requirements, including an extensive 'trigger level system' to ensure ecological values are maintained; separate water management systems for different water types; and long-term design features for future water conveyance.

"Mining progress requires substantial dewatering, greater than the Cloudbreak site requirements of seven gigalitres per year for ore processing and dust suppression," Mr Youngs said.

"Currently, our dewatering abstraction is about 25 gigalitres per year. The remaining 18 gigalitres is returned through injection bores.

"Brackish water is injected laterally along the ore body into future mining areas, and saline water is injected south of the operations into a highly permeable calcrete aquifer.

"There are a number of drivers for injection of the excess dewatering draw – firstly, the preservation of the brackish water resource for ore processing over the life of the mine and, secondly, to minimise the drawdown footprint of the dewatering operation, particularly toward the Fortescue Marsh where ecological functioning is poorly understood but ecological values are known to be high.



Simplified Schematic of the Cloudbreak Managed Aquifer Recharge (MAR) Scheme – Copyright Fortescue Metals Group.

“An important third driver is to address environmental and cultural concerns associated with the surface discharge of excess water – prolonged discharge in an area which is dry most of the year may lead to local vegetation and fauna becoming dependent, and surface discharge is also discouraged by the traditional owners of the project area, the Nyiyaparli people.

“Most of the water Cloudbreak pumps out goes back into the aquifer and the system works to keep salty water away from other water.”

Mr Youngs said dewatering for the Cloudbreak project would increase and is expected to reach about 50 gegalitres per year, 80 per cent of which will be reinjected.

“The Cloudbreak scheme showcases how MAR can be used to meet a range of objectives in a complex environment,” Mr Youngs said.

“The MAR scheme is an ideal water management tool for the Pilbara region, which is characterised by high-yielding and often fresh aquifers, low rainfall, and a proliferation of major mining developments below the water table.

“However, the system has application for many environments and is likely to be used increasingly at mine sites around the world facing varied and difficult water management challenges.”

Mr Youngs said the Cloudbreak MAR scheme was now one of the top two or

three aquifer injection schemes in size in the world - with the expected growth in the scheme it may become the largest such project in the world within a few years.

The project has garnered the attention of the water industry and was recently recognised as a significant and innovative infrastructure project by the industry when it received the prestigious ‘Infrastructure Innovation Award’ at this year’s WA Water Awards.

The awards are supported by the Department of Water and the Water Corporation and category award winners automatically progress as national finalists in the Australian Water Association (AWA) Awards.

The AWA awards have been running for almost 50 years and it’s not often a mining company has landed among the finalists.

For Fortescue Metals Group, it’s an achievement to be proud of.

“Under the MAR scheme, we inject saline water to look after Fortescue Marsh, inject fresher water for future use, and in general return the water to where it came from to keep the environmental footprint of the project as small as possible,” Mr Youngs said.

“The project is about looking after the environment up there while we keep the pits dry, and making sure we’re unchanging the landscape.” ■

FMG’s Cloudbreak Managed Aquifer Recharge (MAR) Scheme is large and complex. The scheme currently includes:

- over 200 abstraction bores (60 operational at any time)
- ten in-pit sumps
- 200 kilometres of pipeline
- six major transfer or settlement ponds
- 100 brackish injection bores (50 operational, others for future use)
- 20 saline injection bores.

The current scheme represents the initial stage of an expanded Chichester wide scheme that will expand water management capacity to greater than 50 gegalitres per year.

The scheme is based on a successful approach of injection, storage, impact minimisation and multi-water quality stream management.

The MAR scheme is a temporary water management system which will be dismantled and rehabilitated on completion of mining.

MATRIX: A CLEAR VISION FOR AUSTRALIAN INDUSTRY

The success of the company selected as the winner of Western Australia's 2010 Large Advanced Manufacturer Export Award - Matrix Composites and Engineering Ltd – is built on a clear vision of future opportunities for Australian industry in the petroleum sector.

At the company facility in Malaga, a metropolitan industrial area, Chief Executive Officer Aaron Begley examines a newly produced marine riser buoyancy module, a pale blue, foam half cylinder, 1.4 metres wide and 4.5 meters long.

"These are the best in the market," he says.

His confidence is justified, not only by Matrix's growing share of the market for buoyancy equipment for deep sea petroleum exploration and production, but also by the results of the company's rigorous testing that ensures the reliability of its products against high industry standards.

The modules are made of syntactic foam with a composite shell; the materials, the design and the production process have been developed by the company's engineers and industrial chemists.

They will be shipped globally, to encase the steel risers that contain drill strings through the kilometres of seawater between vessels on the surface to a drill site on the sea bed.

"At these depths, kilometres below the surface, the pressure is enormous and that length of risers can weigh up to 4000 tonnes," Mr Begley said.

"To support this massive weight and withstand extreme conditions, our modules have to be light, but strong."

The company's computer-controlled, automated facilities operate 24 hours, seven days per week, each month generating production worth more than A\$13 million.

A substantial investment in research and development has produced a wide range of new and better materials,

technologies and products for the petroleum sector.

As well as the modules, Matrix produces a wide range of standard and custom built products to support marine drilling, and floating and subsea oil and gas production.

The company employs more than 400 people across seven facilities throughout the metropolitan area and generates a steady stream of truck movements, most destined for Fremantle Port with nearly 80 per cent of its production being exported.

Mr Begley says the company has built its reputation for innovation and reliability in the deepwater buoyancy market over more than a decade since its foundation in 1999.

However, over the past three years, demand for Matrix equipment has seen the company's export earnings more than quadruple, and Mr Begley estimates the company now supplies about 40 per cent of a global market for new build buoyancy equipment worth A\$400- \$500 million annually.

Matrix-produced equipment is used throughout Asia and Oceania, in the Gulf of Mexico and increasingly in waters off Brazil and West Africa.

He said a major investment in testing equipment, building the largest hydrostatic testing facility in the Asia Pacific region, which included a chamber 6.5 metres long and capable of duplicating pressures experienced in water three kilometres deep, was critical to this growth.

One in every 20 buoyancy modules Matrix produces is tested against the conditions in which it will operate.

In addition, the company's systems and processes have Quality Assurance accreditation ISO 9001:2008 (SAI Global) and Matrix is seeking Q1 accreditation from the American Petroleum Institute.

Mr Begley said the advanced testing capacity is a strong advantage and quality accreditation is essential, for success in an industry, where equipment failure can have disastrous consequences in human and environmental terms, as well as financially.

The Matrix Composite and Engineering group includes three operating subsidiaries: Matrix, Begley International which has extensive heavy oilfield engineering capabilities and Torque Engineering which specialises in offshore winch and reeler construction.

Mr Begley said the growing dominance of advanced materials manufacturing in the group's operations, is a reflection of a changing market.

"Our heavy engineering operations, which began in 1980, have to transform from manufacturing and fabrication, to highly skilled and mobile engineering service providers," he said.

"They still produce high quality equipment and components for the petroleum and mining sectors, but increasingly we can't compete on price with suppliers in Asia."

"On the other hand, our buoyancy modules are shipped to Asian engineering yards and included as part of equipment destined for use around the world."

"This is the challenge facing Australian engineering firms – having high standard production processes is not enough, we need to use our skills and experience differently, either developing unique and better products, or providing mobile repair and maintenance services to operators throughout the region."

Mr Begley is confident about the future for Matrix. The company is close to completing construction of, and opening a new A\$60 million first stage of a purpose built, 20,000 square metre manufacturing facility at the Australian Marine Complex at Henderson, south of Perth.

“The new facility will allow us to double our output and consolidate five operating sites into one, it will also include a testing facility with an even bigger pressure chamber,” he said.

“The AMC is a fantastic location, we’ll be the only deepwater buoyancy manufacturer with a dockside facility and there is a substantial cluster of subsea technology and petroleum logistics operations, so we’ll get great exposure.”

“From here, we will be well placed to service the increase we expect to see in local activity and markets in Asia, Oceania and West Africa which we expect to become increasingly significant.”

“In the longer term, as sales to customers in the strongly expanding deepwater activity off Brazil grow, we may need to develop some offshore production facilities.”

Equipping Matrix’s new facilities has also given Mr Begley stronger confidence about the future of Australian industry.

“We looked for the best technology available from the automotive, aerospace and chemical processing sectors and I’m pleased that between 80 and 90 per cent of the equipment we chose was made in Australia,” he said. ■



Western Australian company Matrix Composites and Engineering Ltd specialise in buoyancy equipment for deep sea petroleum exploration and production.

BUILDING LINKS WITH THE LION CITY

With Western Australia sitting on the cusp of a multi-billion dollar investment cycle, particularly in iron ore and increasingly in natural gas, now is the time to be spruiking our wares and ensuring win-win scenarios for the future.

In close proximity to each other and sharing the same time zone, Singapore and Western Australia have always enjoyed a strong bond and both states have enjoyed strong economic growth in recent years.

In October, Western Australian Premier and Minister for State Development, Colin Barnett, travelled to the island nation at the invitation of Singaporean Minister for Foreign Affairs George Yeo, to encourage investment in Western Australia.

The Premier said his focus for the trip was to transform the bond Western Australia shares with the Lion City into a "new and special relationship".

"Singapore and Western Australia are naturally complementary. Western Australia is a world-scale resources economy with enormous potential for growth, while Singapore, one of Asia's best performing economies and a major global trading centre, is rapidly expanding its role as an investment centre," the Premier said.

"Western Australia is home to 30 per cent of Singapore born Australian residents, many thousands

of Singaporean professionals and business leaders have studied in WA and our universities maintain strong education and research links.

"Singapore is also our second largest source of international visitors and an important investor in tourist accommodation.

"We have opportunities to strengthen these relationships and develop new partnerships," he said.

Western Australia's relationship with Singapore is based on trade, investment,

particularly active role in the Western Australian hotel industry, owning the Ibis, Mercure, Somerset, Sheraton and Duxton Hotels in Perth.

In turn, Western Australian businesses are active in Singapore and Western Australian companies operating there include Strategic Marine Pty Ltd, ICON Engineering, Phosphate Resources Ltd, Crossecom Pty Ltd and Wellard Group.

Annual trade between Western Australia and Singapore is worth more than A\$5billion.

"Singapore and Western Australia are naturally complementary. Western Australia is a world-scale resources economy with enormous potential for growth, while Singapore, one of Asia's best performing economies and a major global trading centre, is rapidly expanding its role as an investment centre," the Premier said.

education and personal connections – more Singapore residents of Australia are based in Western Australia than any other State.

Singaporean companies make a substantial contribution to the Western Australian business community.

Prominent companies include Kim Heng Group, Quaff Ltd, and Stamford Land Corporation, and Singaporeans have a

While in Singapore, Mr Barnett visited Singapore's President Sellapan Ramanathan, Deputy Prime Minister Teo Chee Hean, and other key government ministers.

He also addressed investment and industry leaders at functions hosted by the Australian Trade Commission and the Singapore Business federation, and inspected Singapore's new waterfront development 'Gardens by the Bay', which



Premier Colin Barnett travelled to Singapore to encourage investment in Western Australia and transform the bond between the two states into a "new and special relationship".

provided an opportunity to discuss urban planning initiatives with senior officials.

Raising investor awareness of opportunities to participate in Western Australia's strong economic future, particularly in the resources sector,

the production of urea and there's the possibility of Chinese steel mills setting up steel-making plants at Oakajee.

"A growing number of international investment brokerage companies are establishing a presence in Singapore,

"Western Australia is home to 30 per cent of Singapore born Australian residents, many thousands of Singaporean professionals and business leaders have studied in WA and our universities maintain strong education and research links."

remained the key focus of the Premier's Singapore visit and he took the opportunity to promote the creation of industrial precincts in WA.

"We have been striving to create world-class industrial precincts in Western Australia to encourage international customers to set up manufacturing and processing plants in the state," he said.

"There are signs that this is starting to happen - we're seeing it from India in

while in their own right, Singaporean businesses and government bodies hold overseas investments with a net worth of almost A\$500billion," the Premier said.

"As a small island city state, Singapore is strategically linked in terms of land and sea hubs.

"There is a fantastic opportunity here for both our economies to benefit from closer economic ties." ■



While in Singapore, Premier Colin Barnett appeared on the CNBC program "Squawk Box".



RISING DRAGON

CHINESE DEMAND FOR WA RESOURCES

While China's rapid economic development will continue to drive demand for energy and minerals at unprecedented levels, Western Australian resource industries will face increasing competition for their share of this growth.

Recent visits to China by Department of State Development staff reinforced their understanding both of the scale and excitement of China's development and of the challenges for Western Australian exporters in this vast market.

During September, Executive Director Joe Ostojich and Gorgon Project Manager Lorna Fitzgerald from the Department's Strategic Projects division, along with representatives from the North West Shelf Venture, visited liquefied natural gas (LNG) receival facilities and an industry training centre and met with senior industry and government officials.

In 2010, China is expected to import a total of nine million tonnes of LNG from Australia, Malaysia and Qatar.

Currently, natural gas accounts for less than three per cent of China's electricity generation.

Mr Ostojich said gas usage will increase, providing a cleaner alternative to coal which is used for about 70 per cent of electricity generation.

"China is very conscious of the need to improve air quality in its cities," he said.

"This means LNG import volumes will increase as existing receival terminals in Shenzhen, Fujian and Shanghai are expanded, and joined by another five currently under construction, with five more planned, further into the future.

In 2010, China is expected to import a total of nine million tonnes of LNG from Australia, Malaysia and Qatar.

"This expansion creates vast opportunities for Australian producers.

"However, it was clear from our observations and conversations, that although China values its relationship with Australia, in particular our political and economic stability, they place a premium on security of supply based on diversity of suppliers rather than specific levels of stability in any one place.

"For this reason, they are also entering into major LNG supply contracts with Qatar and Malaysia and building thousands of kilometres of pipelines,

over incredibly rugged country, to source natural gas from Turkmenistan, Uzbekistan, Kazakhstan and Russia."

Ms Fitzgerald said that this diversification of supply also included participating in new Australian production.

"Almost a third of the LNG produced by the massive Gorgon Project will be sold to China and there are other agreements in place for projects which are yet to be developed," she said.

"The Chinese Government is also actively promoting exploration for, and development of domestic resources, including by seeking foreign investment and technology to help develop unconventional gas resources such as coal seam methane, shale gas and tight gas.

"This visit brought home to us, that as China builds and develops additional capacity to store and use the gas, the field of suppliers will also broaden and Australian producers will have to remain highly competitive."

The visit was conducted through the Australia-China Natural Gas Technology Partnership Fund's Technical Visit Program.

The fund is a joint initiative of the North West Shelf Venture and the Western



Inaugural Technical Visit to China. Participants from the funder organisations.

Australian and Australian Governments that supports training, research and knowledge transfer between China and Australia in the natural gas and LNG industry.

The visitors were accompanied by Tracey Lim, the fund's secretariat director, who is also based at the Department of State Development.

Iron Ore

Acting Executive Director Mike James and Senior Adviser Bill Preston, from the Department's Resources and Industry Development Division, were also in China at the same time.

They spoke at the China Iron and Steel Association's (CISA) 10th China International Steel and Raw Materials Conference and visited steel mills, infrastructure developments and government organisations to gauge longer term potential for further trade and investment in Western Australia's iron ore industry.

Mr James said the massive scale of road, rail and port infrastructure construction and residential developments, newly completed or underway, in the six cities

they visited explained the double digit growth in China's steel usage over the past decade.

This construction has underpinned the rapid growth of Western Australia's iron ore exports from 155 million tonnes (Mt) in 2000 – 01 to more than 390 Mt in 2009 – 10.

"Industry and government officials made it clear, however, that these growth rates are unlikely to be maintained," he said.

"China's next five year plan, beginning in 2011, will focus on technology and industry efficiency by replacing inefficient, polluting and high energy use plants.

"They aim to bring new steel growth rates closer to annual GDP growth, that is less than 10 per cent, rather than the more than 20 per cent growth that China's steel production achieved through the first half of the decade."

Mr Preston explained that this development, along with other changes in the iron ore market, would present challenges for more optimistic forecasts of Western Australian producers and project proponents.

"Even if steel growth is limited, Western Australian iron ore exports to China are likely to double to 550-620 Mtpa over the next five years," he said.

"China's next five year plan, beginning in 2011, will focus on technology and industry efficiency by replacing inefficient, polluting and high energy use plants."

"However, in a more constrained steel growth market, unless we significantly increase our market share from the current 42 per cent level, demand will fall well short of the 1.2 billion tonnes per annum production that new and expanding projects in Western Australia aspire to.

"To do this, producers will have to respond to new iron ore pricing arrangements, which are more closely



Iron ore off-loading and steel products load-out facilities, Chongqing Iron and Steel Works, on the Yangzi River, China.



The new container, bulk materials (including iron ore) and petroleum products port at Qingdao on the Yellow Sea coast, China. The ship is loaded with WA iron ore ready for unloading.

aligned to the delivered market price of ore, rather than supply contracts based on a FOB negotiated price.

“Also, the expansion of Western Australian iron ore production means that resources currently being mined, or which are identified for future production, include ore that is of lower quality in terms of its iron, alumina and phosphorus content, than Western Australian exports earlier in the decade.

“This ore either has to be upgraded to higher quality before sale, or priced competitively to reflect the additional cost to the steel producers, who may need to purchase relatively smaller quantities and blend it with higher grade ores.

“Finally, as part of its “going abroad” strategy for securing future iron ore supplies, China is investing in new mines and infrastructure in Asia, Africa and South America as well as in Australia, leading to increased competition for market share.

“The extent to which Western Australia benefits from this investment will depend on the success of existing Chinese investment in greenfields iron ore projects.”

The iron ore and steel visit was supported by the Western Australian Government’s Trade Office in Shanghai, which Mike James said provided effective access to industry and government decision makers, and is clearly well respected by Chinese government officials and influential industry leaders.

BJ Zhuang, Regional Director at Western Australian Trade Office in Shanghai remains confident that Western Australian producers can increase their market share.

“Our industry is in competition with local Chinese production and exports from India which both have also benefited from high spot market prices in recent years,” he said.

“However, the Western Australian iron ore industry has proved itself as the most competitive and reliable supplier to the Northeast Asian steel industry over the years.

“When spot prices decline, along with the growth rate for steel production, these other producers will again have more difficulty competing with Western Australian ore.”

The Departmental staff who visited China concluded that while Western Australia’s exports to China will grow significantly, increased demand cannot be taken for granted.

“However, the Western Australian iron ore industry has proved itself as the most competitive and reliable supplier to the Northeast Asian steel industry over the years.

The visit also underscored the significance of the Department’s role in providing policy advice, negotiating agreements between the Government and proponents, co-ordinating approvals processes and delivering government initiated infrastructure projects on time and within budget, to maximise the State’s competitiveness, and its attractiveness to investors. ■

MAJOR

INDIAN EXPLORER IN WA SHALE GAS DEAL

Norwest Energy and major Indian petroleum explorer, Bharat PetroResources Ltd (BPRL) recently agreed to a farm-in (exploration investment agreement) of two of Norwest's Perth Basin permits (EP413 and TP/15).

With permit EP413 having good shale gas potential, the day marked a significant milestone for the burgeoning Western Australian unconventional gas industry.

Up to A\$10 million will be invested by BPRL towards drilling and testing programs to evaluate the shale gas potential of EP413, earning the company 50 per cent of Norwest's interest.

Permit EP413 is close to the Parmelia and Dampier to Bunbury Pipelines and could satisfy future domestic gas demand.

Documents were formally signed during a recent visit to Western Australia by a delegation including the Managing Director of BPRL.

The ceremony was attended by a number of key stakeholders including Department of Mines and Petroleum (DMP) Executive Director Petroleum Division, Bill Tinapple.

Mr Tinapple said the agreement was particularly important for Western Australia's shale gas industry.

"It is promising that Western Australia's shale gas potential is now recognised worldwide," he said.

"This highly successful overseas company is not only investing money into this exploration venture, but will also bring a wealth of international knowledge to the Western Australian unconventional gas industry."

"It is promising that Western Australia's shale gas potential is now recognised worldwide."

India has a growing interest in shale gas and this venture will assist BPRL in becoming a leader in the shale gas industry in their home country.

BPRL is already a leading marketing and refining petroleum company based in India. The parent company of BPRL,

Bharat Petroleum Corporation Limited (BPCL) is quoted on the Bombay Stock Exchange and, with a turnover of over A\$25 billion, was listed at number 307 in the 2009 Global Fortune 500.

The company has extensive experience as well as success in numerous overseas exploration ventures.

Norwest plans to drill at both EP413 and TP/15 by late 2010 or early 2011. ■



Location map of Norwest's Perth Basin permits.

BRIGHT

FUTURE AHEAD FOR LNG IN WA

When he visited the United States earlier in 2010, Western Australian Premier and Minister for State Development, Colin Barnett, described the growth of the petroleum industry, both oil and gas, as the most important economic change for Western Australia since the Pilbara iron ore projects of the 1960s.

"In every sense, the biggest game in town is the development of mega projects for the export of LNG. These projects, both existing and proposed, dwarf any other industrial projects in Australia," he said.

Western Australia has a significant number of liquefied natural gas (LNG) projects in the pipeline and, with high growth in global LNG demand anticipated, the State is positioning itself as a world leader in the supply of clean, high-quality natural gas.

Thanks to Western Australia's growing status in the world LNG industry, Perth was chosen to host the recent 5th Annual LNG World conference, which attracted nearly 300 delegates from around the world.

On an even bigger scale, in November it was announced that Perth is set to host the 18th International Conference and Exhibition on Liquefied Natural Gas (LNG18) in April 2016, which is expected to attract more than 5,000 delegates and exhibitors.

"LNG18 will bring the heads of major global gas producing and energy companies, and a lot of attention to Perth," the Premier said.

"Western Australia is already the world's sixth largest LNG exporter, and with more than A\$140 billion worth of LNG and gas projects, either under way or close to a Final Investment Decision, is set to become one of the top two."

Perth was announced as the host city for LNG18 in Houston, Texas following presentations to the organisers on behalf of Perth, and the city of Doha in the Middle Eastern emirate Qatar.

Director General of the Department of State Development, Anne Nolan, represented the Western Australian Government, with WA's bid for the conference led by the Australian Gas Industry Trust and strongly supported by the Federal Government and the Australian Petroleum Production & Exploration Association Ltd, Chevron, Woodside and Conoco Phillips.

The International Conference and Exhibition on LNG is held every three years under the auspices of the International Gas Union (IGU), the Gas Technology Institute of America (GTI) and the International Institute of Refrigeration (IIR).

Being chosen to host the conference is a major coup for Perth and underlines Western Australia's growing importance as a world leader in energy supply.

WA's place in the LNG world

The 5th Annual LNG World conference was held at the Burswood Convention Centre in Perth in late August and featured experts in the field delivering a wide range of presentations.

Ms Nolan was the first presenter at the conference and spoke about Western Australia's place in the LNG world.

"Globally, demand for LNG is forecast to triple by 2030 and when we look at global demand and supply, location matters," Ms Nolan said.

"There are a significant number of LNG projects planned for Western Australia and at least A\$60 billion is being spent on LNG projects currently under construction in this State.

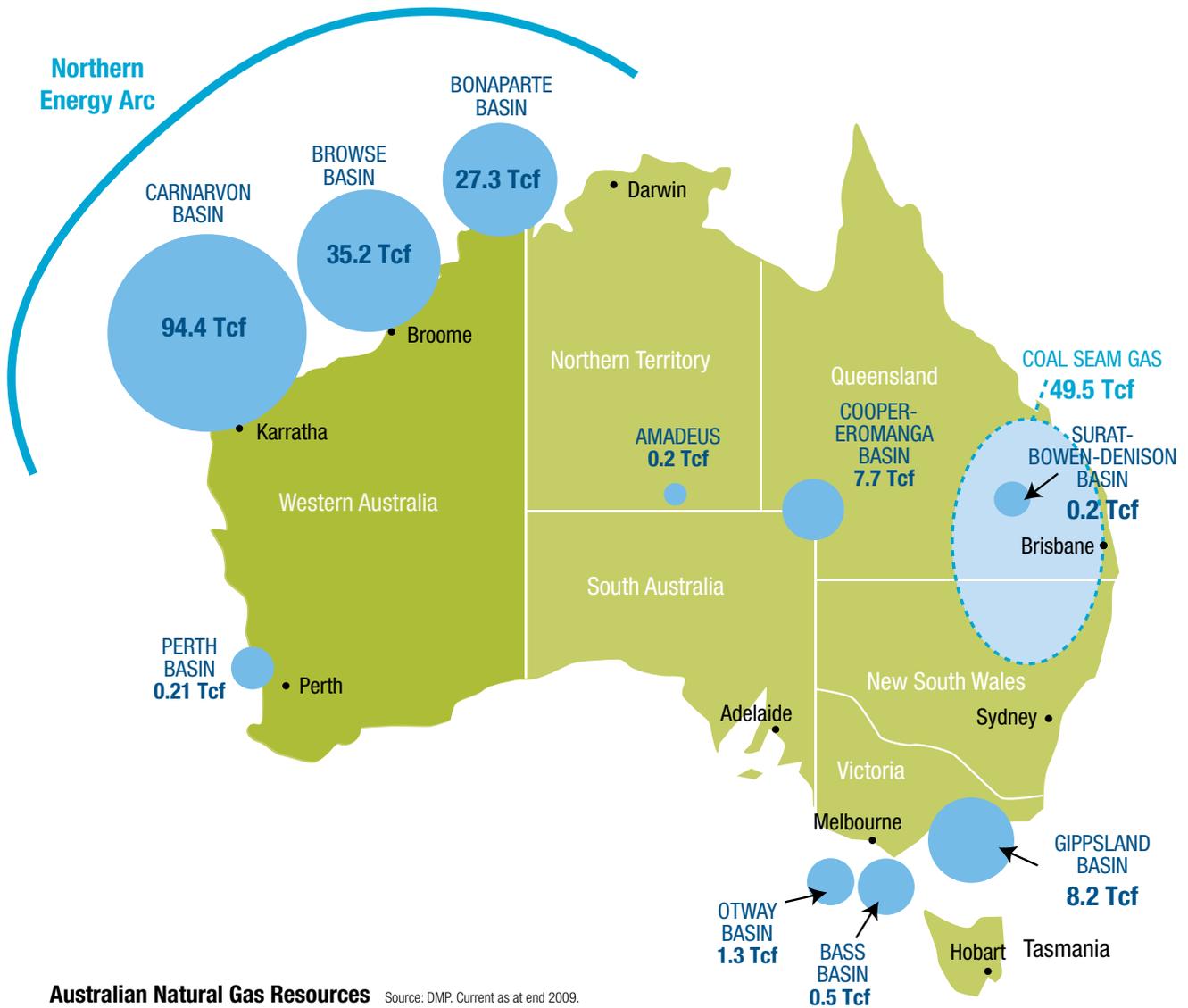
"Global demand for LNG is currently driven by strong economic growth in Asia.

"Asian markets were forecast to consume about 123 million tonnes of LNG (58 per cent of global LNG demand) in 2010. By 2030, that figure will more than double for Asia alone, to about 338 million tonnes per annum.

"When we look at the current Asian LNG market, it's clearly dominated by Japan at about 55 per cent of the market. Korea makes up 22 per cent while India, China and Taiwan are each around eight per cent.

"In 2030, Japan is likely to still have a large share, at 35 per cent but demand from China, India and Korea will have grown to be closer to a 20 per cent stake each."

Ms Nolan referred to the 'Northern Energy Arc', above the north-west coast of WA and reaching towards the Northern Territory, in outlining the discovered gas reserves off the



Australian Natural Gas Resources Source: DMP. Current as at end 2009.

Western Australian coast where the largest Australian gas reserves are located.

“The top three discovered gas reserves are located in the Carnarvon, Browse and Bonaparte Basins,” she said.

“Together, these three finds dwarf any other discovered gas reserves off Australian shores.”

The Carnarvon Basin has over 90 trillion cubic feet of gas (Tcf), Browse Basin about 35Tcf and Bonaparte Basin just over 27Tcf.

Projects operating or planned for the Carnarvon Basin include the world-class North West Shelf Venture, Woodside’s Pluto Project and the A\$43billion Gorgon gas project.

The Western Australian Government is creating a new strategic industrial area at Ashburton North near Onslow for the

development of natural gas projects and associated industries in the State’s North West.

Ashburton North will feature a multi-user port facility, land areas for proponents and infrastructure for LNG and other hydrocarbon-based processing, as well as natural gas for WA’s domestic gas supply.

The State Government is also planning an LNG precinct at James Price Point, north of Broome, for the processing of natural gas from the Browse Basin.

The Browse LNG Precinct will be capable of accommodating LNG processing and shipping facilities for at least two proponents. Planning for the precinct is aimed at minimising the environmental footprint of gas processing in the region, as well as heritage and cultural impacts, while maximising opportunities for local people and businesses.

Several existing LNG developments are also looking to expand production in the future, with Australia’s largest oil and gas resource development – and one of the largest in the world - the North West Shelf Venture among them.

“When we look at the overall potential of LNG developments in WA over the next decade, we see huge capacity in Western Australia for LNG,” Ms Nolan said.

“By 2020, Western Australia’s overall LNG capacity is potentially about 80 million tonnes per annum.

“The Department of State Development on behalf of the Western Australian Government is working to facilitate responsible development of the state’s resources and Western Australia is well placed to take advantage of LNG developments.

“There’s a bright future ahead for LNG in this State.” ■

ONE PERSON'S TRASH IS ANOTHER'S TREASURE

Global aluminium company Alcoa, which has several major operations in Western Australia, has developed a method to simultaneously turn its by-products into a usable material and mitigate greenhouse gases.

Residue from Alcoa of Australia's operations is comprised of two primary components of roughly equal quantity – sand and mud.

Alcoa's Kwinana alumina refinery uses a carbonation and wash system process to turn its bauxite residue into a safe and commercially viable product.

"While 20 years ago our research was driven by a desire to reduce the size of our residue areas, a goal shared by our local communities, the opportunities coming from residue reuse research have become much broader with several

exciting possibilities," Alcoa's Residue Technical Manager Dr David Cooling said.

Alcoa's residue sand and mud both have a range of potential uses including as a soil amendment for broad use acre farming and horticultural uses; as sand for cement manufacture; and for effluent treatment of ponds and septic systems.

Other potential uses for the residue include using it for trace metal retention from road runoff, rubbish tips and acid mine drainage; in ceramics and plastics manufacturing; and as a road base material.

What is Red Sand?

Red Sand™ is literally crushed rock that is red in colour. The product is residue from bauxite refining that is prepared through the carbonation and wash system.



Testing has demonstrated that the sand is suitable for general fill material used in construction backfill or as a material for road base construction.

Commercialisation of Red Sand has other potential benefits including being a viable substitute for increasingly scarce supply of quarry sand; reducing the clearing of natural bushland for sand quarries; and reducing the requirement for residue storage facilities.

"Just as Alcoa's actual product, aluminium, is endlessly recyclable, we've found ways that our by-products can be useful to the community," Dr Cooling said.

"Research spanning over 20 years has identified a number of possible sustainable uses for bauxite residue, one of which is Red Sand."



Alcoa's Residue Technical Manager Dr David Cooling.

As the residue product with the most potential marketable uses, the commercialisation of Red Sand is currently a prime focus for Alcoa.

What is Alkaloam/Red Mud?

Alkaloam™, the registered trademark for Alcoa's red mud, is a fine-grained residue which is carbonated through a reaction with carbon dioxide (CO₂).

Trials have demonstrated that Alkaloam produces a range of benefits when added to sandy soils common to coastal Western Australia.

Adding Alkaloam has proved successful in achieving improved pH levels in acidic agricultural soils much quicker compared to the traditional soil amendment, lime.

The greatest benefit of this residue is the speed at which the product can improve the pH of soil.

Alkaloam can achieve improved pH levels almost immediately whereas traditional lime can take a number of years to achieve the same results.

This multifaceted residue can also prevent phosphorous from being washed from farmland into waterways, helping to stop dangerous algal blooms.

The technology associated with residue reuse is cutting edge and was developed through Alcoa's global refining research and development team, the Technology Delivery Group.

This innovation has not only opened the door for bauxite residue by-product use, but also has further environmental benefits including capturing CO₂ emissions from nearby operations.

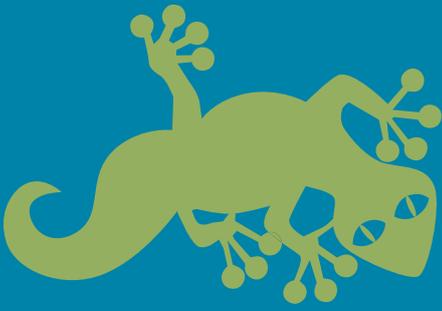
Through 'carbonation' Alcoa mixes CO₂ with the bauxite residue which reduces the alkalinity of the material.

Alcoa has a full scale carbonation plant (known as 'Carbon Capture') operating at its Kwinana refinery which is treating the red mud fraction of the residue, locking up about 70,000 tonnes of CO₂ per year.

"That's equivalent to the emissions given off by 17,500 cars, so this technology is delivering a considerable greenhouse gas emission saving," Dr Cooling said.

Alcoa is a member of Western Australia's Kwinana Industries Council and contributes to research into how Kwinana industries can achieve 'waste' synergies by using each others' by-products.

More information on Alcoa's Red Sand and Alkaloam can be found at www.alcoa.com.au/residue. ■



GOLDEN GECKO

RECIPIENTS FLY THE GREEN FLAG

Two Western Australian companies were awarded for their work to reduce the impact of mining and exploration on the natural environment at the 19th Golden Gecko Awards.

Iron ore exporter Crosslands Resources and mineral exploration company Pluton Resources were both recognised for their commitment to environmental excellence.

Research by Crosslands into the Shield-back Trapdoor Spider at its Jack Hills Iron Ore Project in the Mid-West has led to innovations in conducting low impact fauna surveys, while Pluton was recognised for its approach to low impact exploration on rugged terrain at its Irvine Island Project.

Mines and Petroleum Minister Norman Moore, who presented the awards, praised the two companies for being leaders in environmental excellence and for making significant contributions to balancing environmental responsibility with the development of Western Australia's resources.

"All of the eleven submissions demonstrated exceptional environmental management over a range of different projects," he said.

"Leading innovation in environmental management within the industry, as all the submissions demonstrate they are doing, is what we need to ensure we have a sustainable mining future for WA."

Managing Director and Chief Executive of Pluton, Tony Schoer, identified access as the key issue when considering

the challenges of an island-based exploration operation, which meant engaging key contractors and staff to advise management on the unique environment, heritage and terrain considerations.

"The difficult terrain on Irvine Island required a smart solution," Mr Schoer said.

Pluton's low impact approach to exploration included the development of a universal drilling platform for diamond core drilling to avoid the need for earthworks on slopes and limit ground disturbance.

"The portable platform is able to be set up on slopes of around 25 degrees. The supporting frame is raised on adjustable legs, which avoids the need for earthworks on slopes and reduces

the area of ground disturbance. An intact soil and seed profile enables natural regeneration of vegetation," he said.

It also included a restriction on transport, to foot and helicopter, on the island.

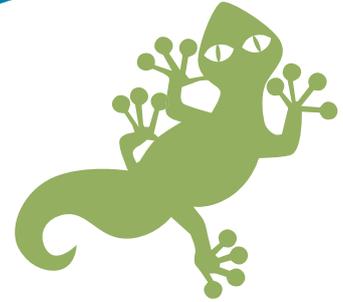
"Pluton is proud of its environmental credentials, however, the thing we are most proud of is the relationship our staff have with traditional owners. The Pluton workforce is made up of more than 40 per cent of Malaya and Bardi community members. We consider the Malaya a key partner and proud supporter of the project," Mr Schoer said.

The company also demonstrated a commitment to managing the risk of contamination from drilling muds and hydrocarbons.

2010 AWARD RECIPIENT



Pluton Resources staff members with their Golden Gecko award.



GOLDEN GECKO Awards for Environmental Excellence

Crosslands Manager of Approvals and Environment, Lara Jefferson, said the company had gone beyond its legal requirements in terms of development.

“The main driver on going beyond survey requirements to undertake scientific research on drilling vibrations was the fact that there was no knowledge or data on exploration drilling impact on the spiders and their burrows,” she said.

Crossland’s research, which was conducted by Phoenix Environmental Services, used two key innovations.

The first was the use of fibre-optic technology to allow the observation of spiders without digging them up.

The second was the design and development of a ‘vibration simulation device’ which matched drilling vibrations and eliminated the need for any new clearing.

“From Phoenix’s research we discovered that there were no short term impacts on the spiders or the burrows due to exploration drilling impacts,” Ms Jefferson said.

The buffer distances were therefore reduced from 200 metres to 25 metres.

The innovative design of the study has provided new techniques for low impact fauna surveys.

“As a result of the research we conducted, the buffer zone has been reduced for Crosslands and other Mid West miners. Large populations were also discovered and thus the conservations status of these spiders is now being reviewed,” she said.

“We have now taken the initiative to utilise the Geraldton Iron Ore Alliance’s sub-committee to share our research findings with other companies through press releases, the website and open and transparent communication between environmental managers.”

Certificates of Merit were awarded to Cliffs Asia Pacific Iron Ore for management of Malleefowl at Mt Jackson and Rio Tinto Iron Ore for developing comprehensive and integrated systems to minimise environmental impacts in the Pilbara.

Entries for the 20th Golden Gecko Awards in 2011 open in February. For further information visit www.dmp.wa.gov.au/goldengecko/

2010 CERTIFICATE OF MERIT



Minister Norman Moore with representatives from Cliffs Asia Pacific Iron Ore.

2010 CERTIFICATE OF MERIT



Minister Norman Moore with representatives from Rio Tinto Iron Ore.

2010 AWARD RECIPIENT



Crosslands Resources staff members with their Golden Gecko award.



WA'S UNDERWATER OIL AND GAS TECHNOLOGY IN THE SPOTLIGHT

Professors David White and Mark Randolph with the geotechnical beam centrifuge used to simulate offshore geostructures at small scale.

The world-class research and industry collaboration being used to help pave the way for Australia's largest resource projects was in the spotlight in Perth in early November.

The Centre for Offshore Foundation Systems (COFS) at the University of Western Australia staged an international symposium – The International Symposium Frontiers in Offshore Geotechnics – to highlight latest developments in the field.

The event attracted some of the world's leading experts in offshore geotechnics and shed light on the innovative engineering techniques used in numerous oil and gas developments in Western Australia such as the A\$43billion Gorgon Project being built off the State's northwest coast.

The COFS is part of UWA's Oceans Institute, and is an international leader in offshore geotechnical engineering research. The centre is home to about 40 staff and world-leading experimental facilities.

Building Australia's offshore oil and gas facilities presents unique challenges for geotechnical engineers, who assess seabed conditions and determine how best to support or anchor offshore structures and how to safely route pipelines.

The Gorgon Project, for instance, will be Australia's largest single resources project. The project's offshore gas wells will be built up to 1300 metres under water and will be entirely subsea.

The pipeline carrying gas back to Barrow Island to be processed will have to negotiate the steep terrain at the margins of the continental shelf. The calcareous sediments that form the

seabed off Australia's coast are rarely found in other regions of oil and gas development.

Calcareous sediments have uniquely challenging engineering properties that prevent many conventional engineering design practices from being utilised offshore Australia.

"The designers of the Gorgon pipelines utilised some of the latest research techniques, many of which have been developed at UWA, to predict the behaviour of the pipelines through the life of the project," Professor David White, Centre for Offshore Foundation Systems, said.

Professor White's keynote lecture at the symposium focused on the geotechnical engineering of sub-sea pipelines.

The Chair of the ISFOG symposium, Professor Susan Gourvenec, said the symposium had attracted expert speakers from around the world.

"We are very pleased to have attracted key industry figures from Houston, London and Norway to speak at our event, and we are also proud of the state-of-the-art contributions coming from our own group at UWA and the local geotechnical industry in Perth," she said.

COFS Director Professor Mark Cassidy said the Centre played a key role in providing research to support the State's resources sector.

"COFS is one of WA's research success stories, hosting world-leading experimental facilities and engaging closely with local industry to support resource developments, such as Gorgon, that underpin the Western Australian economy," he said.

COFS is now involved in all of the major projects currently under development in WA, having performed studies to support the Pluto, Wheatstone, Browse, Ichthys, Sunrise and Scarborough projects.

But the Centre's expertise extends much further. Since it was established in 1997, COFS has worked on major industry projects in virtually every corner of the world. These include the Euripides piles (UK), Tai Po LNG pipeline (Asia), Gwang Yang bridge (South Korea), Hong Kong LNG pipeline (Hong Kong), BP's Angolan fields (Africa) and the Maari platform (New Zealand).

Much of the centre's key research involves the use of centrifuge modelling to test how geotechnical structures and seabed sediments respond.

Full scale testing of offshore structures is impractical and expensive, so UWA's centrifuge technology is used to provide accurate simulations of geotechnical behaviour at small scale in a safe and efficient experimental environment.

UWA is recognised as a global leader in geotechnical centrifuge modelling technology, and is currently hosting researchers from the US, Europe and China who are visiting Perth to use the centrifuge facilities.

COFS is the only place in the southern hemisphere to have both a beam and drum centrifuge and also has the added benefit of having its own electronics laboratory and workshop to custom design and build equipment as needed.

The Western Australian Government supports the centre as a designated State Centre of Excellence and COFS is also supported by the Australian Research Council and the Lloyds Register Educational Trust. ■

NEW MINE CLOSURE GUIDELINES FOR WA

New mine closure guidelines developed by the Department of Mines and Petroleum (DMP) and the Environmental Protection Authority (EPA) offer a new tool for industry in planning for land rehabilitation following the cessation of mining.

Environmental management of mine sites in Western Australia including mine closure is closely regulated by DMP.

The new guidelines will assist industry in planning more efficiently and effectively for the rehabilitation of land on cessation of mining.

The guidelines were developed in response to amendments made to the *Mining Act 1978* following the assent of the *Approval and Related Reforms (Mining) (No. 2) Bill 2009* in June.

The new guidelines, a joint document between DMP and the EPA, are consistent with existing national and international standards and provide greater clarity about the content of mine closure plans.

Formal guidelines will ensure an effective planning process is in place throughout the life of the mine, in order to achieve successful closure of mines in Western Australia.

For new mining proposals, mine closure plans must be submitted alongside the initial application.

Planning at this very early stage allows companies to better prepare for mine closure to ensure the mine is decommissioned and rehabilitated in a cost effective and ecologically sustainable manner.

Mine closure has to be consistent with agreed post-mining outcomes and land uses, and without unacceptable liability to the State.

The Mine Closure Plan is an essential management tool for industry to:

- ensure all stakeholders have their interests considered during the mine closure process
- identify early the risks associated with mine closure
- facilitate progressive rehabilitation and planning toward mine closure
- ensure the cost of closure is adequately represented in company accounts
- ensure there is clear accountability and adequate resources for the implementation of the closure plan
- monitor and review all aspects of mine closure
- establish a set of indicators which will demonstrate the successful completion of the closure process
- establish a point where the company has met agreed completion criteria required for relinquishment of tenure.

As part of their new mining proposals, companies will be required to submit a mine closure plan following standardised instructions set out in the new guidelines.

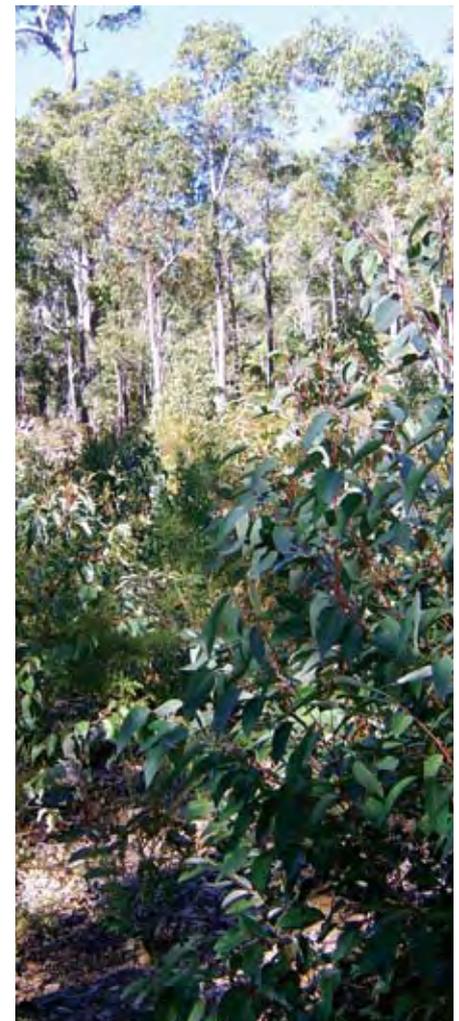
The mine closure plan will be required to be updated and resubmitted every three years, unless specified by DMP.

Submitted plans will be assessed by DMP and/or the EPA to ensure the proposed closure strategy, process, methods and outcomes are acceptable and achievable.

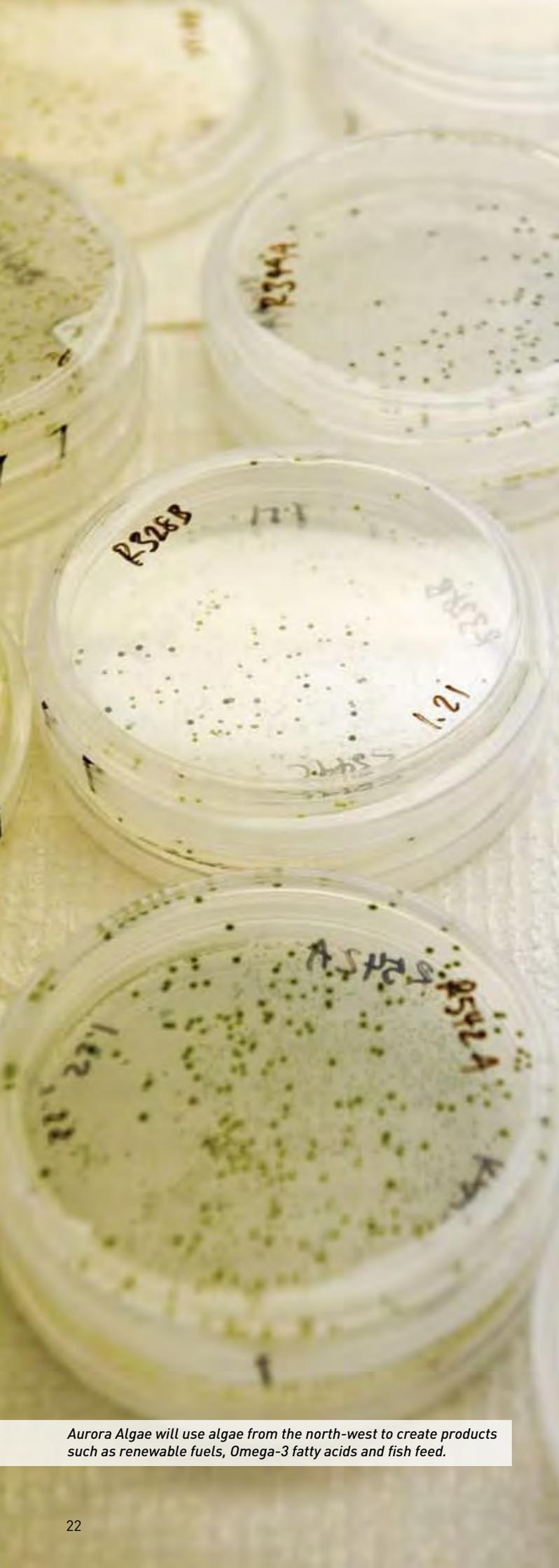
The draft guidelines were put up for public comment for four weeks in October.

All public comments will be taken into consideration and incorporated into the final document.

For more information on the guidelines please contact DMP's Senior Environment Advisor Xuan Nguyen on +61 8 9222 3237 or xuan.nguyen@dmp.wa.gov.au ■



Successful rehabilitation at a mine site in the South-West of Western Australia.



AURORA SEES BRIGHT FUTURE IN WA

California-based Aurora Algae has busily expanded its Western Australian operations since committing to build a commercial scale production facility in the north west of the State.

The company has opened new regional headquarters in Perth and was recently awarded A\$2 million from the State Government's Low Emissions Energy Development (LEED) fund.

Aurora's Australian Managing Director Matthew Caspari will oversee the construction and operation of the company's Western Australian facility, which will create products such as renewable fuels, Omega-3 fatty acids and fish feed.

"As we searched for the ideal location of our first commercial production facility, we identified a number of key factors that were critical to delivering maximum value from our high-tech farming process," Mr Caspari said.

"The combination of a perfect climate and the right blend of resources including abundant seawater, industrial carbon dioxide and skilled labour, made north-western Western Australia an ideal location for our initial high-yield commercial facility.

"These elements combined with the outstanding support of the Australian government at all levels, makes Perth a perfect launching point for commercialising our technology."

The A\$30 million LEED fund supports technological development required to cut greenhouse gas emissions from the energy sector and contributes to the national target of 20 per cent renewable energy by 2020.

It targets technologies where Western Australia has clear natural and competitive advantages.

"The grant is acknowledgement of support from the Australian government for the work we are doing to bring new clean technology business and local jobs to the country," Mr Caspari said.

"For us, it is an offset to a large investment that we are making in building our commercial-scale facility."

Aurora has optimised saltwater algae strains that thrive in open ponds, utilising seawater rather than fresh water to conserve resources.

The company has also pioneered a unique, energy-efficient method to harvesting that uses technology commonly used in the wastewater treatment industry rather than the traditional centrifuge approach.

"These process improvements over traditional algae production, harvesting and extraction methods, combined with the company's ability to take excess carbon dioxide from third-party industrial plants, will result in premium, cost competitive, and carbon-neutral to carbon-negative products," Mr Caspari said.

Aurora currently employs 13 people in Australia and intends to more than double that figure by the end of 2010. ■

Aurora Algae will use algae from the north-west to create products such as renewable fuels, Omega-3 fatty acids and fish feed.

STATE'S RESOURCES SECTOR PERFORMS STRONGLY AMID FRAGILE GLOBAL ECONOMY

Despite a challenging economic period, the value of Western Australia's mineral and petroleum industry reached A\$70.9billion in 2009-10, close to its previous record of A\$71.3billion in 2008-09.

The latest mineral and petroleum statistics released by the Department of Mines and Petroleum (DMP) revealed that record results from the iron ore and gold sectors contributed to the industry's strong performance.

Iron ore, petroleum, and gold, together accounted for 83 per cent or A\$59billion of all mineral and petroleum sales.

Iron ore remained WA's biggest sector in terms of value accounting for A\$33.7billion or 48 per cent of total sales. The sector achieved another milestone with shipments of iron ore increasing by 25 per cent to a record 396 million tonnes.

Petroleum sales accounted for 27 per cent (A\$19billion) of total sales.

The gold sector reached A\$6.6billion, an increase of 26 per cent on the previous year, which can be attributed to continued interest from investors and continued strength in the gold price.

The improving global economy during 2009-10 saw the majority of commodity prices rebound from the lows reached early last year.

WA is well positioned to build on its strengths as a reliable supplier of quality resources at world cost-competitive prices.

Mineral and petroleum exports contributed an impressive 89 per cent towards the State's total merchandise exports, with China continuing its lead as the major market for our resources.

WA also maintained its status as the nation's biggest exporter, contributing 42 per cent (A\$83billion) towards Australia's total merchandise exports. Mining investment reached A\$21.7billion, representing 71 per cent of the State's total (A\$30.4billion) new capital expenditure.

The future of the industry is very bright given the high levels of investment in expansions and new projects being undertaken in the State.

The latest mineral and petroleum statistics are available on the DMP website www.dmp.wa.gov.au/1518.aspx ■



WE WANT TO HEAR FROM YOU.

As the publishers of *Prospect*, the Departments of State Development and Mines and Petroleum want to know what you, the reader, think of the magazine. We want to know your opinions on the content, design and delivery of *Prospect* and what improvements you might like made.

To fill out a brief survey please visit www.dmp.wa.gov.au/prospectreader2010

Thank you for your input.



ONLINE LODGEMENT HELPS STREAMLINE APPROVALS PROCESS

Senior DMP staff members met with AMEC in October to discuss approvals reforms.

Dramatic decreases in the time it takes to process approvals for industry are being achieved, thanks to the Department of Mines and Petroleum's (DMP) online lodgement systems.

The department's third quarter 2010 approvals performance report showed that online applications requiring environmental assessment for mineral exploration Program of Works took an average of 16.8 days to process. This compared to 21.7 days for traditional paper applications.

Deputy Director General Approvals Tim Griffin said a reduction in time of almost one week was considerable for industry.

"DMP has been focusing considerable energy and resources on developing its information technology capabilities for approvals lodgement and tracking," Dr Griffin said.

"As well as saving time and effort for industry, it makes the process of assessment much more transparent and accountable.

"The third quarter data also showed that proponents responded to DMP's

requests for additional information in a shorter timeframe for online applications."

The approvals report revealed the department had achieved further reduction in the pre 2009 approvals backlog and continued its high performance in meeting established timelines.

DMP has recently been cooperating with the Association of Mining and Exploration Companies (AMEC) in its push for approvals reform.

Recently DMP participated in AMEC approval reform meetings that focused on native title, Aboriginal heritage and environmental matters.

One roundtable forum, attended by senior Government and industry officials focused on key recommendations relating to Aboriginal heritage and native title approval issues.

The recommendations propose options for improving the efficiency and effectiveness of regulation and further streamlining approvals processes for the mining and exploration industry.

At a separate environmental forum information was provided on the progress of Minister Moore's Industry Working Group (IWG) Report recommendations, the Lead Agency Framework, approvals tracking, and the proposed new mining securities policy and mine closure guidelines.

Dr Griffin said the department was pleased to collaborate with AMEC and other industry organisations.

"As a result of the interaction the department is now much better informed about issues raised by AMEC on behalf of its members, and is working with AMEC and other government agencies to find resolutions," he said.

"It's important that DMP and government more generally remain open and accessible for industry and that there is transparency in our processes and decisions."

Many of the recommendations from the IWG report have been supported by government and significant progress has been made on resolving issues that were raised. ■

RESOURCING SAFETY REFORM

With Western Australia's resources industry expanding at a rapid pace, the Department of Mines and Petroleum is ensuring its Resources Safety Division has the resources to regulate the industry well into the future with one of the largest recruitment campaigns in recent history.

Since the campaign began in April 2010, more than 50 positions have been advertised across local, national and international media. The campaign even garnered Australia-wide attention in October after a national newspaper featured an article on the recruitment drive in its weekend edition.

Resources Safety Executive Director Malcolm Russell said that the drive aimed to recruit the best possible people for the range of positions available.

"These are technically and intellectually challenging positions and it is vital we have skilled, passionate people to fill them," Mr Russell said.

"I think the nature of this campaign ensures we are doing all we can to attract the right people."

The campaign is a key part of reforms to safety regulation in WA.

"In the mining sector, as for other industry sectors, safety performance has been sitting on a plateau for some time," State Mining Engineer Simon Ridge said.

"Our particular industry has struggled in recent times to maintain an acceptable rate of improvement and, in fact, has started to slide backwards in the fatal incidence rate."

Mr Ridge said that this was a concern for everyone involved in the resources industry in the State.

"Only a significant change in the approach to safety is going to arrest the back sliding and provide mechanisms to achieve a new step change," he said.

Commentators in the oil and gas sector, where there are similar issues with a plateau in safety performance, suggest that the key lies in developing a new safety culture where employees have real ownership of — and drive — safety improvements.

"Traditionally, it has been held that safety performance relies upon leadership from the top," Mr Ridge said.

"It is now recognised that although this is undoubtedly a significant part of success, it also requires that shop floor personnel, and particularly safety and health representatives, are empowered to drive key safety programs."

Mr Ridge said that safety must become a habit throughout the resources sector.

"Only when we all adopt this habit can it be said that a resilient safety culture has taken over our workplaces," he said.

"Habits are only developed when associated behaviours are rewarded. In the case of safety, we need to reward the bearers of "bad news" so that, with the strength of awareness, we can pro-actively treat the symptoms before they develop into a chronic and devastating illness.

"Unless we harvest the knowledge of our employees and workmates so we really understand the issues in the workplace, it is unlikely that our safety performance will improve, and highly likely that serious incidents will continue to occur.

"Managers and supervisors should be seeking out the "bad news" and engaging shop floor employees and their safety and health representatives in meaningful dialogue to develop effective and targeted programs, driven by the employees, that address the problems."

Mr Russell said that in order to save lives and reduce injuries, industry, the regulator and employees must work together to make the necessary cultural changes.

"While extra safety resources and legislation help, significant reductions in incidents can only be achieved if a positive cultural change is encouraged and maintained," Mr Russell said.

"The significant improvements we are seeking in industry safety performance will only occur when every person working in the industry accepts personal responsibility for working safely, at all times."

A Mines Safety Roadshow, presented in October by Resources Safety in the Pilbara, South West, Goldfields and Perth, provided a unique opportunity to consult with workers about how the regulator and industry might work together to achieve the next step change towards resilient safety cultures being commonplace in mining workplaces.

Industry input was sought into a strategic program to understand how widely accepted "tough" behaviours and communication styles affect safety in the workplace, how toughness might be redefined, and what resources and training are required to support this cultural change.

Dr Dean Laplonge was engaged to lead the roadshow workshops, including the 2010 Exploration Safety Roadshow in early December, and will report to Resources Safety on how the safety regulator might support industry as it seeks to make these positive cultural changes.

Further information on the safety reform process is available at www.dmp.wa.gov.au/safetyreform ■



Department of Mines and Petroleum Director General Richard Sellers and Mines and Petroleum Minister Norman Moore attended the Mines Safety Roadshow in October.

GOING UNDERGROUND IN NORTHBRIDGE

A simulated underground mine underneath Northbridge is giving students a taste of what life is like as an underground mine worker.

The Central Institute of Technology recently opened The Cut mine underneath its Northbridge campus and Centre for Mining Lecturer Rod Ebrall said the simulated mine gave students a good idea of what it is like to work underground.

"We want our students to really be thinking about safety," Mr Ebrall said.

"In the classroom, students are used to seeing things in two-dimensions - this facility offers them a perspective much closer to the real thing."

Mr Ebrall said safety is a key element of the course.

"We go through a lot of safety components," he said.

"The one subject that is vital the students demonstrate competence in is safety. If you haven't got that we won't let you go out there (into the industry)."

One of the scenarios puts students "at risk" from a rock fall if they wander underneath a section of unsupported ground. If students venture out underneath the section they are "fired" on the spot.

"It teaches students to be constantly aware of their surroundings and take notice of their environment beyond what is immediately in front of them," Mr Ebrall said.

"This kind of scenario just helps them prepare for the environment they will end up working in. They also quickly learn that you are not supposed to work under unsupported ground."

The mine was opened in November 2009 and is the first of its kind in Western Australia.

Some of the visual effects of the mine were created by a design company that usually specialises in film sets. This included creating simulated ore bodies for students to conduct geological mapping exercises. This offers hands-on experience for future geological assistants.

"It is considerably more difficult when it is in three dimensions," Mr Ebrall said.

"It is all nice and easy when it is on the whiteboard in your classroom. You get down here and it can be a real challenge in this environment."

One of the formations confronting students is based on a typical Kambalda-style nickel ore body.

"For students who haven't seen it in 3D they begin to get an idea of how to put all their theoretical knowledge together," Mr Ebrall said.

The mining industry supported the project and provided vital input into its design.

"A number of companies came in and donated their ideas, equipment and time to help establish this mine," Mr Ebrall said.

One company provided the mine with its own simulated refuge chamber.

"It looks like a real refuge chamber that you would find in an underground mine," Mr Ebrall said.

"We bring the students in here, run through the procedures and give them an experience similar to what it would be like in real life."

It is not just the visual elements that replicate the underground environment. There is also a soundtrack that gets played throughout the mine, though it certainly won't be appearing on any of the music charts. The sound of jumbos, trucks and other machinery saturate the darkness.

"We can turn it up pretty loud, so they get a good idea of the kind of sounds they will experience when working underground," Mr Ebrall said.

Mr Ebrall said it was important to ensure students were aware of the type of working environment they could be entering.

"This mine gives them a good idea of what to expect and whether it is something that they genuinely want to pursue," he said.

Mr Ebrall said the course was quickly gaining an excellent reputation in industry.

"We have had a number of people saying that they have had graduates coming to their companies and they have been excellent," he said.

"The name of this course is pretty well known and regarded. We maintain a high standard and won't give a person a qualification unless they have proved they will be able to work in their field."

Mr Ebrall said the institute runs four six-month courses a year.

"We accept up to 18 students for the course and have a wide range of people applying," he said.

"Some are just out of high school, while others are looking for a career change. But they all want to be here and they all want to learn." ■

A simulated underground mine in Northbridge is giving Central Institute of Technology students a taste of what life is like as an underground mine worker.



Students from the Central Institute of Technology gather in a refuge chamber in the simulated mine.



WOMEN WELCOMED TO THE WORLD OF ENGINEERING

Eleven women have been given a unique opportunity to gain rewarding careers in engineering through new industry-sponsored scholarships at Challenger Institute of Technology.

The women were presented with inaugural Women in Engineering Scholarships at Challenger's Australian Centre for Energy and Process Training (ACEPT) in Perth in November.

Sponsored by BHP Billiton and Chevron, the scholarships have been designed to encourage more women to enter careers in the largely male-dominated field of engineering.

The Certificate III in Civil and Structural Engineering course will provide foundation skills for employment in construction industries associated with Western Australia's expanding resources industry or serve as a pathway to higher-level engineering qualifications.

"The program has been specifically designed to provide women with a supportive, applied learning environment," Challenger Institute managing director Liz Harris said.

"Delivered in collaboration with our industry partners, it will provide work placement and access to female role models. The course has also been designed with flexibility to cater for women with children and family commitments."

A key focus of the course was to provide the participants with an insight into engineering from a female perspective and to address barriers that might discourage women from entering an engineering career.

Chevron's Human Resources Managing Director Kay Butler said there were plenty of opportunities for women with engineering qualifications, particularly within the resources sector.

"Women obviously play a major role in society and Chevron believes it is imperative that our workforce accurately reflects the greater community," Ms Butler said.

"Women make wonderful engineers and anything we can do to help alleviate the present imbalance in this important

field can only serve to change the profession for the better."

ACEPT is a leading provider of process operations training in Australia, offering recognised qualifications for the oil and gas, mineral and chemical processing industries. ■



Toni-Marie Smith was awarded a commendation prize to support her progression into the Diploma of Civil and Structural Engineering.

AGRICULTURE

East Kimberley - Ord - East Kimberley Expansion Project

WA STATE GOVERNMENT

The State Government has committed \$220 million to increase the existing amount of irrigated land in the Kununurra region by adding 8,000 hectares at Weaber Plains. This funding will provide the construction of irrigation channels, roads and off-farm infrastructure to service the future needs of the region's growing population and sustain economic growth. The Commonwealth Government has committed \$195 million of funding for social and common use infrastructure in the East Kimberley region. Construction has commenced and the package will be fully implemented by June 2013. Expenditure: \$415m.

Employment: Construction: 218

IRON ORE

Pilbara - FMG Chichester - Iron Ore Mine, Rail and Port Development

FORTESCUE METALS GROUP LTD

FMG Chichester operates iron ore mines at Cloudbreak and Christmas Creek in the Chichester Ranges of the eastern Pilbara, serviced by a multi-user railway and port facilities at Port Hedland. FMG Chichester is currently ramping production up to 45Mtpa and is investigating increasing its production to 95Mtpa from the Chichester Ranges.

Employment: Operation: 3200

Pilbara - Mesa A

ROBE RIVER MINING CO PTY LTD

Construction of the mine and rail extension started in November 2007 and was completed in Q1 2010. First production commenced in February 2010. Initial production is planned to be approximately 20Mtpa, increasing to 25Mtpa by 2011. The project involves an open cut mine located south of the Pannawonica road off the North West Coastal Highway. Mesa A will sustain production of the sought-after Robe Valley pisolite ore as production from Mesa J decreases. Expenditure: \$1b.

Employment: Operation: 220

Pilbara - Brockman Syncline 4 - Brockman Syncline 4 Iron Ore Mine

HAMERSLEY IRON PTY LIMITED

In mid 2008 Hamersley Iron commenced construction of the mine with a production target of 22Mtpa for the Brockman Syncline 4 iron ore deposit, located approximately 60km north west of Tom Price. First ore was stockpiled in June 2010. A further expansion is under consideration.

Expenditure: \$2b.

Employment: Construction: 1500

Pilbara - Port Hedland - Atlas Iron Turner River Hub

ATLAS IRON LTD

Atlas Iron Ltd is an active explorer and developer, focused on iron ore projects within Western Australia. With a growing number of projects and a large landholding in the Pilbara (15,000km²) located close to existing infrastructure, the company is effectively defining resources and reserves capable of being mined with relatively low capital expenditure. Exports commenced in December 2008 starting with its Pardoo Project located some 75km east of Port Hedland, and has continued with the commencement of production from the Wodgina DSO (Direct Shipping Ore) Project. The company has now reached a 6Mtpa mining and export rate and is targeting 12Mtpa by 2012 with the proposed centralised Turner River Hub crushing and screening plant.

Expenditure: \$28m.

Employment: Operation: 200

OIL & GAS DEVELOPMENTS

Carnarvon Offshore Basin - Pyrenees Oil Fields BHP BILLITON PETROLEUM (AUSTRALIA) PTY LIMITED

In July 2007, BHPB Petroleum announced approval of the Pyrenees oil development located 45km north of Exmouth. The development comprises the Crosby, Ravenswore and Stickle oil fields which have estimated recoverable oil reserves in the range of 80-120 million barrels. The project involves the development of 13 subsea wells connected via flowlines to a Floating Production Storage and Offloading vessel, which will be capable of producing about 96,000 bbl/d of oil. First production commenced March 2010. As planned, the wells will be drilled and brought on in phases, with approximately half the field ramping up from first oil and the other half over the next six months. Expenditure: \$2b.

Carnarvon Offshore Basin - Van Gogh Oil Field APACHE ENERGY LIMITED

The Van Gogh oil development, located around 50km northwest of Exmouth, will utilise a Floating Production Storage and Offloading (FPSO) vessel (the Ningaloo Vision) with a processing capacity of 63,000bbl/d of oil and storage capacity of 540,000 barrels. It will be linked to two subsea drill centres with 10 production wells. Development drilling and sub-sea production equipment installation is completed awaiting the arrival in the field of the FPSO. Production commenced Feb 2010. Expenditure: \$700m.

Employment: Operation: 80

BAUXITE

Worsley/Boddington - Alumina Refinery - E & G Project Expansion to 4.7Mtpa

BHP BILLITON WORSLEY ALUMINA PTY LTD

BHP Billiton announced in May 2008 the go-ahead for the A\$2.5 billion Efficiency and Growth (E&G) expansion project at its Worsley alumina refinery. The expansion project will lift capacity of the refinery from 3.5Mtpa to 4.7Mtpa through expanded mining operations, additional refining capacity and upgraded port facilities. Construction has commenced and production capacity is expected to be expanded by 2012. An additional A\$500 million will be spent on a new multi-fuel cogeneration power plant to be built at the refinery.

Expenditure: \$2.5b.

Employment: Construction: 1500; Operation: 200

ELECTRICITY

Pilbara - Karratha 7 Mile - 7 Mile Power Station HAMERSLEY IRON PTY LIMITED

Rio Tinto has proposed a power infrastructure rationalisation program and upgrade for its mining and port operations in the Pilbara region. Hamersley Iron Pty Limited is constructing a new power generating facility at 7 Mile near Karratha. Robe River Mining Company Pty Limited is constructing a 220kV transmission line and a sub-station at Cape Lambert. The Cape Lambert sub-station will be linked to the 7 Mile main power generator via the new transmission line. Hamersley and Robe will share the generation capacity created by the new power station. This new single station will replace the two aging plants at Dampier and Cape Lambert. Construction of the power station commenced in late 2008.

Expenditure: \$700m.

HEAVY MINERAL SANDS

Tutunup South - Heavy Mineral Sands Mine ILUKA RESOURCES LIMITED

The Tutunup South mineral sands mine, located approximately 15km south east of Busselton, received environmental approval in August 2009.

Site works commenced early in Q4 2010 and first production is expected in mid-2011. The project involves the construction of mine pits, screen plant, ore concentrator, solar drying dams and associated mine infrastructure. The mine is expected to produce over 1.2Mt of heavy mineral concentrate over its four to five year life, which will be transported to Capel for further processing.

Expenditure: \$30m.

Employment: Construction: 130; Operation: 30

IRON ORE

Mid West Region - Extension Hill Hematite Mine MOUNT GIBSON IRON LIMITED

Mount Gibson Iron has environmental approval for a 3Mtpa hematite mining operation at Extension Hill, 260km south east of Geraldton. The ore will be trucked to a rail head near Perenjori then railed to the port of Geraldton for export. Construction of the project has commenced with first shipments expected to be in June 2011.

Expenditure: \$73m.

Employment: Construction: 150; Operation: 100

Mid West Region - Karara Iron Ore KARARA MINING LTD (GINDALBIE METALS LTD / ANSTEEL JOINT VENTURE)

The Karara Iron Ore Project is Karara Mining's cornerstone production project in the Mid West region. Construction commenced in November 2009. Karara will deliver some 10Mtpa of iron products before the end of 2011, comprising 8Mtpa of high grade magnetite concentrate and blast furnace quality pellets and 2Mtpa of Direct Shipping Ore hematite. The Project is underpinned by a world-class JORC-Code compliant resource base comprising a 522 million tonne magnetite reserve, a 1.85 billion tonne magnetite resource, a 10.9Mt hematite reserve and a 16.2Mt hematite resource.

Expenditure: \$1.975b.

Employment: Construction: 1500; Operation: 500

Pilbara - BHPB Rapid Growth Project 5 BHP BILLITON IRON ORE PTY LTD

BHP Billiton Iron Ore has obtained all relevant Government approvals to further increase its installed production capacity of its Western Australian Iron Ore operations. The project includes mine expansions, dual tracking of sections of the railways and additional berths at Port Hedland inner harbour, for which engineering is 98% complete, construction is 77% complete and the overall project is 79% complete. The Company is in the study phases for future potential expansions.

Expenditure: \$4.8b.

Employment: Construction: 3500

Solomon - Pilbara - Solomon Hub Stage 1 FORTESCUE METALS GROUP LTD

Fortescue has completed a definitive feasibility study for a 60 million tonne per annum iron ore mine and supporting infrastructure. The Solomon Hub is planned to initially involve at least two mining areas, two processing plants and a 130 kilometre rail link to Fortescue's existing Christmas Creek to Port Hedland rail line. The proposed mining areas and rail corridor for the Solomon Hub are within unallocated Crown Land and active pastoral leases and approximately 70 kilometres north of Tom Price in the Hamersley Ranges. Subject to Government approvals and final sign off by the Fortescue Board, a two year construction period will begin in 2011.

Expenditure: \$4b.

Employment: Construction: 1000; Operation: 1000

Yilgarn - Koolyanobbing Iron Ore Upgrade CLIFFS ASIA PACIFIC IRON ORE PTY LTD

In September 2010, Cliffs approved an upgrade of its Koolyanobbing iron ore operations from 8.5Mtpa to around 11Mtpa. Koolyanobbing is located 50km north east of Southern Cross and also includes the Mt Jackson and Windarling mines. The improvements are expected to consist of enhancements to the existing Kalgoorlie-Esperance

Committed Projects

rail infrastructure, an increase in rolling stock and upgrades to various other existing operational constraints. Cliffs anticipates these improvements to be fully implemented in the second half of 2012. Expenditure: \$320m.

IRON ORE PROCESSING

Pilbara - Cape Preston - Sino Iron CITIC PACIFIC

CITIC Pacific Mining is constructing the Sino Iron project at Cape Preston, 100 kilometres south west of Karratha. The magnetite iron ore project will include a concentrator, 6Mtpa pellet plant, 25km slurry pipeline, combined cycle 450MW power station, new port and trans-shipment facilities, and 51GL desalination plant. At full production up to 27.6 million tonnes of magnetite concentrate and high grade pellets will be exported each year. First shipment of concentrate is expected in the first half of 2011.

Expenditure: \$5.2b.

Employment: Construction: 4000; Operation: 500

LITHIUM

Great Southern Region - Mount Cattlin Lithium Project, Ravensthorpe GALAXY RESOURCES LIMITED

Galaxy Resources Limited commenced commissioning of the Mt Cattlin lithium concentrate processing plant in September 2010. The mine and the processing plant will produce approx. 137,000tpa of spodumene concentrate. Galaxy is preparing for the first shipment of its product through the Esperance Port to China, in November 2010. In China, Galaxy will produce 17,000tpa of battery grade lithium carbonate. A large proportion of this will make its way into the growing markets of Japan, Korea and Europe.

Expenditure: \$75m.

Employment: Construction: 100; Operation: 75

NICKEL

Ravensthorpe - Ravensthorpe Nickel Operation FIRST QUANTUM MINERALS AUSTRALIA NICKEL PTY LTD

First Quantum Minerals (FQM) acquired the Ravensthorpe Nickel Operation (RNO) from BHP Billiton (BHPB) in February 2010. FQM plans to return RNO to sustainable production by late 2011. RNO is an open cut mine and hydrometallurgical process plant that produces a mixed nickel cobalt hydroxide intermediate product. The modifications are within the plant's existing footprint in the materials handling area, including crushing, conveying and stockpiles. FQM aims to produce 39,000tpa nickel metal for the first five years after recommencement and 28,000tpa nickel metal over the current anticipated mine life of 32 years.

Expenditure: \$150m.

Employment: Construction: 200; Operation: 600

OIL & GAS DEVELOPMENTS

Carnarvon Basin - Pluto LNG WOODSIDE ENERGY

Approved for development in July 2007, the Pluto LNG Project will process gas from the Pluto and Xena gas fields, located in the Carnarvon Basin about 190km north-west of Karratha, Western Australia. The Pluto and Xena gas fields are estimated to contain 4.6 trillion cubic feet (Tcf) of dry gas reserves and an additional 0.5Tcf of contingent resources. The initial phase of the project comprises an offshore platform, connected to five subsea wells on the Pluto gas field. Gas will be piped in a 180km trunk line to the Pluto LNG Park onshore facility located on the Burrup Peninsula. Onshore infrastructure comprises a single LNG processing train with a forecast production capacity of

4.3 million tonnes a year. Storage and loading facilities include LNG and condensate storage tanks and export jetty. The Pluto LNG Project is on track to become the world's fastest developed LNG project from discovery of the gas field in 2005 to first LNG in early 2011.

Expenditure: \$12b.

Employment: Construction: 4000; Operation: 300

Carnarvon Offshore Basin - Barrow Island - Gorgon Project GORGON JOINT VENTURE

The Gorgon Joint Venture (GJV) made a final investment decision on the \$43 billion Gorgon Project on 14 September 2009. The GJV's foundation project on Barrow Island includes a three train LNG development capable of exporting 15Mtpa and a domestic gas project capable of delivering at least 300 terajoules per day of gas to the mainland. The development on Barrow Island also includes potentially the largest commercial geosequestration project in the world. The project obtained State and Commonwealth environmental approval in August 2009. The project is based on gas from both the offshore Gorgon and Jansz/lo gas fields. On-island activity commenced in late 2009 and will ramp up through 2010 with the processing plant construction scheduled to commence in 2011.

Expenditure: \$43b.

Employment: Construction: 3500; Operation: 300

Carnarvon Offshore Basin - Cossack/Wanaea - Cossack/Wanaea Redevelopment WOODSIDE ENERGY

The Cossack Wanaea Lambert Hermes (CWLH) fields, 135km northwest of Karratha, have produced 395 million barrels of oil since production began in 1995. The redevelopment work includes the purchase and conversion of the Okha floating storage and offloading facility into a floating production storage and offloading facility to replace the Cossack Pioneer in late 2010, as well as the replacement of associated subsea infrastructure. At a total investment of about A\$1.8 billion, the CWLH Redevelopment Project will support ongoing safe and reliable production from the CWLH fields beyond 2020.

Expenditure: \$1.8b.

Carnarvon Offshore Basin - North Rankin - North Rankin Redevelopment WOODSIDE ENERGY

In March 2008 the North West Shelf Venture participants approved funding of the \$5 billion North Rankin Redevelopment Project which will recover remaining low pressure gas from the North Rankin and Perseus gas fields, and extend the field life to around 2040. The project involves the installation of a new second platform - North Rankin B - with gas compression facilities, low pressure separators, utilities and accommodation. North Rankin B will be connected by a 100m bridge to the existing North Rankin A platform and on completion both platforms will be operated as a single integrated facility known as the North Rankin hub. The North Rankin Redevelopment project also includes the necessary connections to North Rankin A and some refurbishment of the North Rankin A platform. North Rankin B is scheduled for start-up in 2013 and will support the North West Shelf Venture's onshore gas requirements to supply future customer commitments.

Expenditure: \$5b.

Pilbara - Devil Creek Development Project APACHE ENERGY LIMITED

Apache Northwest and Santos Offshore are continuing construction works for the Devil Creek Development Project (DCDP), a greenfield gas project comprised of an unmanned offshore gas production platform over the Reindeer gas field located about 80km northwest of Dampier; offshore and onshore gas pipelines; an onshore gas processing plant and a sales gas export pipeline connected to the Dampier to Bunbury Natural Gas Pipeline (DBNGP). Gas plant site earthworks are

complete and civil works progressed sufficiently to allow for the sequential installation of pipe rack and gas processing modules. The onshore gas supply pipeline is nearing completion and the pipeline shore crossing, installed by horizontal directional drilling methods, is well advanced. The development site is located near Devil Creek, 65km south west of Karratha where the construction workforce is being accommodated within a purpose built facility. The DCDP is designed to provide up to 200 terajoules per day of dry natural gas and between 80kl to 160kl per day of gas condensate. All gas from the DCDP will service the domestic gas market in Western Australia, with first gas delivered into the DBNGP second half 2011.

Expenditure: \$800m.

Employment: Construction: 200; Operation: 20

RARE EARTHS

Mt Weld - Rare Earths Mine LYNAS CORPORATION LTD

The Mt Weld deposit is located about 35km south of Laverton. Its resources were recently updated from an estimated 12.2Mt at 9.7% grade for 1.18Mt rare earth oxides (REO) to 17.4Mt at 8.1% for 1.41Mt REO, an increase of some 19% contained REO. The mine development includes an open pit mine and concentration plant at Mt Weld. The concentrate will be bagged and containerised on site, and trucked to the Port of Fremantle for export. The ore will be shipped to a \$300 million processing plant in Malaysia, which will have an initial production capacity of 11,000tpa REO in 2011, expanding to 22,000tpa by 2013. Lynas raised \$450 million in equity to enable suspension of the project to be lifted in November 2009. Construction work recommenced at Mt Weld in April 2010 and the first ore feed to the concentration plant is scheduled to occur in December 2010.

Expenditure: \$135m.

Employment: Construction: 135; Operation: 90

SILICON METAL

Kemerton - Silicon Metal Plant Expansion SIMCOA OPERATIONS PTY LTD

Simcoa announced in October 2009 its decision to expand the company's 32,000tpa capacity silicon metal plant at Kemerton. The first stage expansion, involving installation of a third furnace, will increase the plant capacity to 48,000tpa and commissioning is scheduled for Q3 2011. Providing world demand for silicon continues to increase strongly, a second stage expansion, involving installation of a fourth furnace could take place by late 2013 and increase plant capacity to 64,000tpa.

Expenditure: \$100m.

Employment: Construction: 120; Operation: 40

VANADIUM

Windimurra - Windimurra Vanadium Project ATLANTIC LIMITED

In September 2010, Atlantic Limited announced in its Prospectus the execution of the final definitive agreement to acquire the Windimurra Vanadium Project. Atlantic is now working towards completion and commissioning of the project. The company is at an advanced stage of appointing construction contractors to begin work on the project, and is finalising arrangements for the sale of the existing haematite ore stockpile at Windimurra. Full production is scheduled to commence by mid 2011.

Expenditure: \$500m.

Employment: Construction: 350; Operation: 120

Projects Under Consideration

AMMONIA/UREA

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

Perdaman Chemical and Fertilisers Pty Ltd is developing a \$3.5 billion coal to urea plant at the new (to be developed) Shotts Industrial Park, near Collie. The plant will use proven "best in class" coal gasification and fertiliser production technologies. Around 2.7Mtpa of coal will be used to produce approximately 2Mtpa of urea, primarily for export. The urea will be transported to Bunbury Port by rail. The company has recently received environmental approval from the WA Minister for Environment in accordance with the Environmental Protection Act. A 20-year off take agreement has been signed with Incitec Pivot. Construction is expected to commence in 2011 with the first shipment of urea planned for 2014.

Expenditure: \$3.5b.

Employment: Construction: 1500; Operation: 200

AMMONIUM NITRATE

Pilbara - Burrup Industrial Estate Site D - Burrup Nitrates

BURRUP NITRATES PTY LTD

Burrup Nitrates Pty Ltd (BNPL), a joint venture between Burrup Holdings Ltd (BHL) of Australia and Yara International ASA of Norway, is conducting a feasibility study into the construction of a 350,000tpa Technical Ammonium Nitrate (TAN) plant to be located on the Burrup Peninsula. Ammonia feedstock will be supplied from BHL's subsidiary company Burrup Fertilisers Pty Ltd, which operates its facility directly adjacent to the proposed location for the new TAN plant. It is expected that all manufactured product will be sold into the Pilbara region. Regulatory approvals are in progress. The company is aiming for operations to commence by Q4 2013.

Expenditure: \$600m.

Employment: Construction: 600; Operation: 65

ELECTRICITY

Collie - Bluewaters III and IV, Coal Fired Power Stations

GRIFFIN ENERGY PTY LTD

Griffin Energy is planning to expand the Bluewaters Power Station Project with two additional 208MW coal-fired power stations at the Coolongatta Industrial Estate, near Collie. Commissioning of the Bluewaters III base-load power station is expected by late 2013 and commissioning of Bluewaters IV by late 2015.

Expenditure: \$800m.

Employment: Construction: 600; Operation: 50

Mid West Region - Centauri 1 Power ENEABBA GAS LIMITED (EGL)

Eneabba Gas Limited is planning to develop a 168MW Centauri 1 gas-fired turbine power station near Dongara. Generation capacity can be increased to 365MW. The project is focused on supplying additional volumes of energy for the developing Mid West iron ore industries. Besides sourcing gas from the Dampier to Bunbury Natural Gas Pipeline, the company is working to develop an underground coal gasification gas supply for the facility.

Expenditure: \$200m.

Employment: Construction: 100; Operation: 4

GOLD

Kalgoorlie (330kms North East) - Tropicana Gold ANGLOGOLD ASHANTI/INDEPENDENCE GROUP JOINT VENTURE

AngloGold Ashanti, as Joint Venture Manager, has undertaken an intensive exploration and resource development program approximately 330kms north east of Kalgoorlie. Plans for the project are to develop an open-cut gold mine and nearby processing plant. So far, a resource estimate of 5 million oz of gold has been identified with a mine life of at least 10 years. The feasibility study commenced in July 2009 and is ongoing. The 8 week Public Environmental Review period closed on 24 November 2009. Construction is anticipated to commence in late 2010. Commissioning is expected to be around the first quarter in 2013 with production of up to 410,000 oz per annum. The recently released (19 July) 2010 EPA report has recommended project approval to the Minister for Environment. State Environmental Approval granted on 24 September 2010. Awaiting Federal approval expected before the end of 2010.

Expenditure: \$700m.

Employment: Construction: 700; Operation: 400

HEAVY MINERAL SANDS

Happy Valley - Heavy Mineral Sands Mine BEMAX CABLE SANDS (WA) PTY LTD

Located adjacent to the Bemax Gwindinup deposits, the project will involve the mining of the Happy Valley North and South mineral sands deposits situated on private land and in State Forest. The two deposits contain over 750,000 tonnes of recoverable heavy mineral concentrate, with average production expected to be around 150,000tpa over a combined mine life of eight years. The Environmental Review and Management Program document was released for public review and closed in November 2009. Subject to obtaining all relevant approvals, Bemax expects to commence mining of the North deposit in early to mid-2011 and then plan to transfer mining to the South deposit in 2013. The concentrate will be trucked to Bemax's Bunbury Mineral Separation Plant for final processing.

Expenditure: \$35m.

Employment: Construction: 100; Operation: 30

Jangardup South - Heavy Mineral Sands Mine BEMAX CABLE SANDS (WA) PTY LTD

The Jangardup South minerals deposit is situated 54km south of the Nannup township and adjacent to the D'Entrecasteaux National Park. Cable Sands estimates that the deposit would provide 2Mt of minerals. Feasibility and environmental studies are well advanced. An environmental impact statement for the project is being prepared.

Expenditure: \$60m.

Employment: Construction: 100; Operation: 50

Keysbrook - Heavy Mineral Sands Mine MATILDA ZIRCON LIMITED

Matilda Zircon proposes to develop a mineral sands mine located near the township of Keysbrook, approximately 70km south of Perth. It has ore reserves of 41Mt, containing 1.2Mt of heavy mineral concentrate. The project is expected to produce 40,000tpa of leucoxene and 47,000tpa of ilmenite, high titanium ilmenite and zircon over its eight year mine life. Keysbrook received environmental approval in October 2009. Matilda's applications for development approvals have been refused by the Murray and Serpentine-Jarrahdale Shires, and have been referred to the State Administrative Tribunal. A determination from this process is now likely to occur in early 2011.

Expenditure: \$18m.

Employment: Construction: 35; Operation: 30

Shark Bay - Coburn Zircon Project GUNSON RESOURCES LIMITED

Gunson proposes to develop the Coburn mineral sands project, located south of Shark Bay. It contains total ore reserves of 308Mt at an average grade of 1.2% heavy minerals, all of which lie within the portion of the project area that has received government environmental approvals for mining. At the proposed mining rate of 17.5Mtpa, the Coburn mine life is estimated to be 17.5 years which could be extended by six years if the northern area receives government approvals for mining. The Definitive Feasibility Study was completed in December 2009 and Gunson is continuing to advance discussions with potential strategic funding and offtake partners.

Expenditure: \$169m.

Employment: Construction: 170; Operation: 110

INFRASTRUCTURE

Kimberley - James Price Point - Browse LNG Precinct

WA STATE GOVERNMENT

The State Government is developing a Liquefied Natural Gas (LNG) Precinct in the Kimberley to enable processing of natural gas from the offshore Browse Basin. The LNG Precinct will be capable of accommodating LNG processing and shipping facilities for at least two proponents currently exploring for and developing these resources. This approach will minimise the environmental footprint of gas processing in the region while maximising opportunities for local people and businesses to participate in, and benefit from, employment and business opportunities. Woodside's final investment decision for the precinct is expected to be made in mid-2012.

Expenditure: \$30b.

Employment: Construction: 6000; Operation: 400

Oakajee - Oakajee Midwest Development WA STATE GOVERNMENT

The Oakajee Port will include common user infrastructure (channel, breakwater, turning basin, navigational aids, provision for tug and pilot boat pens, port administration offices and roads and utilities) funded by the State and Commonwealth Governments and private use infrastructure (at least one Cape Class iron ore berth, as well as associated materials handling equipment and rail infrastructure) funded by Oakajee Port and Rail Pty Ltd. The Port will also include provision for a non iron ore berth in the future to provide import / export capability for value-adding industries in the Oakajee Industrial Estate. A northern railway will link the port to mining tenements north-east of Geraldton and a southern railway will link the mining tenements to the south-east. The northern rail line will be operated by Oakajee Port and Rail though an open access regime. Oakajee Port and Rail has now identified three foundation customers with an expected initial throughput of 45Mtpa and delivered its draft bankable feasibility study to the State for consideration.

Expenditure: \$4b.

Employment: Construction: 2000; Operation: 300

IRON ORE

Great Southern Region - Southdown Magnetite Mine

GRANGE RESOURCES LTD

The Southdown Magnetite Mine is situated 90km north east of Albany near Wellstead. Grange Resources Ltd is targeting a 2014 start up with a revised production from 6.6Mtpa to 10Mtpa of magnetite concentrate. The slurry concentrate will be transported via a 100km pipeline from Southdown to the Port of Albany for export and pelletising. The merger of Grange with Australian Bulk Minerals brings significant magnetite mining and pelletising experience to the Southdown project. Albany Port Authority (APA) is expanding the Port to allow access by Cape size vessels and to increase berth,

Projects Under Consideration

storage and loading facilities to ship the Southdown concentrate. The APA is waiting on the final appeals process and the Minister for Environment's Statement. The current 6.6Mtpa mine and pipeline environmental approvals were received by Grange in November 2009. Grange is aiming for an updated prefeasibility study to be completed by late 2010 and bank feasibility studies by late 2011 to allow the expansion to 10Mtpa.

Expenditure: \$1.7b.

Employment: Construction: 2000; Operation: 600

Mid West Region - Extension Hill Magnetite Mine ASIA IRON

Asia Iron has primary environmental approval to produce up to 10Mtpa of magnetite concentrate, which will be transported by slurry pipeline to the port of Geraldton for export. The company is currently seeking secondary approvals.

Expenditure: \$2b.

Employment: Construction: 1000; Operation: 350

Mid West Region - Jack Hills Expansion

CROSSLANDS RESOURCES

Crosslands commenced trucking 1.5Mtpa hematite from its Jack Hills operations to the port of Geraldton in December 2006. Jack Hills Stage 2 would involve an increase to 25-35Mtpa of hematite and beneficiation feed ore. The ore would be transported by a new railway to a new deepwater port at Oakajee. A bankable feasibility study and exploration drilling program on the Stage 2 project is progressing.

Expenditure: \$2b.

Employment: Construction: 450; Operation: 350

Mid West Region - Weld Range Iron Ore Mine

SINOSTEEL MIDWEST CORPORATION LIMITED

Sinosteel Midwest Corporation proposes to develop a 15Mtpa iron ore mine at Weld Range 65km southwest of Meekatharra, producing a mix of hematite lump and fines. The project is expected to utilise a new rail line and a new deepwater port facility at Oakajee. The company finalised a bankable feasibility study in July 2010.

Expenditure: \$1b.

Employment: Construction: 1000; Operation: 500

Pilbara - BHPB Rapid Growth Project 6

BHP BILLITON IRON ORE PTY LTD

BHP Billiton Iron Ore announced on 29 January 2010 early expenditure of US\$1.73 billion (BHP Billiton share) to facilitate further growth. The funding will allow early procurement of long lead time items and detailed engineering to continue for infrastructure items such as the expansion of the inner harbour at Port Hedland and to progress rail track dual tracking work. Studies are continuing for the Company's future growth plans.

Expenditure: \$2.144b.

Pilbara - Cape Lambert Iron Ore Project

MCC AUSTRALIA HOLDING PTY LTD

MCC Australia Holding Pty Ltd (MCAH) is developing a 15Mtpa iron ore (magnetite) concentrate project at Cape Lambert and aims to ship its first ore by 2015. The Project comprises a proven JORC compliant 1.9bt iron ore resource and exploration licences covering 369 square kilometres. The Project would consist of a beneficiation plant (A\$1b), 300MW power plant, a port for exporting concentrate (A\$1b) and other related infrastructure. MCC has completed feasibility studies for the port, power supply, water supply, accommodation and general site infrastructure. The mine and processing studies are progressing. The company commenced native title negotiations with the Ngarluma Aboriginal people in March 2010. A draft environmental scoping document was submitted in June 2010 to the EPA.

Expenditure: \$3.7b.

Employment: Construction: 1000; Operation: 800

Pilbara - FMG Central Pilbara (Solomon 2 and Western Hub) Project

FORTESCUE METALS GROUP LTD

FMG's Central Pilbara project is located in the Solomon 2 area (about 70km north of Tom Price) and the Western Hub (west Solomon) in the Pilbara. To date, Solomon 2 has identified resources of 1.1 billion tonnes, with a target of 2 billion tonnes, comprising channel iron, bedded Brockman and detrital iron deposits. Start up production from Solomon 2 of 20Mtpa is scheduled for 2014, with aspirations to expand to around 200Mtpa by 2017 (100 Mtpa from Solomon 2 and 100 Mtpa from Western Hub). The project comprises mines, a new 250km railway linking the Solomon 2 mines to berths and ship loading facilities in the 350Mtpa multi-user Port Anketell. Capital expenditure is estimated at \$7 billion. Transportation of ore from the future Western Hub mines can be either on FMG's central rail or on the API rail. Western Hub mines are 250-300km via API rail and 280-320km via FMG central rail.

Expenditure: \$7b.

Pilbara - Roy Hill Iron Ore Mine & Infrastructure

HANCOCK PROSPECTING PTY LTD

Hancock Prospecting is developing the Roy Hill iron ore project located 105km north east of Newman. This project is expected to come into production in 2014 and will produce iron ore for over 20 years after ramp up at 55Mtpa. The project includes the development of the mine, a new railway and port facilities at Port Hedland. Environmental approval for Roy Hill mine Stage 1 was received in December 2009 and environmental approval for Stage 2 was received in March 2010. Roy Hill's mining leases have been approved. The Railway (Roy Hill Infrastructure Pty Ltd) Agreement Bill 2010 was passed by both houses of Parliament in October 2010.

Expenditure: \$7b.

Employment: Construction: 1500; Operation: 750

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 30Mtpa of direct shipping iron ore from its Red Hill and Mt Stuart mine sites located 35-80km south west of Pannawonica. The ore will be exported via a new heavy haul railway to a new multi-user port facility at Anketell. Subject to the successful completion of feasibility and environmental studies, and receipt of government regulatory approvals, the company anticipates that the first shipment will occur in 2014.

Expenditure: \$4b.

Employment: Construction: 2000; Operation: 700

OIL & GAS DEVELOPMENTS

Carnarvon Basin - Pluto LNG Project Expansion - Trains 2 & 3

WOODSIDE ENERGY

Woodside's master planning studies have confirmed that the Pluto LNG Park can accommodate an expansion of up to five LNG trains. This gives Woodside the opportunity to consider both equity gas development and other resource owner (ORO) gas supply at the Pluto LNG Park. Onshore FEED studies for Pluto Train 2 and Train 3 are now complete and contractor selection processes are underway.

Carnarvon Offshore Basin - Macedon Domestic Gas Project

BHP BILLITON PETROLEUM (AUSTRALIA) PTY LIMITED

The Macedon gas field, about 90km west of Onslow, was discovered in 1992 during drilling of the West Muiron-3 well and is estimated to contain a gas resource of up to 600bcf. BHP Billiton Petroleum (Australia) Pty Ltd and Apache Energy Limited are currently progressing the necessary approvals for a domestic gas project for Western Australia. The development will involve a number of sub-sea gas wells connected to the gas field, offshore

and onshore wet gas pipelines, an onshore gas processing plant 15km southwest of Onslow, and a sales gas pipeline connected to the Dampier-to-Bunbury Natural Gas Pipeline. Daily production is expected to be on the order of 200TJ. Construction is expected to start in late 2010, and gas production to commence in early 2013.

Expenditure: \$1b.

Employment: Construction: 300

Pilbara - Wheatstone LNG Development

CHEVRON AUSTRALIA PTY LTD

Chevron is investigating the feasibility of an LNG project based on its Wheatstone and Iago gas fields, to be located at Ashburton North, near Onslow. The project will also process gas from sub-economic third party fields in the Carnarvon Basin. Chevron entered FEED (Front End Engineering Design) in July 2009 with a Final Investment Decision planned for mid 2011. Gas to market is scheduled for 2015/16. The project will initially have two LNG trains with a 10Mtpa capacity, expandable to five, and a 250 million cubic feet per day domestic gas plant.

Expenditure: \$23b.

Employment: Construction: 5000; Operation: 400

TIMBER

Mirambeena Timber Processing Precinct -

Engineered Strand Lumber

LIGNOR LTD

Lignor Ltd Lignor is proposing to develop an Engineered Strand Lumber ESL®/ Engineered Strand OSB® plant located at Mirambeena, about 15km north west from Albany. Further tests are scheduled to improve the product and production. A new strand mat forming head will be designed prior to the development of the press proper. Lignor is finalising its design of the new forming head which may obviate the need for a Demonstration Plant. If testing of the new strand mat head is not successful, then a Demonstration Plant would need to be built before the construction of the Commercial Plant is undertaken. If this is the case then Lignor will propose to delay the building plans for the Demonstration Plant until early 2011. Lignor's Plants will use technology developed in conjunction with the German engineering companies Siempelkamp or Dieffenbacher. Either Plant will produce a range of products for certification to the Australian Building Code and overseas equivalents to allow firm off-take contracts to be finalised. Both the Demonstration Plant and Commercial Plant will source most of the timber from the extensive eucalypt plantations growing in the Albany region. Following the anticipated successful testing of the new forming head will allow construction of the Commercial Plant to commence in the first quarter of 2013.

Expenditure: \$276m.

Employment: Construction: 350; Operation: 125

URANIUM

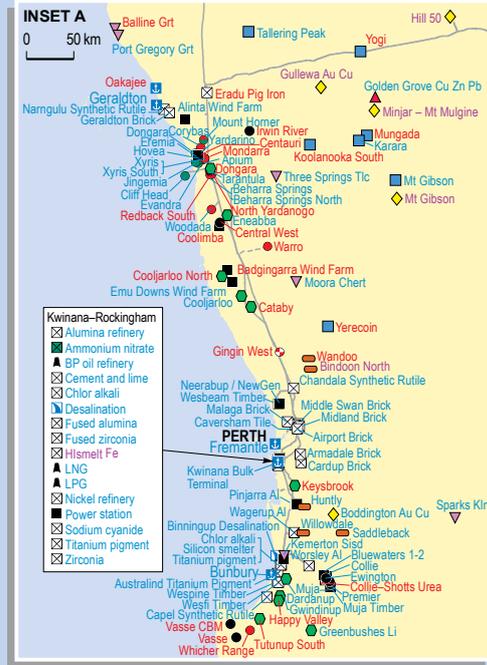
Mid West Region - Yeelirrie - Yeelirrie Uranium

BHP BILLITON YEELIRRIE DEVELOPMENT COMPANY PTY LTD

BHP Billiton proposes to develop the Yeelirrie Uranium Project in the North-eastern Goldfields, near Wiluna. The proposal 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 would produce up to 5,000tpa uranium oxide concentrate over about 30 years. The formal environmental impact assessment process was initiated in 2009 and the project Environmental Scoping Document was approved in May 2010. The Company plans to submit its draft ERMP in March 2011 and to achieve all government approvals by end 2012. Construction is expected to commence in early 2013 and mining in 2014. The uranium oxide will be transported to South Australia by road for export to overseas markets.

Employment: Construction: 700; Operation: 300

Major Resource Projects — December 2010



Project labels:
 PROJECTS OPERATING OR CURRENTLY UNDER DEVELOPMENT WITH AN ACTUAL OR ANTICIPATED VALUE OF PRODUCTION GREATER THAN \$40 MILLION ARE SHOWN IN BLUE
 PROPOSED OR POTENTIAL PROJECTS WITH A CAPITAL EXPENDITURE GREATER THAN \$A20 MILLION ARE SHOWN IN RED
 PROJECTS ON CARE AND MAINTENANCE ARE SHOWN IN PURPLE

