



ISSUE 112, MAY 2017



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Multi-year slump

Iron ore price set to suffer five year decline



"A 12 PER CENT
DROP IN VALUE
IN MARCH, AND
FURTHER DECLINE
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APRIL."

(CONTINUED ON PAGE 4)

Oversupply fears have seen a recent drop in iron ore prices.

Image: Anglo American.

CAMERON DRUMMOND

STEADY decline in iron ore prices is expected over the next five years, with a targeted drop in production from the world's largest steelmaker China and new ore production from mega projects in Australia and Brazil sparking oversupply fears.

Surging iron ore prices during 2016 saw

the commodity reach more than \$US80 per tonne (t) for the first time since October 2014 after hitting a record low of \$US38.50/t in January last year.

The 62 per cent Fe Qingdao spot price had jumped more than 100 per cent, and by February 2017 had peaked at \$US94.86 – its highest level since 2014 – according to a Metal Bulletin report.

The price rally – which consistently

ignored widespread bearish forecasts in 2016 – had been largely attributed to burgeoning infrastructure investment in China and a slowdown in the country's supply growth.

According to Platts, continued strength in China's steel market had caused iron ore prices to rise as mills pursued productivity to maximise margins.

China imported 91.98mt of iron ore in November 2016; up 12 per cent year-on-year

and 13.7 per cent from the previous month, according to government data released in December by China's General Administration of Customs.

However on 5 March, Chinese Premier Li Keqiang announced a 50 million tonne (mt) cut to steel production for 2017.

The Chinese Government said it aimed to close between 100mt and 150mt of annual steel capacity by 2020.

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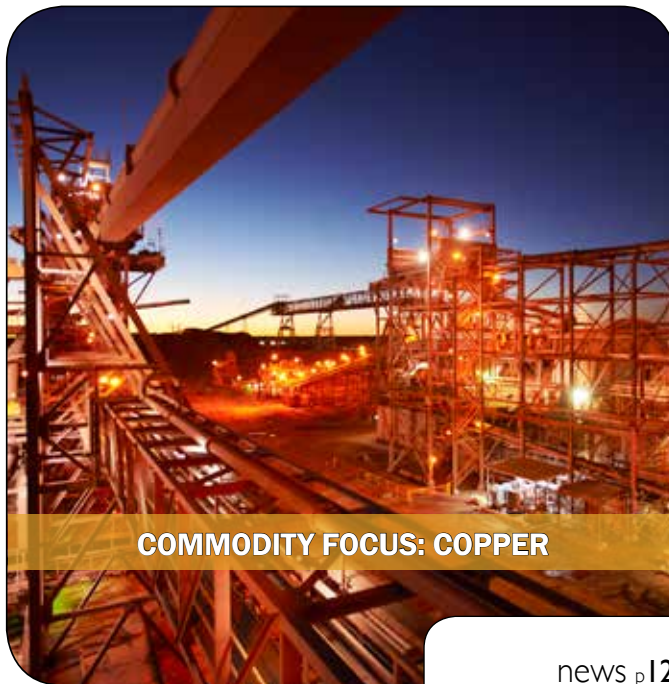
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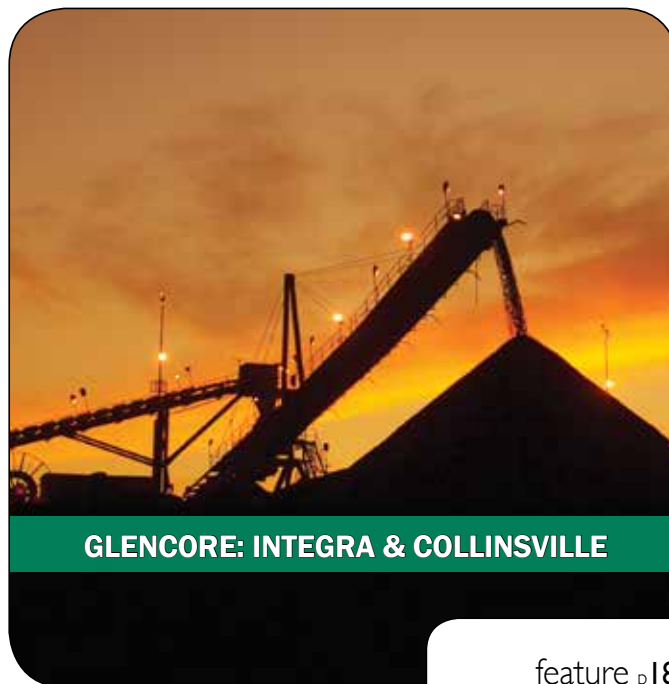
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Debbie no Yasi repeat: Canavan

REUBEN ADAMS

WHILE figures from the Resources and Energy Quarterly predicting record-high export earnings of \$215 billion in 2016–17 and 2017–18 were completed before Cyclone Debbie, the Federal Government is confident the storm's impacts will be manageable.

Minister for Resources and Northern Australia Senator Matt Canavan said separate early assessments show that the Queensland resources sector should be able to absorb the impact of the cyclone.

"While there has been some damage to coal haulage rail lines which transport coking coal to the Dalrymple Bay and Hay Point coal terminals, the majority of mines should be able to stay open and stockpile production," Mr Canavan said.

"At the moment the expectation is they'll then be in a position to make up for the lost transport time over the next

few months.

"This is in contrast to the impacts from Cyclone Yasi in 2011, where mine production was significantly disrupted and about 26 million tonnes of coal exports were lost."

As of 7 April, Mr Canavan said it looked likely that an estimated 13 million tonnes of coking coal exports would be delayed, and a further 2mt to 3mt of thermal coal exports, although these numbers would potentially change as more information is known about the impacts.

The Resources and Energy Quarterly projected nation-wide export volumes well above pre-mining boom levels out to 2021-22.

The 32 per cent increase in export earnings was expected to come from price spikes in iron ore and metallurgical coal, driven by the resurgence of China's steel sector, combined with increased LNG export volumes.



Image: NASA/NOAA/Suomi NPP.

NASA-NOAA's Suomi NPP satellite provides a visible look at Tropical Cyclone Debbie from space.

Green light for Coal & Allied purchase

ELIZABETH FABRI

YANCOAL Australia's \$US 2.45 billion acquisition of Rio Tinto's Coal & Allied has received the tick of approval from the Foreign Investment Review Board (FIRB).

Announced on 13 April, the approval marked an important milestone for the coal giant in its pursuit to become Australia's largest pure-play coal producer.

Coal & Allied had majority interests in a number of NSW coal operations including the Hunter Valley Operations (HVO) mine, Mount Thorley Warkworth (MTW) coal mines, as well as a 36.5 per cent interest in Port Waratah Coal Services in Newcastle.

Yancoal chief executive Reinhold Schmidt said the approval was a positive step forward for the company and its shareholders, and demonstrated the Australian Government's support for continued investment in the local resources sector.

"Yancoal remains a key provider of employment, training and investment within NSW and we look forward to continuing to grow our operations," Mr Schmidt said.

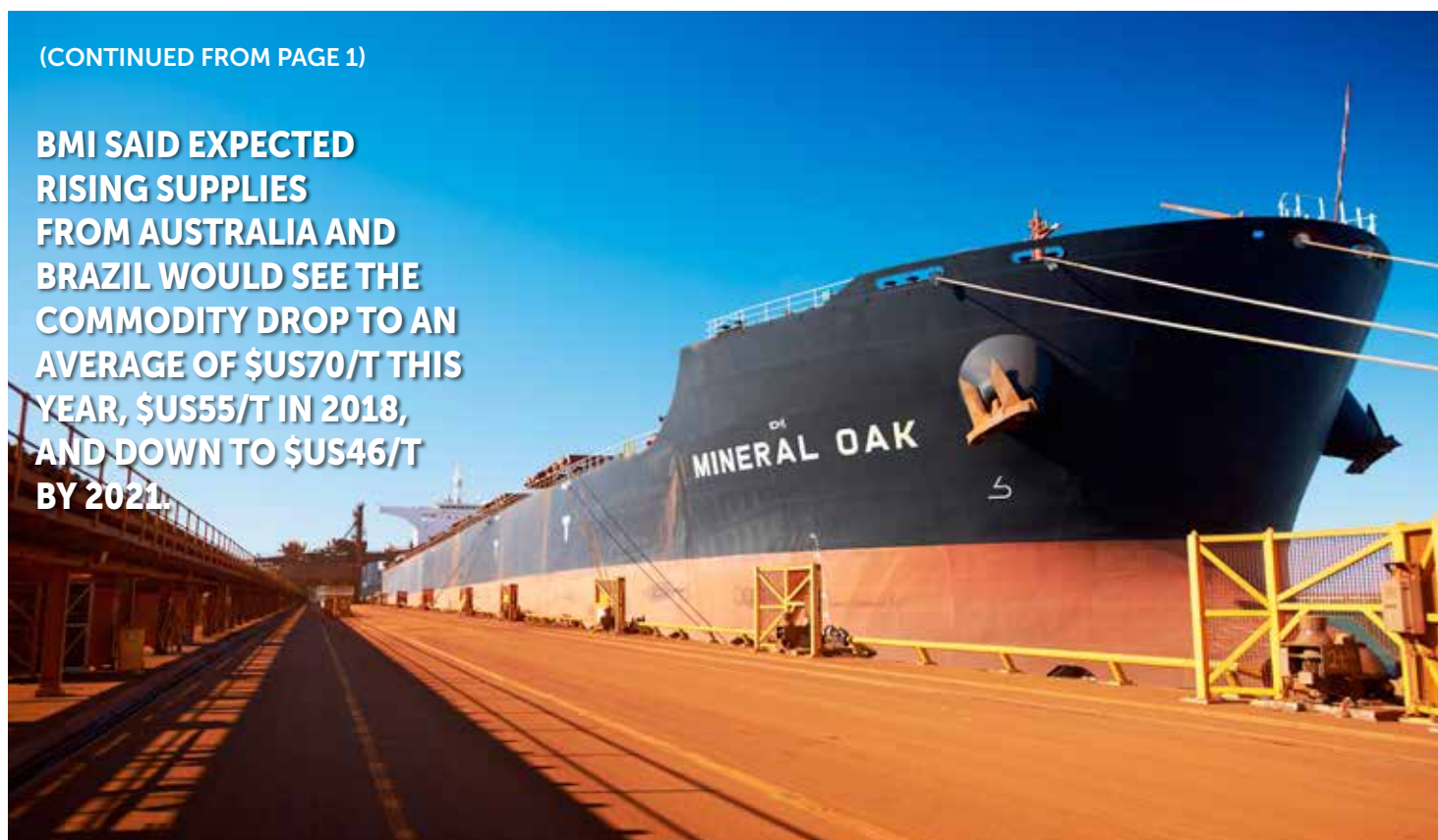
"The transaction remains subject to a number of further closing conditions, including Rio Tinto plc and Rio Tinto Limited shareholder approval and Yanzhou Coal Mining Company shareholder approval."

Mr Schmidt said the transaction was expected to complete in the third quarter of 2017.

Iron ore price set for 5 yr decline

(CONTINUED FROM PAGE 1)

BMI SAID EXPECTED RISING SUPPLIES FROM AUSTRALIA AND BRAZIL WOULD SEE THE COMMODITY DROP TO AN AVERAGE OF \$US70/T THIS YEAR, \$US55/T IN 2018, AND DOWN TO \$US46/T BY 2021.



This, coupled with the addition of recently ramped up mega projects such as Hancock Prospecting's Roy Hill, AngloAmerican's Minas Rio and Vale's S11D, has led to oversupply fears that could continue to drive down prices during 2017.

Off the cuff of its production ramp up at S11D, Vale hit a fresh record quarterly production high of 86.2mt for the March quarter; 11.6 per cent higher than the

previous corresponding reporting period.

A recent BMI Research report stated iron ore prices would continue to slide for at least the next five years, averaging lower each year through to 2021.

BMI said expected rising supplies from Australia and Brazil would see the commodity drop to an average of \$US70/t this year, \$US55/t in 2018, and down to \$US46/t by 2021.

A 12 per cent drop in value in March,

and further decline through April saw iron ore continue its downward trend to trade at \$US66/t by 25 April.

In the last month, the four largest iron ore producers had already seen lower prices affect company value.

Vale was down 6 per cent in the month to mid-April, with Fortescue Metals Group down 2.6 per cent over the same period.

BHP Billiton and Rio Tinto had also seen a drop in share price.


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BMA invests \$US204m in CRSC

ELIZABETH FABRI

BHP Billiton and joint venture partner Mitsubishi Development will begin construction on a \$US204 million overland conveyor system connecting two of its coal mines in Central Queensland in mid 2017.

The Caval Ridge Southern Circuit (CRSC) project includes development of an 11km conveyor system to deliver coal from Peak Downs mine to Caval Ridge Coal Handling Preparation Plant; a new stockpile pad and run-of-mine station at Peak Downs; and new mining fleet, including trucks and excavators.

The project would also see Caval Ridge preparation plant increase its throughput capacity to 10 million tonnes per annum, with the 18 month construction schedule set to begin mid this year.

BHP Billiton Minerals Australia president operations Mike Henry said the project was expected to generate up to 400 construction jobs and 200 operational positions.

"This investment furthers our productivity agenda, reduces costs, releases latent equipment capacity, and strengthens our coal business' global competitiveness," Mr Henry said.

"We are committed to Queensland's Bowen Basin and this project creates new employment opportunities during construction and locks in ongoing operational roles.

"The investment flowing from the project will help support the local community and State economy after what has been a difficult time in the region."



Image: BHP Billiton.

South32 scraps Colliery buy

CAMERON DRUMMOND

BHP Billiton spinoff South32 has scrapped its \$US200 million purchase of Peabody Energy's Metropolitan Colliery and associated port infrastructure near Wollongong, NSW.

On 23 February, the Australian Competition and Consumer Commission (ACCC) released a statement saying the proposed acquisition could substantially lessen competition in the coking coal supply to Australian steelmakers, as it would leave South32 as the only major supplier in the region.

"The ACCC considers that competition is necessary for customers in a region to obtain export price parity," the competition monitor wrote.

"If there is a single exporter in a region, that supplier will likely set the price to local customers to match the next best option available to the customer, which will be supply from another region."

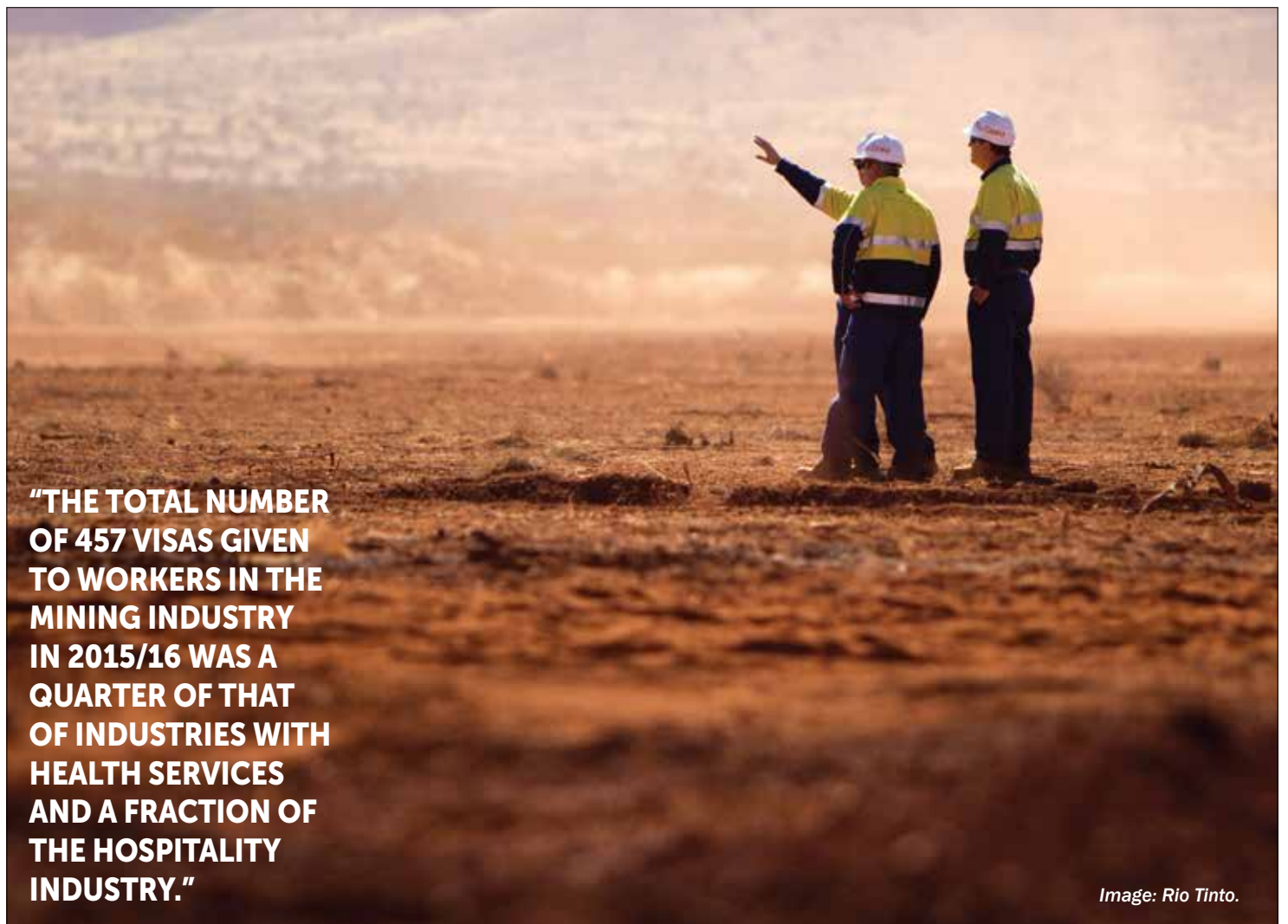
In light of the ACCC writ, the company decided to pull out of the deal.

"South32 is not prepared to make significant concessions in favour of Australian steelmakers that would likely be required to mitigate the competition concerns," the company said in a statement.

"To do so would be contrary to the global market in which metallurgical coal producers compete and would adversely affect the value proposition of the acquisition."

In November last year the company had agreed to purchase the NSW Colliery and a 16.7 per cent interest in the Port Kembla coal terminal from the US coal giant.

Industry backs 457 visa axing



"THE TOTAL NUMBER OF 457 VISAS GIVEN TO WORKERS IN THE MINING INDUSTRY IN 2015/16 WAS A QUARTER OF THAT OF INDUSTRIES WITH HEALTH SERVICES AND A FRACTION OF THE HOSPITALITY INDUSTRY."

Image: Rio Tinto.

ELIZABETH FABRI

THE Federal Government's plan to abolish the 457 visa for foreign workers has already received strong support from mining industry officials, who remain hopeful a new scheme would safeguard Australian jobs and fill the void where skilled workers were currently needed.

On 18 April, Prime Minister Malcolm

Turnbull announced the Subclass 457 visa would be scrapped and replaced with a Temporary Skill Shortage (TSS) visa with a reduced list of occupations, tighter criminal background checks, and higher standards for English language skills.

The TSS program would be split into two streams; a short term visa of up to two years, and a medium term visa for up to four years.

Mining occupations that made the list

included construction project managers, engineers, environmental consultants, geologists, metal fitters and machinists, and occupational health and safety advisers.

Mr Turnbull said the new visa would also include strengthened training obligations for employers sponsoring foreign skilled workers to provide enhanced training outcomes for Australians in high-need industries and occupations.

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“These changes will give Australian job seekers more opportunity to find work while finding the right balance so businesses can prosper by acquiring the expertise they need,” Mr Turnbull said.

“Implementation of the new visa will begin immediately, with full implementation to be completed by March 2018.”

Applications for 457 visas in the Australian resources industry had dropped from 6630 in 2011-12 and 2600 in 2013-14, to just 230 in 2016-17, according to Department of Immigration figures.

Australian Mines and Metals Association acting chief executive Tara Diamond said resources industry employers had welcomed the new TSS scheme, which would ensure the nation’s skilled migration systems were fit for the current economic climate.

“In this context, the replacement of the 457 visa program with a new temporary immigration program will help ensure skilled migrants, and the significant contribution they make to our nation, is no longer trivialised and leveraged for cheap political point-scoring,” Ms Diamond said.

“However, it should be recognised that the 457 visa program has worked as intended.

“The system was built to be responsive to changes in our economy and fluctuating labour demand, and has delivered on this objective.

“The resource industry is one sector that has seen a dramatic change in labour demand and skills availability in recent years.”

Queensland Resources Council chief executive Ian Macfarlane said the natural resources sector was no longer a significant employer of the 457 visa holders.

“Those that are employed possess highly specialised skills and experience, particularly, university degrees,” Mr Macfarlane said.

“The QRC welcomes Prime Minister Malcolm Turnbull saying we’ll only take the best and brightest from overseas.

“The total number of 457 visas given to workers in the mining industry in 2015/16 was a quarter of that of industries with health services and a fraction of the hospitality industry.”

Mr Macfarlane said 457 visa holders in the Queensland mining industry last financial year decreased by 26.5 percent and growing the skills base in communities was a great investment for companies and locals.

The Australian Institute of Geoscientists (AIG), however called on the Federal Government to include geoscientists in the list of professions that are not exempt from Labour Market Testing (LMT) in light of the high rate of unemployment among Australian geoscientists.

“During the ‘mining boom’, Australian exploration and mining companies benefited from an ability to sponsor overseas trained and experienced geoscientists to work in Australia under the temporary work visa program,” AIG president Mike Erceg said.

“The need for this now, however, at a time of dramatically reduced opportunities for geoscientists who are Australian citizens and permanent residents, must be questioned.

“New admissions need to be assessed very carefully against opportunities for geoscientists already in Australia and seeking work.”

More information on the visa abolishment and list of jobs under the TSS scheme can be found at: www.border.gov.au/Trav/Work/457-abolition-replacement.

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GE drives South32 digital growth

REUBEN ADAMS

GE has signed on to help drive South32's digital transformation as part of a three-year strategic partnership.

GE's Predix platform – connecting industrial equipment, data analysis and instant insights – will help the miner make fast, informed decisions and optimise entire operations rather than individualised assets and equipment.

"Bringing the world of operational technology and information technology together to monitor equipment and systems remotely and predict future behaviour is a game changer," South32 chief executive Graham Kerr said.

"It has the potential to identify and solve a problem before it affects operations."

South32 chief technology officer Ricus Grimbeek added that "if we get this right, the result won't just be an incremental improvement but a new level of efficiency and performance".

GE chief executive and chairman Jeff Immelt said the future of mining was digital.

"With data and analytics, we can achieve greater levels of productivity, operational efficiencies, and improve safety," Mr Immelt said.

"We look forward to working with South32 to help them optimise their operations and accelerate the digital transformation of the mining industry at large."

"IF WE GET THIS RIGHT, THE RESULT WON'T JUST BE AN INCREMENTAL IMPROVEMENT BUT A NEW LEVEL OF EFFICIENCY AND PERFORMANCE".



GE chief executive Jeff Immelt (left) with South32 chief executive Graham Kerr (right).

DMP trials online mapping tech

ELIZABETH FABRI

THE Department of Mines and Petroleum WA will launch an online version of its well-known TENGRAPH mapping system to help miners better discover suitable ground for mineral exploration in the State.

The technology has been a reliable resource for WA explorers since its launch in 1992, but was showing its age with links to technology that were no longer supported.

"TENGRAPH has served the department well over the years and we have had a great return on our investment, but it does not provide the seamless coverage of the entire State that the new browser-based system does," DMP Mineral Titles executive director Dr Ivor Roberts said.

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

The new web-based system is more business oriented with a focus on tenements and approvals, and increased functionality for the user.

The program has a new interface that offers users the ability to produce high-quality maps that included overlays of topography and geology.

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

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

Innovators unite in Shield-X challenge



Since 2014, Uearthed has connected more than 2000 innovators to resource industry challenges.

Image: Uearthed.

ELIZABETH FABRI

THE world's leading technological minds will join forces in an online 'hackathon' aimed at designing a safety-stop device to communicate with all pieces of autonomous equipment.

A joint initiative between BHP Billiton, Barrick, Caterpillar, Uearthed and the Mineral Research Institute of WA (MRIWA), the Shield-X online challenge held in the first week of May provided the opportunity for designers, engineers and developers from around the world to collaborate with the mining

industry.

Participants had a week to design and submit a prototype, and pitch online for the chance to win more than \$20,000 in prizes; as well as a technology workshop to assess and develop their prototypes.

"The Shield-X challenge is a great opportunity to bring miners, manufacturers, and entrepreneurs together to generate fresh ideas for our industry," Barrick chief innovation officer Michelle Ash said.

"We look forward to working with the talented innovators that will be participating in the challenge and seeing the unique solutions that are generated."

BHP Billiton Technology Strategy & Innovation principal Graeme Mitchell said the challenge recognised that people with no mining experience could bring valuable insights to the table and solve the industry's challenges.

"We're excited to partner with Uearthed to tap into the international innovation community in pursuit of more efficient, effective and safer ways to work," Mr Mitchell said.

The event kicked off on 28 April in Perth and runs until 5 May with a co-working space made available at CORE Innovation Hub in Perth for WA participants.

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IN BRIEF

Anglo American offloads assets

SOUTH AFRICA

GLOBAL miner Anglo American will sell its Eskom domestic thermal coal operations in South Africa to a subsidiary of Seriti Resources for about \$US164 million.

Subject to regulatory approvals, the sale included Anglo American's New Vaal, New Denmark and Kriel collieries, as well as four closed collieries.

"We are pleased to have agreed the sale of our Eskom-tied domestic thermal coal operations in South Africa," Anglo American chief executive Mark Cutifani said.

"This transaction forms part of our ongoing commitment to reshape and upgrade our global asset portfolio, recognising appropriate value and further demonstrating Anglo American's longstanding support for the development and sustainability of South Africa's mining industry."

Atlas Copco expands manufacturing plant

INDIA

ATLAS Copco is doubling the capacity of its manufacturing plant in Hyderabad, India to accelerate its drilling consumable services to the mining industry.

The investment, valued at MINR 800, included a world-class R&D centre for rock drilling products, and would create jobs for about 35 additional people.

"The expanded factory will strengthen our delivery process, enhancing productivity for our customers globally," Atlas Copco Mining and Rock Excavation Technique business area president Helena Hedblom said.

"It will also ensure development of competitive products at a faster pace."

Bass Metals to purchase lithium project

MADAGASCAR

ASX-listed Bass Metals has inked an agreement with Ruby-Red Madagascar SARL to purchase its Millie's Reward potentially high-grade spodumene hosted lithium project in Madagascar.

The transaction would see Bass Metals acquire two adjacent mining permits and the lithium mining rights for a third mining permit.

"The team is excited to bring a project like Millie's Reward into our portfolio, especially as it's fully permitted for exploration and potential development," Bass Metals chief executive Tim McManus said.

"The Company's primary focus remains optimising the premium asset of Graphmada to generate positive cash flows in 2017."

Amani hits gold at Giro

REUBEN ADAMS

ASX-listed Amani Gold (formerly Burey Gold) is returning exceptional results from an infill drilling program at its Giro gold project in the Democratic Republic of Congo (DRC).

Amani received results for a further eight RC holes for 1121m from the infill drilling program at the Kebigada deposit, which kicked off mid-February.

GRRC217 reported standout results – 36m at 6.56 grams per tonne of gold from 14m including 14m at 15.15g/t gold from 15m; and 65m at 7.73g/t gold from 74m including 44m at 10.69g/t gold from 85m, including 1m at 179g/t gold from 107m.

The hole ended in high-grade mineralisation which is open down-dip.

Amani chairman Klaus Eckhof said the exceptional result of 105m at 7.33g/t gold confirmed the company's belief that Kebigada had potential to become a substantial standalone deposit.

"This result is similar to some of the better results reported at Kibali during the exploration phase," Mr Eckhof said.

"We eagerly await results of a diamond hole planned to twin this RC hole to determine the true width of the zone of mineralisation."



The Giro gold project is within the under-explored Kilo-Moto Belt, which also hosts Randgold Resources' 16moz Kibali project.

Image: Amani Gold.

"The infill drilling has certainly highlighted the high-grade potential at Kebigada and the potential for high-grade zones of mineralisation to continue to depth which could eventually yield a substantial underground project with continued deeper drilling."

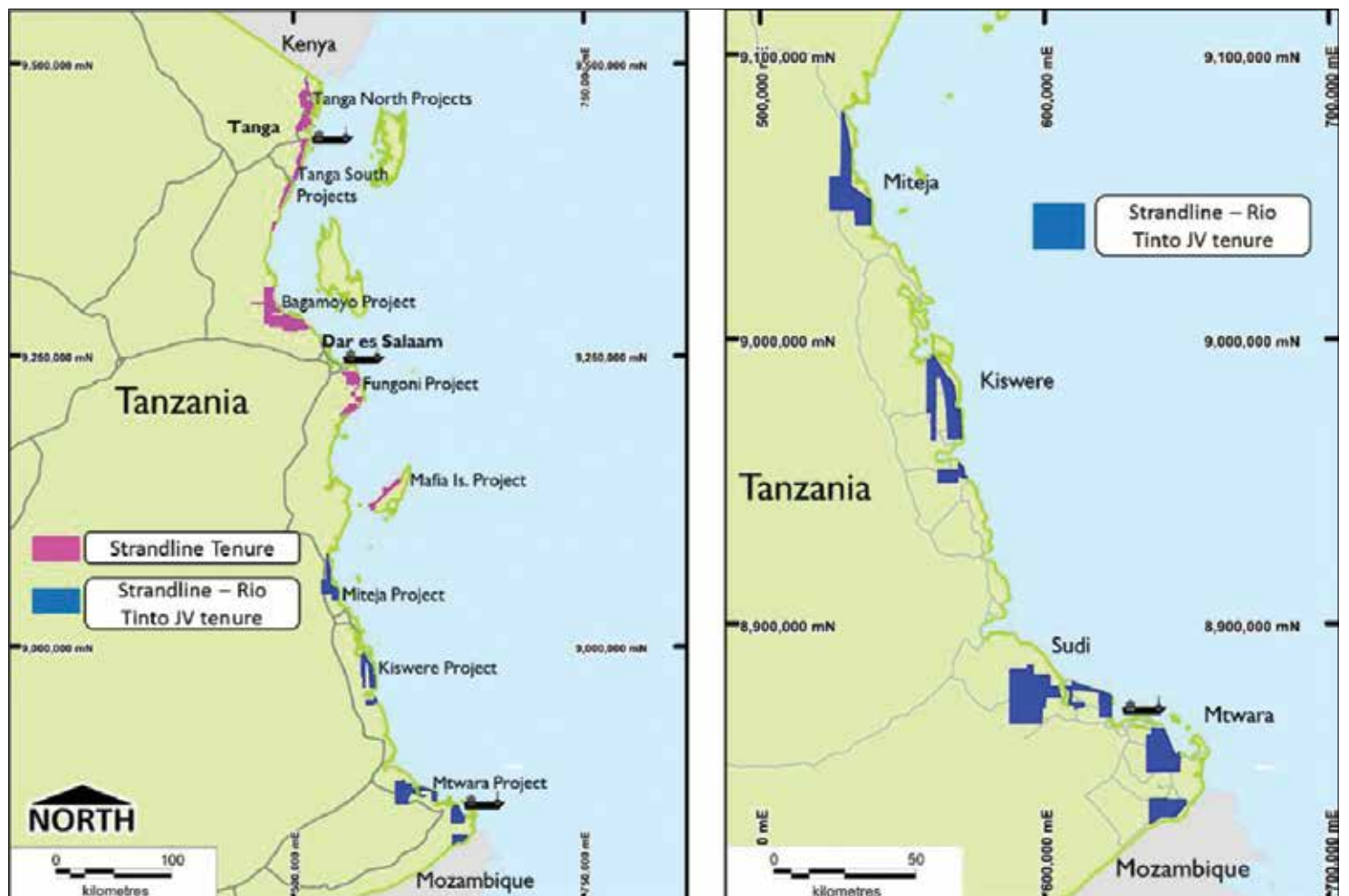
Mr Eckhof said the company expected these excellent grades to be reflected in the maiden mineral resource estimate expected before the

end of the second quarter.

The 497sqkm Giro gold project comprises two exploitation permits within the Kilo-Moto Belt; a significant under-explored greenstone belt hosting Randgold Resources' 16moz Kibali group of deposits, about 35km from Giro.

In 2015, Kibali produced 642,720 ounces in its first full year of operation, confirming the prospectivity of the region.

Rio partners in Tanzanian project



The JV will encompass the company's southern tenements in Tanzania including Miteja, Kiswera, Sudi and Mtwara.

Image: Strandline Resources.

ELIZABETH FABRI

RIO Tinto has entered an earn-in joint venture agreement with ASX-listed Strandline Resources for a majority interest in the company's mineral sands tenements in southern Tanzania.

Rio Tinto is required to spend \$US5 million within three and a half years to earn a 51 per cent participating interest, including a mandatory commitment of \$US2 million within 18 months.

A second stage payment of \$US4 million within two years would earn Rio a 75 per cent

interest in the project. Both parties will begin an initial soil sampling fieldwork in the next two months, funded by an 'at risk' payment of \$US340,000 from Rio Tinto.

The agreement covered Strandline's suite of tenements in the southern region of Tanzania including the Miteja, Kiswera, Sudi and Mtwara prospects, plus a surrounding "area of interest".

Strandline managing director Luke Graham said the commitment from Rio Tinto confirmed the Tanzania tenements' potential as a world-class mining region.

"The company is delighted by the merits of this strategic partnership with Rio Tinto,

one of the world's largest and most respected exploration and mining companies," Mr Graham said.

"This transaction delivers a strong source of funding and regional mineral sands expertise to significantly enhance the development potential of the company's southern ground in Tanzania, with a view to ultimately develop one or more economic mineral sands mines."

"Rio Tinto has undertaken technical reviews and site inspection of the project area and this agreement contemplates mobilisation of exploration activity led by Strandline as soon as practicable to take advantage of the current field season."

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THE AUSTRALIAN
MINING REVIEW

Sparks flying?

A sudden price recovery for copper in late 2016 had industry analysts optimistic for what was predicted to be one of the best performing commodities of 2017. Three month lows in April however, have cast doubt on copper's uphill trajectory.

ELIZABETH FABRI

AUSTRALIA is believed to contain the second largest economic resource of copper in the world (about 13 per cent) and ranked fifth in production, behind Chile, China, Peru and the US.

About 68 per cent of Australia's copper was in South Australia, however there were also large-scale copper projects operating in WA, NSW and Mount Isa in Queensland.

BHP Billiton's Olympic Dam project in South Australia was the leader of the pack as the country's largest known deposit; also ranking as the fourth largest copper deposit in the world, and largest known single deposit of uranium.

Talks of further expansion at the mine are advancing, which if confirmed could see copper levels reach 450,000 tonnes per annum from 2025.

The construction of OZ Mineral's Carapateena project, also in South Australia, was another exciting development that was estimated to contain 61mt at 2.9 per cent of copper equivalent.

While copper sentiment in Australia was broadly positive, a number of global issues have resulted in volatile price swings in recent times.

By mid 2011, the price had hit its peak at \$US9650/t, before dropping to \$US5216/t October 2015, and \$US4731/t in October 2016.

Then, at the end of November the monthly copper price average spiked to \$US5450/t, partly attributed to Donald Trump's US presidential election victory, and continued rising hitting more than \$US6000/t in February 2017.

The price recovery was also tied to disruptions at Rio Tinto and BHP's jointly owned Escondida mine in Chile where workers undertook a 44-day strike, leading to a substantial loss in production.

However in April, copper prices hit a three month low, fetching as low as \$US5530/t.

The drop in prices was believed to be attributed to a potential resumption of production at Freeport-McMoRan's Indonesian operations.

Speaking at the CRU World Copper Conference on 5 April, BHP Billiton Minerals America president Daniel Malchuk said the copper industry on a global level was facing increasing challenges; from declining grades, deeper deposits, harder ore, labour productivity issues, and higher expectations from host governments and communities.

"Our challenges are massive, for example in the area of labour relations, as shown by the recent collective bargaining process at Minera 2 Escondida," Mr Malchuk said.

"But no matter how difficult, what's certain is that change and transformation, is a fundamental part of keeping the industry alive for the long term.

"As producers, we cannot shy away from this responsibility, nor can we do it alone."

Rio Tinto chief executive of copper and diamonds Arnaud Soirat, who also spoke at the conference, said despite the challenges, copper has continued upside ahead.

"Copper's long-term fundamentals are positive, and we expect to see further demand growth from emerging markets," Mr Soirat said.



"WITH CONTINUED MODEST GROWTH IN DEMAND, A SUBSTANTIAL SUPPLY GAP MAY EMERGE BY THE BEGINNING OF THE NEXT DECADE; THIS COULD RESULT IN HIGHER PRICES, ENCOURAGING RESTARTS OF HIGHER COST MINE SUPPLY AND INCENTIVISING NEW PROJECT CAPACITY."

"The downturn in China, for example, seems to have plateaued.

"Most indicators have seen strong growth so far this year; copper remains central to continued development in China, and demand from India, Southeast Asia and Africa will continue to rise over the next decade."

Mr Soirat said investments in power grids, a major consumer of copper, would also drive further demand as well as new uses for copper in renewable energy applications and electric vehicles.

"In the last 18 months, the industry has seen around 800kt of price-related cutbacks and we now see the market

moving into a small deficit this year," he said.

"Over the next three to five years there are limited new greenfield projects expected to come online.

"This – combined with grade decline and end of life closures over the next few years – means we see overall mine supply potentially plateauing before the end of the decade.

"With continued modest growth in demand, a substantial supply gap may emerge by the beginning of the next decade; this could result in higher prices, encouraging restarts of higher cost mine supply and incentivising new project capacity."

Capricorn Copper redevelopment gains special status

REUBEN ADAMS

THE \$152 million Capricorn Copper mine redevelopment has gained special status from the Queensland Government to cut red tape and create hundreds of jobs in north-west Queensland.

The re-opened mine is forecast to produce 30,000 tonnes per annum of copper metal in concentrate over an initial mine life of 10 years.

The former Mount Gordon copper mine was mothballed in 2013 due to plummeting copper prices, before it was sold to a joint venture of Brisbane-based Lighthouse Minerals and Melbourne-based EMR Capital in late 2015.

State Development Minister Dr Anthony Lynham said jobs and business opportunities in the north-west mineral province were a priority for the government.

"Granting prescribed project status will allow the Coordinator-General to assist this project to efficiently navigate

processes and timely approvals through government," he said.

"This is all about getting almost 90 construction jobs during construction and more than 200 direct operational jobs underway and available by the third quarter of 2017."

First ore production from Capricorn was expected in October this year, with a four-month ramp-up to steady production.

The joint venture has committed to prioritising employment, suppliers and contractors from Mount Isa and other north-west Queensland communities, including Cloncurry.

Dr Lynham said Capricorn Copper was looking to the future and investing a further \$14 m in exploration over the next two years to identify more resources in its permit areas and extend the life of the mine beyond the initial 10-year window.

"This is new investment in one of the world's most valuable base metal areas, and clear evidence of the opportunities still to be had in the north-west," he said.



First ore from Capricorn was expected in October this year, with a four-month ramp-up to steady production.
Image: QLD Department of State Development.

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Haul truck elevators for cost reductions in mining

IAN EDMONDS

ONE of the principal costs in mining is the capital and running costs of haul trucks to lift ore from mines (Figure 1).

Ignoring rolling friction, the fuel energy consumed by a truck ascending out of the mine is $E = e(M + m)gd$, where 'M' is the mass of the truck and 'm' is the mass of the ore load, 'g' is the gravitational acceleration, 'd' is the depth of the mine and 'e' is the fuel to mechanical energy conversion efficiency of the engine.

Ore lifting using haul trucks wastes fuel because the fuel cost of lifting the ore is accompanied by the fuel cost of lifting the haul truck.

A typical large haul truck has an engine power (P) of about 3MW, a truck mass of about 300 tonnes and carries about 300t of ore.

Therefore there is a potential 50 per cent reduction in fuel cost by eliminating the need for a haul truck to lift itself out of the mine.

A solution is to link an ascending haul truck to a descending haul truck so that gravitational energy can be transferred from the descending truck to the ascending truck.

Many large haul trucks are diesel-electric and utilise regenerative braking when descending into a mine.

Rather than dissipate the electrical energy generated by the wheel motor/generators to the air via resistive heaters, the electrical energy could be transferred via overhead conductors suspended above the ramp to ascending haul trucks.

The upper sketch in Figure 2 illustrates the electrical connection of an empty descending truck, (LHS), via dual pantographs and overhead wires to a loaded ascending truck, (RHS).

"AS AUSTRALIA EXPORTS ABOUT 800 MILLION TONNES OF IRON ORE PER YEAR THIS FIGURE, IF TYPICAL OF IRON ORE MINING, WOULD REPRESENT AN ANNUAL FUEL COST SAVING OF \$120 MILLION."

This seems the most practical solution as it can be implemented on curved ramps of varying slope, [1].

An alternative solution is to link a descending truck via a cable and pulley to an ascending truck as in the lower sketch in Figure 2.

However, this solution requires straight ramps.

Ignoring frictional or electrical losses the energy analysis is the same in both cases.

Because the mass of the ascending truck is compensated by the mass of the descending truck the net mass lifted is just the mass of ore (m) in the ascending truck.



Figure 1: A loaded haul truck ascending out of a mine must lift its own mass as well as the ore mass.

Therefore the energy required for the lift is mgd .

This can be compared with the energy required when the ascending truck is unassisted by the elevator arrangement, $(M+m)gd$.

As a result, the energy and fuel required is reduced by the factor $m/(M+m)$.

If both trucks are pulling at full power (P) the available power is 2P.

As the energy required to lift the ore through height, d, is mgd , the time to accomplish the lift is $mgd/2P$.

This can be compared with the time of lift when the ascending truck is unassisted by the elevator arrangement, $(M+m)gd/P$.

We see that the time for the lift is reduced by the factor, $m/2(m+M)$.

Under this scenario there is, in principle, no requirement for braking. Thus, the advantages are: (1), a reduction in fuel required; (2) a reduction in lift time or turnaround time of the haul trucks; and (3) a minimal brake operation and brake wear.

To make the reductions more specific, miners can consider the typical case of haul trucks of mass 300t lifting ore loads of mass 300t out of a pit 200 metres deep.

The energy required for an unassisted lift is $(M+m)gd = 600,000 \times 9.8 \times 200 = 1176$ MJ; for the elevator assisted lift the energy required is one half this, 588 MJ.

With the power of each truck equalling 3MW, the unassisted lift time is $1176/3 = 392$ seconds or 6.5 minutes.

The elevator assisted lift time is just one quarter of 6.5 minutes, for example 1.63 minutes.

Notice that powered operation at 2P for one quarter of the time results in a halving of fuel cost as noted earlier.

If rolling friction is ignored, the time of lift is independent of the ramp gradient. Assuming the ramp gradient is 15 per cent, with a mine depth of 200m the ramp length is 1.35km.

The unassisted haul truck ascends this ramp in 6.5 minutes so the ramp speed, v, is 12.46 km/hr = 7.7 mph. The ramp speed of the elevator assisted haul truck is four times this, v = 49.8 km/hr = 31 mph.

Rolling resistance is only weakly dependent on truck speed, [2,3], so the rolling resistance, if included, would be essentially the same in both cases.

The brake specific fuel consumption of a large diesel engine is about 200 g/kWhr. With the density of diesel 0.851 g/cc this converts to 0.24 litres/kWhr.

Thus, referring to the example outlined above, an unassisted lift requires the operation of one truck at 3000kW for 6.5 minutes delivering $3000 \times 6.5/60 = 325$ kWhr of energy and consuming $325 \times 0.24 = 78$ litres of diesel fuel.

The elevator assisted consumption is just one half this; 39 litres.

With diesel price about 115 c/litre in Australia the cost saving per load is about \$45 or about $\$45/300 = \0.15 per tonne of ore.

As Australia exports about 800 million tonnes of iron ore per year, this figure, if typical of iron ore mining, would represent an annual fuel cost saving of \$120 million.

The example indicates an elevator assisted lift time of 1.63 minutes, just one quarter of the unassisted lift time, 6.5 minutes.

Assuming that the turnaround time is dominated by the lift time it follows that the elevator arrangement provides about four times the number of ore loads per hour; in the present example, 36 loads per hour as opposed to 9 loads per hour.

It follows that two haul trucks operating with the elevator arrangement could lift the same amount of ore as eight haul trucks operating with the unassisted system.

This represents a capital cost saving as a large haul truck can cost up to \$5 million.

In this case the capital cost saving in a mine using two rather than eight haul trucks would be \$30 million.

There would also be a large reduction in operator, maintenance and replacement cost.

The saving in fuel cost and in turn around time both depend on mine depth, d. Extrapolating the above example to a deep mine that lifted a million tonnes per

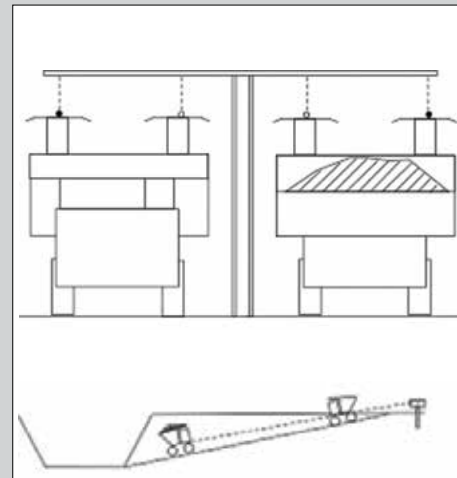


Figure 2: The haul trucks in an elevator can be linked electrically via overhead conductors as in the upper sketch or can be linked by a cable via a pulley as in the lower sketch.

day through 1000m with large haul trucks the fuel cost saving is \$0.75 per tonne amounting to \$270 million per annum, the turn around time is reduced from 32 minutes to 8 minutes and the number of haul trucks required reduced from 60 to 15.

The significant savings on haulage cost envisaged above can only be achieved if an elevator system can be implemented at reasonable cost.

The implementation with electrical energy transfer involves the erection of an overhead wire system from the top of the dual ramp to the bottom, and the attachment of pantographs to the top of each truck to transfer electric power from the motor/generators of the descending trucks to the motor/generators of the ascending trucks.

On exiting the dual ramp the trucks would proceed under their own engine power to loading and dumping.

The haul truck elevator could be a disruptive technology as it drastically reduces the requirement for haul trucks.

However, the elevator technology itself offers significant opportunities for mining equipment companies.

Ian was a physicist at Queensland University of Technology (1972 – 2005) and is currently an independent researcher with interests in energy conservation.

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**Government of
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SPECIAL FEATURES

MINING IN VICTORIA



All images: Victorian State Government.

"WE ARE PROUDLY THE BIGGEST EXPORTER OF MINING EQUIPMENT, TECHNOLOGY AND SERVICES (METS) IN AUSTRALIA – A SECTOR WORTH \$17 BILLION TO THE STATE'S ECONOMY IN 2012."

Unlocking potential

Despite a long history digging up gold and coal across its major mining hubs – Bendigo, Stawell, the Gippsland Basin and Latrobe Valley – Victoria currently ranks the least or second least attractive destination for minerals investment. Yet the State is the METS capital of the country; and through Government backing more investment is expected to flow into the region. A proud advocate of mining in the State, Victorian Resources minister Wade Noonan spoke to **Elizabeth Fabri** about the importance of mining and the programs in place to promote growth.

Q. While Victoria doesn't top the list for mining investment in Australia it does have a proud history. How important is mining to the State economy?

The mining industry is a key driver of the Victorian economy, supporting jobs and future investment opportunities. We are proudly the biggest exporter of mining equipment, technology and services (METS) in Australia – a sector worth \$17 billion to the State's economy in 2012.

Our mining industry encompasses large-scale, open-cut coal mining for the power industry, mining for metals including gold and copper, and minerals for manufacturing.

The industry is made up of engineering, manufacturing, transport, professional services, consulting, legal services, accounting and finance.

A recent Deloitte Access Economics report estimated that Australian mining and METS activities were worth \$133 billion in 2015-16 – with more than 484,000 jobs supported by the sector. Looking at Victoria through this lens could see our mining and METS sector supporting more than 121,000 jobs.

The Andrews Labor Government's



Victoria's infrastructure program will support a pipeline of new jobs.

unprecedented program of infrastructure works includes level crossing removals, the Metro Tunnel and West Gate Tunnel projects, and the widening of the Tullamarine Freeway, M80 Western Ring Road and Monash Freeway.

All of these projects are supported by the

mining and extractives industries for raw materials.

Research shows there are about 485 operating quarries across our State that supply the rock, gravel, sand and base resources for our \$21.6 billion a year construction industry.

Q. How has the Victorian mining industry fared in recent years?

After 150 years of exploration, gold mining remains a key pillar of the Victorian mining industry – even as international gold prices fluctuate.

A number of resources companies are still exploring for gold today. Victoria's brown coal, which is not exported but used for electricity generation, remains a valued resource. Breakthroughs in technology are opening up the prospect of exports of highly-transformed brown coal as fertiliser, liquid biofuels and even hydrogen gas.

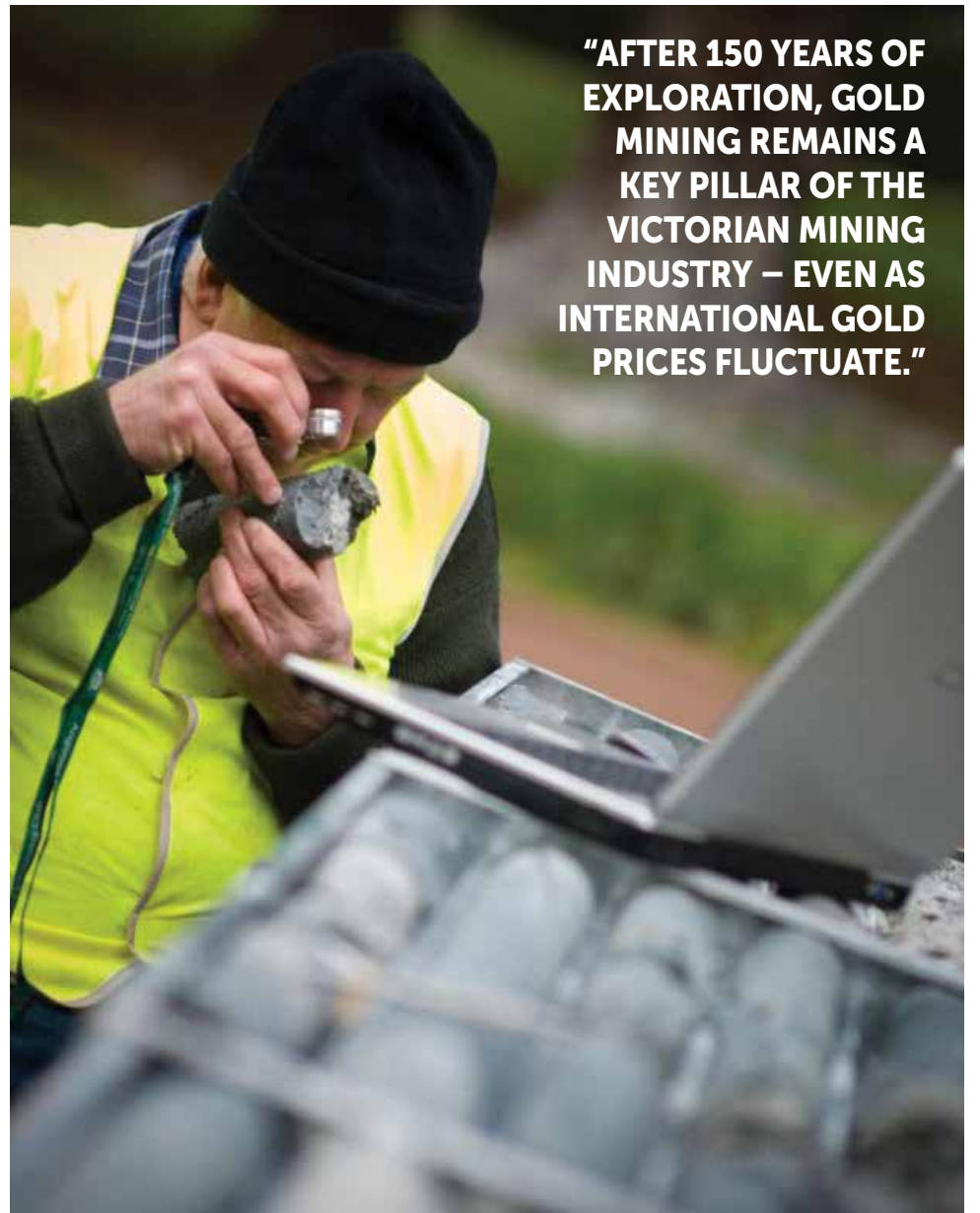
Q. Can you describe State Government initiatives supporting the mining industry, such as the TARGET grants and Latrobe Valley Mine Rehabilitation?

The \$15 million TARGET co-investment grant program provides financial co-investment funding for companies wanting to explore for minerals. It's a dollar-for-dollar to help cover up to half the cost of eligible exploration activities – including geophysical surveys, drilling and sampling analysis.

“VICTORIA’S PROJECTED POPULATION GROWTH AND URBAN DEVELOPMENT IN THE COMING DECADES WILL DRIVE DEMAND FOR NEARLY 90 MILLION TONNES OF STONE, SAND, CLAY AND OTHER MATERIALS ANNUALLY, UP FROM THE 46 MILLION TONNES NEEDED IN 2015.”



“AFTER 150 YEARS OF EXPLORATION, GOLD MINING REMAINS A KEY PILLAR OF THE VICTORIAN MINING INDUSTRY – EVEN AS INTERNATIONAL GOLD PRICES FLUCTUATE.”



Latrobe Valley coal mine rehabilitation is being managed in a number of ways. We are developing a Regional Rehabilitation Strategy for the Latrobe Valley’s three brown coal mine voids.

The strategy seeks to set a safe, stable and sustainable landform for the Latrobe Valley coal mine and surrounding areas. It will address the knowledge gaps and unresolved issues associated with pit lake rehabilitation options.

To support this work, we have created a Latrobe Valley Mine Rehabilitation Advisory Committee to take on a key role in community engagement.

Additionally, we are moving to appoint a Latrobe Valley Mine Rehabilitation Commissioner, who will provide independent advice to the Government on rehabilitation issues.

The Commissioner will work closely with the community, stakeholders and the Latrobe Valley mine operators, and oversee individual rehabilitation planning for each of the coal mines.

We are currently finalising a statement on the future uses of coal in a low-emissions context. It’s examining uses of coal beyond thermal combustion. There are technologies that can transform coal to in-demand biofuels, fertilisers and even hydrogen gas for export.

This could potentially open up new industries and employment opportunities for the Latrobe Valley.

The Committee for Gippsland’s report found there is “the potential to create thousands of jobs for Victoria through the development of coal for low emission fertiliser, hydrogen, and a number of other products.”

Q. How are the region’s major mines benefiting local communities?

Last year I attended the launch of the Committee for Gippsland’s economic report *Our Region Our Future*. That report found that almost 1100 people work in the mining sector, earning collectively \$154 million a year in wages.

That’s a major boost to local economies –



Victorian Resources Minister Wade Noonan.

particularly as people spend their money in local restaurants, cafes and shopping outlets.

Q. You mentioned Victoria is the largest exporter of METS in the country.

Every year Melbourne has the great pleasure of hosting the International Mining and Resources Conference (IMARC) – the largest international mining conference in the Southern Hemisphere.

It’s a valuable opportunity for local METS companies to showcase their capabilities on the world stage, build networks and create opportunities for local companies to get involved in major projects.

More than 2000 global mining industry leaders and international policy makers from 58 countries attended IMARC 2016.

Victoria is home to the global headquarters of BHP Billiton, MMG, Oceanagold, Newcrest Mining, Alumina, Saint Barbara and Orica, as well as Rio Tinto’s Asia Pacific regional headquarters.

Victorian-based firms account for around two thirds of mining market capitalisation and around three quarters of mining revenue in the ASX100.

The Stawell Gold Mine is currently in care and maintenance mode to keep the mine in a fit state should the management decide to re-open the mine in the future.

Q. How important is exploration to mining in the region?

We want Victorians to benefit from the state’s natural resources to support regional employment.

Our TARGET grants encourage continued exploration for natural resources in regional Victoria.

There is a pipeline of new resources projects for the future in regional Victoria, which will provide skilled jobs and an economic boost for local regional communities.

Q. What is your outlook for the Victorian resources sector in terms of expected growth, direction and opportunities in 2017 and beyond?

We believe the future for Victoria’s mining and extractives industries is positive. The growing demand for extractives will support our huge package of infrastructure investment – including public transport projects, level crossing removals, new roads and the Metro Tunnel.

Victoria’s projected population growth and urban development in the coming decades will drive demand for nearly 90 million tonnes of stone, sand, clay and other materials annually, up from the 46 million tonnes needed in 2015.

We expect the earth resources industry will continue to develop as Victoria’s largest program of infrastructure works gets underway.

This will support a pipeline of jobs and training opportunities, and infrastructure of the future. This will ultimately improve the standard of living for all Victorians.

Victoria boasts an AAA-rated economy which has created more than 200,000 jobs in the last two years. We’ll continue to attract investment and drive jobs and economic growth into the future.

According to an Austmine, more than 1900 Victorian companies are involved in the resources supply chain.

Recent survey findings show that the METS companies interviewed generate \$4.3 billion in gross annual revenue and employ some 21,000 people.

Q. What will the Stawell and Hazelwood mine closures mean for the State?

These were commercial decisions made by the mines’ respective owners. Our thoughts are with every worker affected by the closures in these regional communities, and we’ll continue to support their transition to new jobs.

We’ve developed a landmark worker transfer scheme to enable displaced Hazelwood workers to move to other Latrobe Valley power stations. This will allow older workers to take early retirement packages and open up vacancies for people to continue their careers, and keep skilled jobs in the Valley.

We’ve established the Latrobe Valley Authority to kick-start new economic opportunities, while a transition package of \$266 million is supporting jobs and the growth of local businesses.

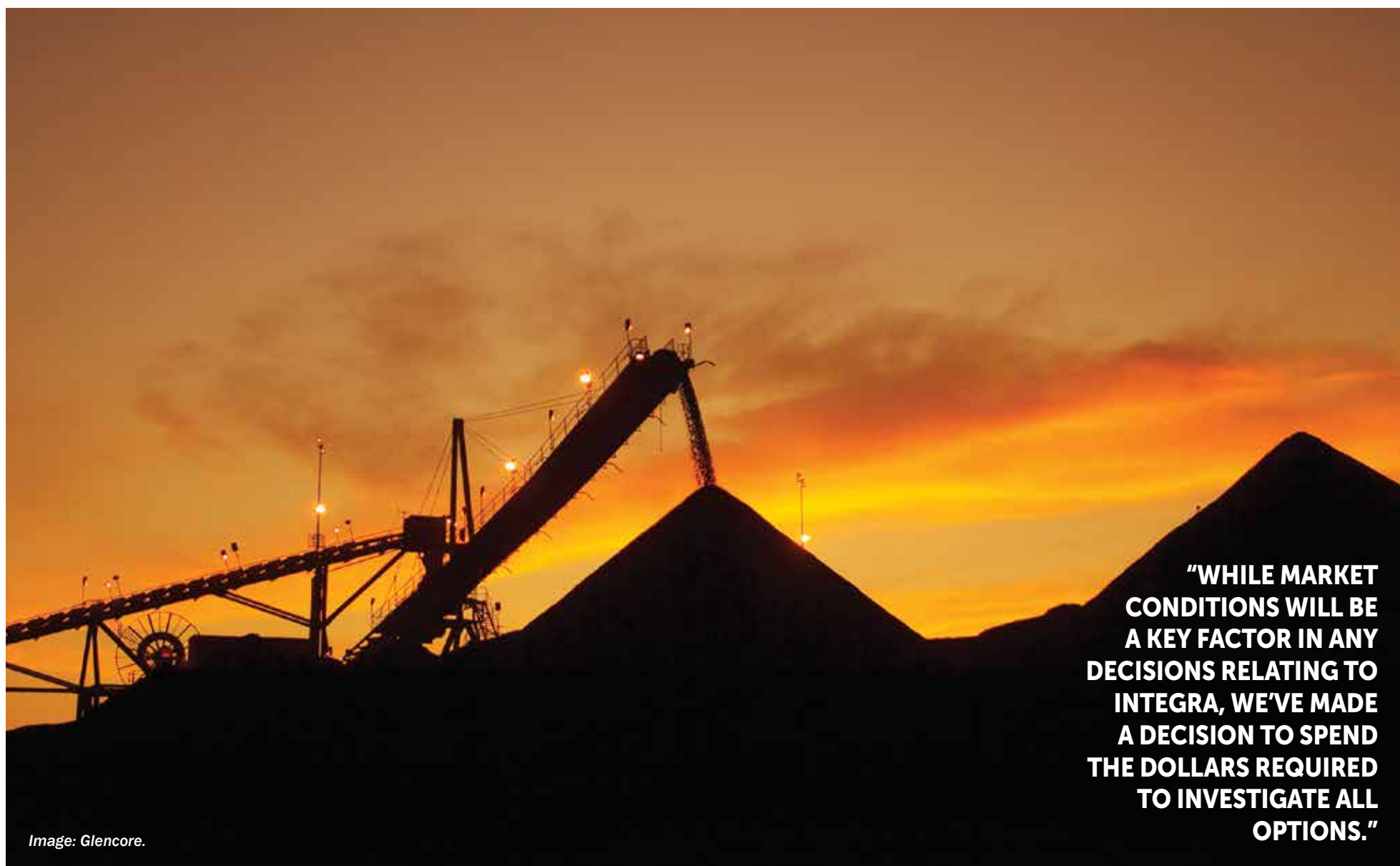


Image: Glencore.

"WHILE MARKET CONDITIONS WILL BE A KEY FACTOR IN ANY DECISIONS RELATING TO INTEGRA, WE'VE MADE A DECISION TO SPEND THE DOLLARS REQUIRED TO INVESTIGATE ALL OPTIONS."

New life

A surge in coal demand during 2016 prompted Glencore to restart two of its shuttered Australian coal operations, Collinsville and Integra, helping inject new life into the Hunter Valley and Bowen Basin regions.

CAMERON DRUMMOND

IN November 2016, Swiss-based Glencore announced plans to restart mining at its Integra underground coal operation in the NSW Upper Hunter Valley.

It was the second time in as many months Glencore had decided to kick-start one of its shuttered Australian coal mines, following an October announcement that it would reopen Collinsville in the Bowen Basin of QLD, after halting production back in December 2015.

The decision lay on the back of supply disruptions in China and India – both of which turned to international suppliers such as Australia to meet additional demand.

In response, thermal coal prices doubled to more than \$US110 per tonne (t) during the first nine months of 2016 and the coking coal price went from \$US75/t to more than \$220/t by mid November.

The price of thermal coal from Australia's Newcastle port, a benchmark for Asia, reached its highest in more than three years during October, trading at \$87.30/t compared with \$48.50/t in April.

Integra

The Integra underground coal mine is in the Hunter coalfields in the Upper Hunter Valley of NSW, about 12km north east of Singleton.

Integra, formerly Glennies Creek Colliery, was established in 1999, with



First cargo from the Collinsville coal mine in 1910.

Image: Supplied.

first longwall mining commencing in the Middle Liddell seam in 2002.

In mid 2014, then-owner Vale placed the operation care and maintenance on completion of longwall 12.

In December 2015, Glencore subsidiary HV Coking Coal acquired the assets of the Integra from Vale, with a look to restarting the mine once economically

viable.

Glencore didn't have to wait long. In November 2016 the company announced that operations at Integra would restart sometime in 2017 to meet demand in the metallurgical coal market.

Glencore Australia head of coal operations Ian Cribb said that because the Integra mine had an already formed

longwall block, mining could begin with minimal delays or additional investment.

"Over the next two years, we also plan to complete and extract coal from a second longwall block that has already been partially developed at the mine," Mr Cribb said.

(CONTINUED ON PAGE 20)



CONTINUED FROM PAGE 19

Glencore's decision to reopen two of its Australian mines is welcome news for workers.

Glencore's new management was already been preparing for the restart, and the recruitment of up to 275 people was well underway.

"An engineering review and overhaul of the mine's diesel fleet, continuous miners, conveyors and longwall was in process, as was the design and planning for development work, longwall mining and gas drainage," HV Coking Coal operations manager Peter Ostermann said.

"We hope to receive approvals that will enable development work to start in the first quarter of the year with first coal from the longwall expected by mid-year."

A drilling program across the mine lease was initiated during February as part of a planning exercise to look at longer term options for Integra.

"Glencore have agreed to support our capital request for up to \$5m to learn more about the resource that's available on the combined lease footprint between the Integra, Glendell and Mt Owen operations," Mr Ostermann said.

"At the moment, we don't have sufficient data to make informed decisions on the mine's future beyond two longwalls and the exploration program will give us the information to make those decisions should the market for coal remain positive.

"While market conditions will be a key factor in any decisions relating to Integra, we've made a decision to spend the dollars required to investigate all options.

"We are also applying to modify the mine plan to provide optionality should the drilling program deliver positive results."

Glencore expected to produce 1.3 million tonnes (mt) of saleable coking coal at Integra during 2017.

Collinsville

Collinsville is part of the NCA project; a mining, processing and exporting joint venture between Glencore (55 per cent), Itochu Coal Resources (25 per cent) ICRA

NCA (10 per cent) and Sumitomo (10 per cent), which includes the Abbot Point Bulk Coal terminal.

Discovered in 1886 and started as an underground operation in 1919, Collinsville is QLD's oldest coal mine, about 270km south east of Townsville in the coal-rich Bowen Basin.

In 1952 Mt Isa Mines (MIM) acquired an interest in the State-owned mine, and gained a controlling interest in 1972.

The mine had since transformed from an underground to an open pit operation that produces both thermal and coking coal for export to Asia at a production rate of up to 6 million tonnes per annum (mtpa).

Current owner Glencore acquired MIM in 2003 and mined Collinsville until December 2015, when depressed coal prices forced the company to suspend operations.

The mine was not shuttered for long, and in late 2016 Glencore announced it would reopen Collinsville in 2017 to meet demand from Asian markets.

"We are now seeing increased demand from Southeast Asia for the specific type of coal produced by Collinsville," the company said.

The return to production would see more than 200 jobs become available.

"Our Collinsville mine has made material progress in increasing operational efficiencies and reducing costs in the current market and the decision to return to production is positive news for the local community and the wider region," Glencore head of open cut coal Tony Galvin said.

Queensland Resources Council chief executive Michael Roche said it was great news for the local Bowen Basin community and QLD coal sector, which had struggled through a downturn in the past few years.

"We are very pleased today to hear that Glencore is returning the Collinsville Mine to production, which will employ hundreds of people and bolster state revenue through royalties and taxes," Mr Roche said.



Supply issues in the two largest countries on the planet have driven demand.

Glencore's integrated approach to Integra

A THREE pronged approach to mine rehabilitation and recommissioning has paid handsome time, cost-efficiency and community dividends for Glencore as it brings its Integra Coal mine in the Hunter Valley back into production.

Integra commissioned the Chute Technology engineering partnership to handle in an integrated way a succession of tasks vital to the mine's reintroduction that would normally be handled in separate stages, taking longer to co-ordinate and costing more.

The result has been completion on time and on budget of the complex series of tasks within the narrow nine-week window of time required by Integra.

The mine is on schedule to deliver first coal from the longwall in Q2 and continues to build workforce numbers, with 134 staff and mineworkers on site early in the quarter.

Glencore made the decision to re-open the Integra underground mine in 2016 after purchasing it from former owner Vale in 2015.

The mine had been in care and maintenance since 2014.

"Integra was very smart in the way it approached this recommissioning," Chute Technology partner Tom Woods said.

"Thanks to the integration of tasks and our productive partnership with Integra's on-site team, we not only got our components of the process chain up and running in the required time frame, but we also boosted capacity and resolved

output issues with old plant not suited to higher volumes.

"The re-opening of Integra has been very well received across the Hunter industry.

"The recommissioning process was handled in a very different way from a typical mine rehab piecemeal approach of solving problems in one area of plant, only to see further delay as production bottlenecks are then discovered further up the line.

"It's like shooting ducks in a row – the ducks just keep on popping up.

"You have to take an integrated approach that goes to the root of systemic issues."


Essential to such an integrated approach are elements such as diagnostics, structural audits, DEM Modelling, Finite Element Analysis (FEA), process design, detailing, one-stop manufacturing processes and the ability to provide complete turnkey projects.

Chute Technology worked directly in partnership with the mine managers and engineers, so that they were able to have ownership in the design and get the results they wanted.

The Chute Technology engineering group targets problems common to many coal and ore plants and loading systems by addressing them with a three-pronged combination of problem insight and solution skills sets.

This approach can typically halve or better the time involved in getting a mine back to its full potential.

CHUTE TECHNOLOGY



- ✓ Fast mine recommissioning
- ✓ Integrated services

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A proud history in the Hunter

DELTA SBD has a strong history of providing practical mining solutions and servicing the Australian underground coal mining industry.

The diverse range of services includes experienced mining approaches combined with the right equipment to major mining companies.

In a series of recent successes, DeltaSBD secured a two-year contract with Glencore Australia for work on its Integra mine in the Hunter Valley, providing positions for more than 120 underground production and engineering personnel, many of which will be offered as full-time for the entire length of the contract.

DeltaSBD is providing the production and maintenance labour for the mine's roadway development and longwall production, following Glencore's announcement that operations at the Integra Underground mine would restart in 2017.

The first stage involves the completion of development for and extraction of two longwall blocks and works to support additional reserves which include exploration drilling, geological modelling and project approval processes to further inform project requirements and scope.

Integra is expected to produce 1.3 million tonnes of high fluidity saleable coking coal for 2017.

DeltaSBD has a proud history in the region following the establishment of its Hunter Valley division more than 12 years ago.

The company has serviced a range of mines in the area since that time.

The Integra appointment follows Delta's success securing new works in the Bowen Basin in Queensland, as well as retaining several significant contracts at Illawarra Mines.



DeltaSBD has signed a two year contract with Glencore for work at its Integra mine.

DeltaSBD chief executive Neville McAlary said that recent contracts awarded to Delta were aligned with the organisation's growth strategy.

"Delta is well placed with further capacity for works as swing coal production is brought on to support the current uplift in demand.

"Our deep experience and solutions based approach continues to be well received by the UG Coal Mining Industry. "Our Integra operation continues to recruit

and is looking at high calibre, experienced people as well as new starters to the industry.

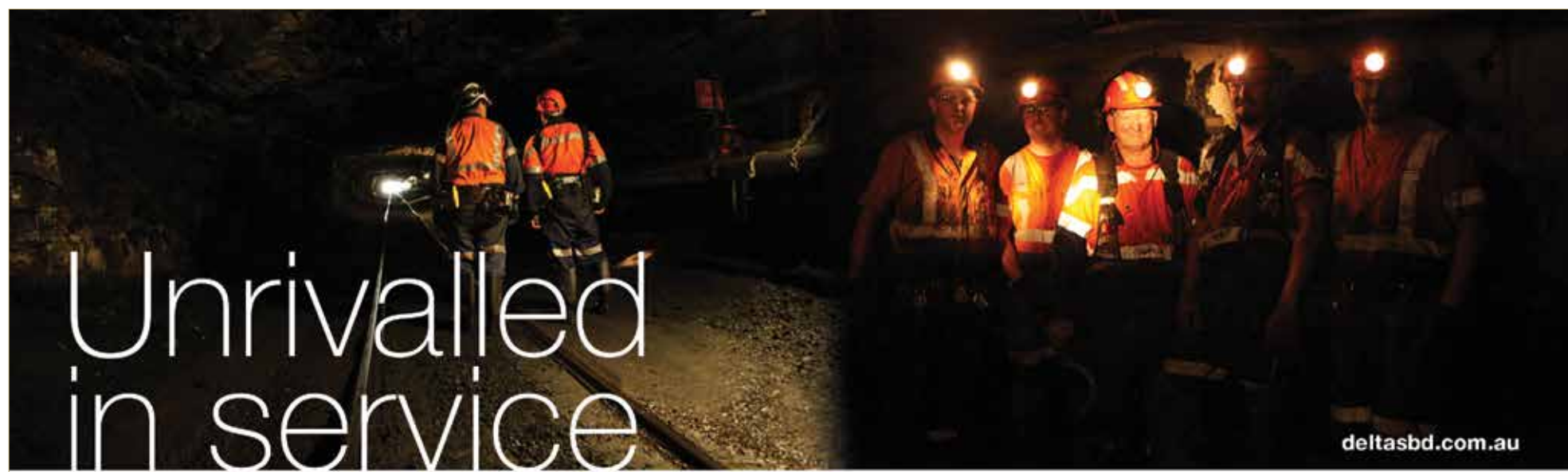
"We are seeking equipment operators and trades people looking for a future in the underground coal industry; candidates must integrate with the Integra team and add value at all levels within the operations.

"People interested in a position that will offer them the ability to learn new skills and contribute to the future of a

world class operation should apply via the DeltaSBD website."

DeltaSBD provides customers with a large pool of resources (both labour and equipment); cross fertilisation of ideas, systems and techniques; and has the ability to attract and retain experienced and qualified management and personnel.

Delta is highly responsive and assists customers in achieving safety and production targets by providing mining services based on industry best practice.



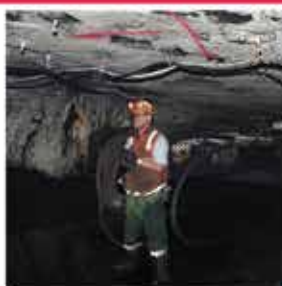
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DeltaSBD is one of the largest contract companies servicing the Australian underground coal mining industry. We provide a diverse range of services (both labour and equipment), and skills to our clients, who include most of the major coal mining companies.

We are committed to delivering safe, quality and cost-effective services in a timely manner minimising disruptions at clients' sites.



Underground mine roadway development and extraction of coal



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All necessary statutory approvals associated with the operations of the mine



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Setting the benchmark



More information can be found at www.westrac.com.au.

WESTRAC has completed an overhaul, modification and mini-build on the Glencore Integra longwall system at its Beresfield facility in NSW.

A new Caterpillar EL2000 Shearer is now complete and will begin operation in longwall 13.

The Shearer is fitted with the latest PMC-S control system, which is being successfully used at several Australian

longwall installations.

While reducing direct manning and dust exposure the Caterpillar automation system which is typically 96 per cent utilised, has demonstrated benefits such as increased production of up to 30 per cent and a 5 per cent increase in equipment availability.

Automation has also contributed to a reduction in shear times, panel parts

usage, and component wear rates of up to 15 per cent.

The WesTrac and Cat underground coal team are focused on ensuring the ongoing support its customers require.

This includes a full review of its field service, product support, overhauls, repairs and parts capability, all with the key focus on helping its customers do more.



PROUD TO BE ASSOCIATED WITH GLENCORE FOR OVER 10 YEARS AND MOST RECENTLY WITH THE REOPENING OF COLLINSVILLE COAL

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Two seams from one vent shaft

A 390m deep ventilation shaft designed and constructed by Abergeldie for the Integra underground mine by blind boring is the first of its kind in Australia to serve simultaneous workings on two coal seams; the Liddell seam between 327m and 330m, and the Hebden seam below it at 390m.

The shaft was drilled and hydrostatically lined from the surface downward, using one of Abergeldie's blind boring rigs. The initial contract was for a 320m shaft with composite concrete/steel liners to serve only the Liddell seam.

The design was modified to drill an additional 10m, unlined through the Liddell seam, and then a further 60m with simple steel segment liners down to the Hebden seam.

An Australian first for blind boring, the two-part design enables working access to two coal seams from one blind bored shaft.

The initial contract price for the upper section of the shaft was approximately \$13 million, and the part-two extension added approximately \$3 million to the overall cost.

The blind bore construction method allows the shaft to be remotely drilled from the surface downward, with no personnel entering the shaft during the construction process.

This is by far the safest method of shaft construction and is especially suitable for difficult ground conditions where there may be unstable or water-charged strata.

A heavily weighted drilling assembly provides vertical thrust to a hard rock cutter head, which grinds concentric grooves into the rock face, leading to



More information can be found at www.abergeldie.com.au.


fragmentation of the rock between the cutter paths.

The rock fragments are transported from the face to the surface by a strong flow of water directed around the cutter head and up through the centre of the drill rods and discharged into sedimentation ponds on the surface.

Abergeldie's blind boring rigs are the largest of their type in the world, having drilled shafts to record-breaking depths of up to 520m with diameters up to 6.2m.

Safely drilling deeper than ever before

Your one-stop shop for all mining infrastructure



Using Abergeldie designed and developed blind boring equipment, Abergeldie has recently drilled and lined the largest blind bored shaft in Australia.

- Drilled in a single pass to more than 515m deep and at 6.2m diameter it is, perhaps, the world's largest blind bore shaft.
- Drilled and lined from the surface for maximum worker safety. No worker entered the shaft during excavation or lining.

- Lined using the Abergeldie composite method to provide a high quality, smooth, 5.0m finished diameter shaft with a 50 year design life and requiring minimal maintenance.
- No mine interruption. All excavated material brought to the surface by Abergeldie using reverse circulation.

Now with increased tunnelling expertise and capability in New Zealand and Australia with the acquisition of Harker Underground now operating as Abergeldie Harker.

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Streamlined approach for business

ABOUT 40,000 people use the workforce management system Damstra Technology customised, installed, and maintains on Glencore sites across NSW.

Incorporating state-of-the-art technology, the web-based system is proving a much-needed tool to manage, track and protect an entire workforce.

“Our engineers are continuously formulating the optimum solution for Glencore’s workforce management needs,” Damstra Technology chief executive Christian Damstra said.

Damstra Technology supplies a contractor pre-qualification service for Glencore, which verifies contractors’ compliance documentation for everything from insurance to diversity reporting requirements to ensure all workers are compliant, skilled and site ready.

Glencore also uses many other services Damstra Technology provides, from its fully featured time and attendance tracking systems, to its automated alcohol testing and biometric verification.

The company also provides site and access control, visitor management and even controls the PPE vending machines.

“All workers are issued with a Damstra card, and with this in hand, they simply scan into the terminals based on site to get access,” Mr Damstra said.

“Also by scanning the card’s QR Code with a smart phone, anyone can immediately see all the training, skills, site appointments,



The Damstra Technology swipe card terminal.

competencies, high risk licences and related expiration dates.

“The system is used on more than 900

sites across Australian and New Zealand with organisations such as Orica, Wesfarmers, NBN, Thiess, Holcim and Hanson using it to

manage their workforces.”

More information can be found by visiting www.damstratechnology.com.



For almost 20 years Damstra Technology has been providing real-time, web-based workforce management solutions to ensure a safe and compliant workforce.



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D A M S T R A



"CLEAR STRATEGIC WATER PLANNING WILL LEAD TO INFORMED AND CONSISTENT WATER MONITORING AND REPORTING."

Water dust suppression at Dampier port.

Image: Department of Water WA.

The importance of water management

Australia is one of the driest continents in the world, and mining is thirsty business. In remote areas of the country water can be both scarce and overabundant, forcing mining operations to continually advance water management strategies and technologies to secure supply, minimise environmental footprint; and ride through extreme weather events such as cyclones, flooding, and droughts.

ELIZABETH FABRI

WATER management in mining is a hot topic in all mining jurisdictions across the country.

During 2014-15, an estimated 76,140 gigalitres (GL) of water was extracted to support the Australian economy, according to the Australian Bureau of Statistics (ABS).

Of this amount, 768GL or 4.4 per cent was from mining operations; a sizeable increase from the 652GL consumed by mining in 2013-14 and 489GL in 2009-10.

Like many industries, the resources industry requires access to a reliable supply of water to effectively carry out operations; from supplying drinking water to site workers, washing ore, managing dust emissions, slurry tailings and wastewater services, to generating hydroelectric power.

Water can be sourced from surface or groundwater systems, varying from site to site and depending on the size and location of the mine and volume of water required for different ore types.

On average it takes about 1690 litres of water to process a tonne of gold ore, and about 773,000L to produce a kilogram of gold, Monash University research found.

Yet, water is a finite resource and miners must incessantly innovate to reach a point of sustainability across their operations, and address concerns from local landowners and environmentalists alike.

Mining operators are faced with tough decisions on how to extract and dispose of water safely and cost effectively, and ensure no pollutants flow out into the environment.

Mining operations are generally positioned in isolated regions where established water and sewage infrastructure are not readily available, and wastewater rich in metals and harmful particles require intensive treatment.

Queensland Resources and Mines minister Anthony Lynham said water management in mining was an important issue in all States, and a modern water management framework would ensure mines had continued access to water while keeping operational costs down.

"For example, coal mines need water to operate and wash their coal," Dr Lynham said.

"Water is also used for drilling, for construction of infrastructure, for dust suppression to protect air quality, to revegetate rehabilitated land, and for the accommodation of the workforce."

While much attention was paid to water security and sustainability, auxiliary water management was also essential in areas where wet weather and cyclones were rife.

Cyclone Debbie, which passed through Queensland late March, is just a recent example of how wet weather can have an impact on mining, causing flooding in pits and significant damage to infrastructure.

"The State's mining industry has been significantly impacted by the effects of Tropical Cyclone Debbie, mainly due to rail infrastructure damage which has slowed some levels of production," Dr Lynham said.

"Broadly, the modern mining industry responds to weather events through careful planning, particularly with regards to emergency preparedness and worker safety and health.

"For example, mines in the path of Tropical Cyclone Debbie proactively suspended

operations for the duration of the weather event and resumed operations in a controlled manner."

Meanwhile in WA where the climate was typically a lot drier, mining operations had to think outside the box to ensure sustainable supply in months with no rainfall.

"The increased scale, complexity, concentration and commodity diversity of resources activity in Western Australia have all had an impact on the industry's approach to water," Department of Water WA Regional Delivery and Regulation executive director Paul Brown said.

"For example, in the Pilbara region, the expansion of port, rail and road infrastructure has led to rising demand for construction and maintenance water supplies.

"Miners are often operating in areas where water supplies are associated with local environmental or Aboriginal cultural values and with existing or perceived future competing uses, and in addition, much of the easy to find water may already be used or allocated.

"All of these factors have served to heighten industry understanding of the value attached to water and the need for greater water innovation and efficiency, and the importance of compliance with regulatory, allocation and licensing requirements."

Water management trends

Many miners in Australia are exploring water efficiency plans and new technologies as a key part of their business planning.

"Some local examples include miners exploring alternative approaches to dust

suppression to reduce water use and improved water management strategies such as paste reinjection and the reuse of tailings water excess," Department of Water WA Regional Delivery and Regulation executive director Paul Brown said.

Miners were also building dams for water storage and dedicated water treatment plants to process water into usable qualities.

Techniques that have been used to manage water included building upstream dams to reduce risk of water contamination from waste rock and exposed ore; installing covers and liners on waste rock and ore piles to reduce risk of contamination; recycling water used to process ore to reduce the amount of water used during a treatment; allowing water to evaporate in ponds; capturing drainage water through liners and pipes and direct to tailings dams; and desalination plants.

In South Australia alone, more than 50 small desalination plants were already in operation.

The resources industry was also working closely with METS companies to develop innovative technologies to help better manage water and reduce operation costs.

CSIRO, for example, recently developed a new technology called Virtual Curtain, which used hydrotalcites to trap metal contaminants and remove them from wastewater.

Adelaide-based company Micromet had also developed a Generation 3 water treatment machine that used electrolysis to remove pollutant materials.

(CONTINUED ON PAGE 26)

DMI-65® Filtration Systems for Water Management in the Mining Industry

Water management is emerging as the pre-eminent sustainability issue within the mining resource industries. With water being the most important resource in all mining and quarrying developments and operations; it can be used and abused.

Miners often work in dry, remote areas, where environmental issues make water sourcing, use and disposal problematic. With water being used in all steps of the mining process, from drinking water production, cooling equipment, separating waste from valuable minerals to controlling dust, working with such large volumes of water presents a variety of risks.

To comply with regulations and ensure that the quality of water leaving mine sites is not adversely affecting water users downstream, mining companies develop water management plans to minimize the potential for water contamination, and to prevent the release of polluted water into the environment. Mining water treatment applications include potable water treatment for mine sites, process water treatment, product recovery, recycle water treatment systems, residuals management and a variety of other treatment technologies.

CASE HISTORY

Fortescue Metals Group Cloudbreak mine has won national recognition and awards with the Australian Water Association for their advanced groundwater management scheme. With a capacity of 25 gigalitres of water recharged each year the Cloudbreak Managed Aquifer Recharge Scheme is one of the largest and complex managed aquifer recharge schemes in Australia. The scheme, first established in 2008, is an innovative approach to mitigating environmental impacts related to surface discharge and dewatering drawdown while also conserving water resources for future mine water supply.

Iron and manganese removal plays an important role in the management of the water treatment system at the Cloudbreak Mine site. The Water Treatment plant uses DMI-65® for treating ground water elevated levels of iron and manganese to meet Australian Drinking Water Standards as an alternative to costly reverse osmosis (RO) processes.

"The DMI-65® used in this treatment plant consistently reduces iron and manganese to ultra low levels. After filtration through the DMI-65, manganese levels went from 0.939 mg/L to 0.02mg/L when mixed with our other potable water supply," Fortescue water supervisor Mark Botica said.

The Scheme to date has been so successful that it was awarded the National award for Infrastructure Project Innovation at the Ozwater11 conference and also won the Western Australian Water Infrastructure Innovation Award in 2010.

The DMI-65® water filtration system has been in continuous service since 2009.



DMI-65® filtration systems are designed for the removal of iron and manganese without the use of potassium permanganate through an Advanced Oxidation Process.

Incorporation of a DMI-65® filtration system in the water management strategy will:

- Reduce iron and manganese contamination in drinking water to well below health authority standards.
- Materially reduce the symptoms of iron and manganese bio-fouling. Remove impurities to control deposition, carryover, and corrosion in the boiler systems.
- Prevent the clogging of water feed systems.
- Reduce iron and manganese contamination in waste to well below regulatory limits to allow reuse or discharge into the environment.

Manufactured in Australia, DMI-65® has been certified NSF/ANSI 61 for Drinking Water Systems.



Government regulation

In addition to developing its own set of rules and guidelines for water management, mining operations in all States are required to adhere to strict Government regulations.

And today information is more readily available than ever before to assist miners with the process.

In 2014, the WA Government introduced a new water mining guideline to inform miners about the regulatory assessment and approvals.

"A key objective of the Water in Mining guidelines is to ensure mining companies in WA use water efficiently and that fit-for-purpose water is used wherever possible in mining operations," Mr Brown said.

"It is a one stop document for all regulation and approvals relating to mining proposals.

"To help streamline approvals and licensing, minimise duplication of processes and reduce red tape, the guideline is aligned with approval processes administrated by the Department of Mines and Petroleum, the Environmental Protection Authority and the Department of Environmental Regulation."

Mr Brown said the WA Department of Water required miners to demonstrate an understanding of how water would be managed over the life of a mine and how issues would be prevented or minimised after its closure.

He said miners must provide detailed hydrogeological and groundwater modelling data with their water licence applications, which was then reviewed by the department and compared with regional water plans to ensure the abstraction, use and discharge would not adversely impact the environment.

"One major change in regulation that has a positive impact by reducing unnecessary red tape for the mining sector was the new 26C exemption order enacted under the Rights in Water and Irrigation Act 1914," he said.

"This order allows for non-artesian wells that are used solely for the purpose of monitoring water levels and/or water quality to be exempt from licensing.

"Previously any non-artesian bore drilled for monitoring purposes needed to be licensed.

"By exempting these bores from licensing miners are free from unnecessary administration in regard to creating and maintaining them, which saves time and money."

Environmental breaches however still occurred, with Fortescue Metals Group subsidiary Chichester Metals as a recent offender.

In April, the miner was fined \$25,000 over a hypersaline discharge back in 2015 that impacted vegetation at Cloudbreak Iron Ore Mine in the Pilbara.

Between 2.5 million and 3.6 million litres of hypersaline water (close to double the salinity of seawater) was released into nearby vegetation.

The miner immediately notified the Department of Environment and cooperated with DER during the investigation.

In Queensland, the State Government had passed new laws in November which ordered all mines in development that will have an impact on groundwater to obtain an associated water licence, excluding Adani's Carmichael mine.

"The Government has recently made changes to ensure that before a mine receives a limited right to remove groundwater to ensure the safe operation of the mine, the impacts must be assessed up front and considered in granting the environmental authority," Dr Lynham said.

"Also, mines that have already received their environmental authority but have not yet started taking associated water will be required to apply for an Associated Water Licence, to make sure that in every case the impacts are assessed before the right to remove the water can be granted."

Dr Lynham said Queensland currently had 24 water plans in place through which it ensured secure water supply and management.

"Recent legislative amendments mean

(CONTINUED FROM PAGE 24)



Department of Water officers inspect mineral sands mine dewatering in WA's South West.

"THE STATE'S MINING INDUSTRY HAS BEEN SIGNIFICANTLY IMPACTED BY THE EFFECTS OF TROPICAL CYCLONE DEBBIE, MAINLY DUE TO RAIL INFRASTRUCTURE DAMAGE WHICH HAS SLOWED SOME LEVELS OF PRODUCTION."

Image: Department of Water WA.



Monitoring mine dewater discharge into the Oakover River.

Image: Department of Water WA.

that when groundwater may need to be removed to allow for safe operation of the mine, this will now be assessed up front through the environmental authority, with a comprehensive framework for ongoing management to ensure that make good arrangements are in place for any potentially affected landholders," he said.

In April, the State Government gave Adani's Carmichael mine approval to take 4.55GL of groundwater water each year.

"The mine's Associated Water Licence and its EPBC approval both require Adani to offset any groundwater it incidentally removes from Great Artesian Basin aquifers," Dr Lynham said.

"Adani intends to achieve these offsets by capping and piping free flowing bores in the GAB."

International stewardship

In recent months, responsible water management has been especially high on the global agenda, with the International Council on Mining and Metals (ICMM) announcing new commitments on water stewardship and a practical guide to consistent water reporting.

On 10 January, ICMM released its new water stewardship position statement which aimed to improve water security across the board.

The position statement was a binding document for ICMM members which required them to publicly disclose the company's approach to water stewardship; allocate clear responsibilities and accountabilities for water; integrate water considerations in business planning from company strategies, life of assets to investment planning; and publicly report company water performance, material risks, opportunities and management.

ICMM's members included 23 of the world's leading miners, such as Rio Tinto, BHP Billiton, MMG, South32, Newmont, Barrick, AngloAmerican, AngloGold Ashanti, and Glencore.

"Society will not be able to meet the sustainable development challenges of the 21st century without improving the management and use of global water resources," ICMM chief executive Tom Butler said.

"As an industry we have a leading role to play in contributing practical solutions to water resource challenges.

"Water is vital for local communities, the natural environment and for businesses so leadership on water stewardship is required from all parts of society."

On 22 March, ICMM also published a 72-page practical guide to consistent water reporting report, which included a new minimum disclosure standard for external water reporting using consistent and standardised metrics.

Mr Brown from the WA Department of Water said the ICMM guidelines built on the efforts many miners were already undertaking in working with government agencies during the application and approval process.

"Leading practice water management in the resources industry involves miners and explorers developing clear water management objectives, establishing strategies to meet defined objectives and creating an adaptive management framework," Mr Brown said.

"Clear strategic water planning will lead to informed and consistent water monitoring and reporting."

Strategies for improvement

Despite the increasing attention paid to water security in mining, there were still

areas for improvement.

"Key issues currently facing the industry include water availability; water allocation limits; licensing requirements; competition between other water uses and the need to meet environmental and other regulatory requirements," Mr Brown said.

"For example, as below water table mining sees miners shift away from bore fields and toward mine dewatering, issues associated with disposal and reuse must be managed and addressed.

"The accumulative impacts of mine dewater continues to be an important issue."

Mr Brown said miners were increasingly required to understand, plan for, and address complex and interrelated factors that affect water supply.

"These include competition from other users, allocation and licensing issues, regulation and compliance, the need for improved efficiency and innovation and the effect of the drying climate trend in the south west of the State," he said.

Concerns of dam failures were also shared by the industry following two significant tailings dam failures in 2014 and 2015, including BHP Billiton and Vale's Samarco Fundão tailings dam in Brazil.

Mining companies such as South32 have released sustainability reports covering all bases.

"Preventing tailings dam failures is vital to the mining industry's ability to maintain the trust given to us by communities around the world to manage their land and natural resources safely," South32 stated in its Dam Management report.

"At South32, we monitor and manage our tailings dams; we assess the risks for each tailings dam, taking into account the materials contained, the location and other factors to identify and put in place the most appropriate failure prevention mechanisms, or controls."

In Queensland, the State Government established a new water panel on 31 March, to provide independent advice to the government on water planning issues.

"The Queensland Water Act Referral Panel will advise on water planning, such as the size of reserves which may eventually be available to agricultural users and industry," Dr Lynham said.

"Mining, like any industry must go through a rigorous assessment process before receiving approval to access surrounding water supplies.

"There is a clear need for the mining industry to coexist with other water users and to have measures in place to promote co-existence.

"By using water wisely and demonstrating industry best practice the industry will continue to achieving this balance with communities and surrounding industries."

New radar sensor tech brings benefits

VEGA Australia has launched a new radar level sensor that has been strategically designed for all simple applications in the water-supply and sewage sectors.

Featuring a wide range of mounting options, the VEGAPULS WL S 61 is an especially cost-effective radar solution, and can be readily integrated into existing infrastructure.

Just as with the VEGAPULS WL 61, which has been available for several years with a large installed base, the new VEGAPULS WL S 61 offers a design optimised for use in the water-supply and sewage sectors.

Radar technology offers numerous advantages compared with ultrasonic sensors, which used to be standard in this sector; radar is independent of weather influences, strong sun, wind, fog or rain.

In addition, no compensation is needed for variations in the signal transmission time due to air temperature fluctuations.

With an accuracy of +/- 5mm, the VEGAPULS WL S 61 covers a wide range of applications.

This sensor is particularly suitable for level and flow measurement in water treatment plants.

Its excellent focusing enables its use in pumping stations and rainwater overflow basins, for flow measurement in open channels, and for level monitoring.

The sensor's robust housing is wear and maintenance-free, and its high degree of protection – IP 68 (2 bar) – also makes it suitable for applications where the sensor may be temporarily submerged.

The unit complies with the latest LPR standard (Level Probing Radar),



Excellent resistance to weather conditions, make VEGAPULS WL S 61 the ideal level sensor for water-supply and sewage applications.

and is approved for open-air use without restrictions or special attachments.

VEGA drew on its many years of experience in its development of this new sensor for simple measurement tasks.

Today, about 40,000 VEGAPULS WL 61 sensors are being successfully used worldwide in the water-supply sector.

An entirely new feature is Bluetooth wireless operation from a smartphone or tablet (and/or a PC with PACTware) when combined with a Bluetooth USB adapter; this makes commissioning and diagnosis even simpler.

Corresponding display and signal processing units enable the display of measurements and provide the relay outputs needed, for example, to control a pump.

More information can be found at: www.vega.com/wls61.


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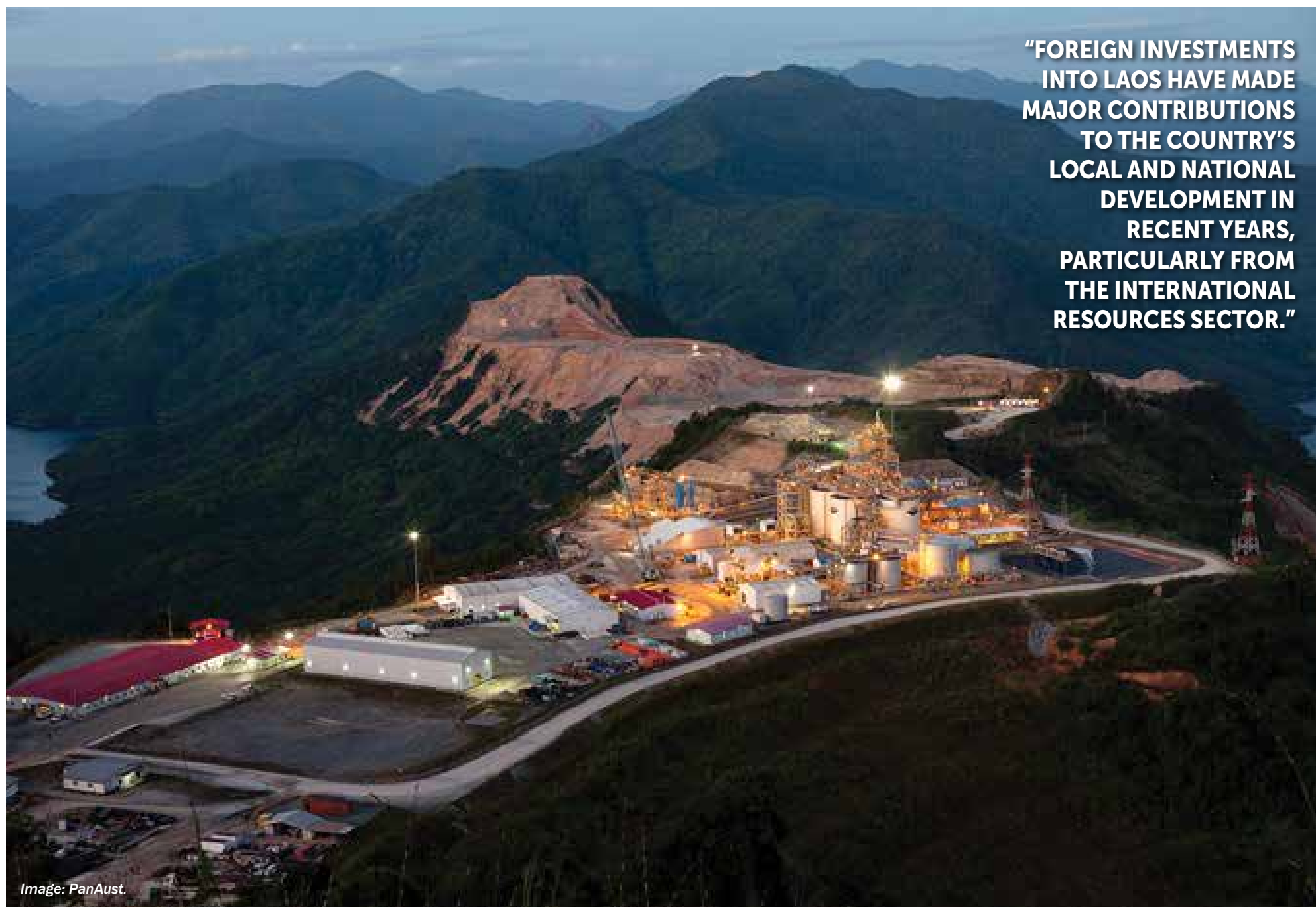
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"FOREIGN INVESTMENTS INTO LAOS HAVE MADE MAJOR CONTRIBUTIONS TO THE COUNTRY'S LOCAL AND NATIONAL DEVELOPMENT IN RECENT YEARS, PARTICULARLY FROM THE INTERNATIONAL RESOURCES SECTOR."

Image: PanAust.

Nation building reform

With the help of Australian expertise and Government support, Laos is primed to boost its fledgling mining industry with reforms that could lead to an influx of foreign investment and much-needed revenue for one of the poorest nations in South East Asia.

CAMERON DRUMMOND

THE mining sector can provide long term benefits when companies, governments and local communities work together to optimise the economic impact of foreign investment into a country.

Direct and indirect benefits from ethical mining practices by foreign companies in poorer countries such as the Lao People's Democratic Republic (Laos) can help through employment opportunities and community development programs.

Laos' resources sector is currently undergoing reform with the help of foreign aid and expertise, and the Lao Government is reworking its 2009 mining law to address a number of shortcomings in its current mining regime.

Australian Ambassador to Laos John Williams said the Australian Government fully supported the reforms.

"Given the potential long-term benefit of a quality mining sector for the Lao PDR's socio-economic development, Australia has in recent years dedicated aid funding to support the Lao Government's mining policy reform agenda," Mr Williams said.

There are currently two major mining operations in Laos, which have proved valuable additions to the country's gross domestic product.



Australian Ambassador to Laos John Williams (left) with Prime Minister Malcolm Turnbull on his visit to Laos.

In 2002, a relative "mining boom" was instigated in Laos when first gold was poured at Oxiana's (now MMG's) Sepon copper-gold mine – the first major commercial private sector mine established in the country.

The boom continued with the 2008 commissioning of another major development: PanAust's Phu Kam copper-gold mine, about 140km from the

capital Vientiane.

Mr Williams said the two companies had set the bar high in terms of the international standards the Lao Government can, and should, expect from foreign miners.

"These two Australian mining operations have contributed tens of thousands of jobs in Laos, both direct hire and through local contractors, and invested heavily in the skill development

of their largely Lao workforces," Mr Williams said.

The projects remain the country's largest mining operations to date and the driving force behind the country's mining sector, which made up 21.5 per cent of Lao exports in 2015.

According to the Lao Statistics Bureau, mining accounted for 14.7 per cent of Laos' economic output (real GDP), and 17.7 per cent of the country's 7.6 per cent GDP growth.

"Both mining operations have operated to the highest international standards in terms of work health and safety, environmental protection and in their contributions to the Lao economy," Mr Williams said.

"The two Australian operations have contributed almost all of Lao Government revenue from mining – over \$2 billion over the past 10-15 years to help build schools, medical facilities, roads and other vital public infrastructure and services.

"Both companies have also set high standards in terms of corporate social responsibility, helping to markedly increase incomes and living standards in local communities around their projects.

"Pan Aust, trading here as Phu Bia Mining, has won international awards for its community development projects in Laos."

Mr Williams said while MMG and PanAust's projects had built successful operations, Laos' significant potential for mining investment remained largely in limbo as the Lao Government tried to sort out its mining sector.

"Sadly for Laos, the gap in standards is vast between what Sepon and Phu Bia have delivered, compared with the country's other 60 or so mining operations," Mr Williams said.

"In the preceeding years, Lao authorities had opened up the sector and issued too many licences without due process, or sufficient due diligence on the applicant companies.

"The result was a plethora of concessions, and potentially valuable mineral deposits in the hands of speculators or companies with little public accountability.

"There is also now a mismatch between the large number of companies with exploration and mining licences, and the limited capacity of Laos' mining bureaucracy, which needs regeneration and ongoing support."

Mr Williams said that there were still positive signs for foreign investment in the country through a need for mining equipment, technology and services (METS).

"There are large numbers of companies in dire need of Australian expertise in METS [and] Austrade and IMARC have been active in connecting suppliers."

Australian support

Through international aid initiatives and industry support, Australia has had a direct hand in helping Laos build and reform its mining sector.

"We have, for example, provided



additional funding for mining reform for a World Bank-managed technical assistance project - the Hydropower and Mining Technical Assistance, or HMTA project," Mr Williams said.

"The project has, inter alia, been helping Laos develop a functioning cadastre management system to provide greater visibility on exploration and mining licences, and advice on how Laos can develop a simplified, more transparent licencing regime.

"The Minerals Council of Australia has also been generous with advice for senior Lao Government Ministers and officials on Australia's regulatory

approach – most recently, in a briefing in Canberra in late February for Lao Deputy Prime Minister Sonexay Siphandone.

"In addition, the Deputy Prime Minister and Lao Minister for Mines and Energy have met separately with senior resources ministers and officials in Tasmania, Victoria and Queensland over recent months to learn from Australia's approach to mining governance."

"We are excited too, about new global mining for development initiatives being planned in Canberra that will aim to draw on corporate Australian mining expertise to assist developing countries to maximise the potential benefit of their mineral resources through improved governance.

"Laos is a priority country for Australian assistance in mining."

Mr Williams said Australian volunteers had also played an active role in supporting mining reform in Laos.

"The Lao Ministry of Energy and Mines has drawn heavily on the advice of several Australian mining experts who have been placed with the Ministry under our Australian Volunteers for International Development (AVID) program."

Pan Aust - Phu Kham

Phu Kham is PanAust's flagship mining project, and is operated by its subsidiary Phu Bia Mining.

The mine comprises of an open-pit mine feeding ore to a process plant with recovery of copper and precious metals into a saleable concentrate using conventional flotation methods.

The concentrate contains between 23 per cent and 25 per cent copper, 9 grams per tonne (g/t) gold and up to 60g/t silver.



OSSS connects companies with local talent to provide camp management services.

Local footprint for international miners

ON Site Support Services (OSSS) was founded in 2009 to provide services to companies looking to participate in hydro, mining, oil and gas and infrastructure projects with local Asian and African companies as a means of driving real growth in the national and local economies.

OSSS uses local and community based people and businesses to provide camp management services in remote areas at international standards throughout South East Asia, Papua New Guinea and Africa.

From the outset, OSSS worked closely with international companies to develop a product that was compliant to their high standards; a product that ensures strict safety, electrical, and structural benchmarks.

Its main business is the manufacture of modular containers and steel structures; used for camps, offices, schools and warehouses; that can be demolished and re-mobilised time and time again.

The design is focused on quick assembly, cost effectiveness and re-use for second and third projects.

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80 per cent of concentrate is trucked for export to smelters mainly in Asia.

2016 marked record annual production at Phu Kam, mining a total of 57 million tonnes (mt) at a recovery rate of 79.9 per cent copper to produce 89,187t of concentrate.

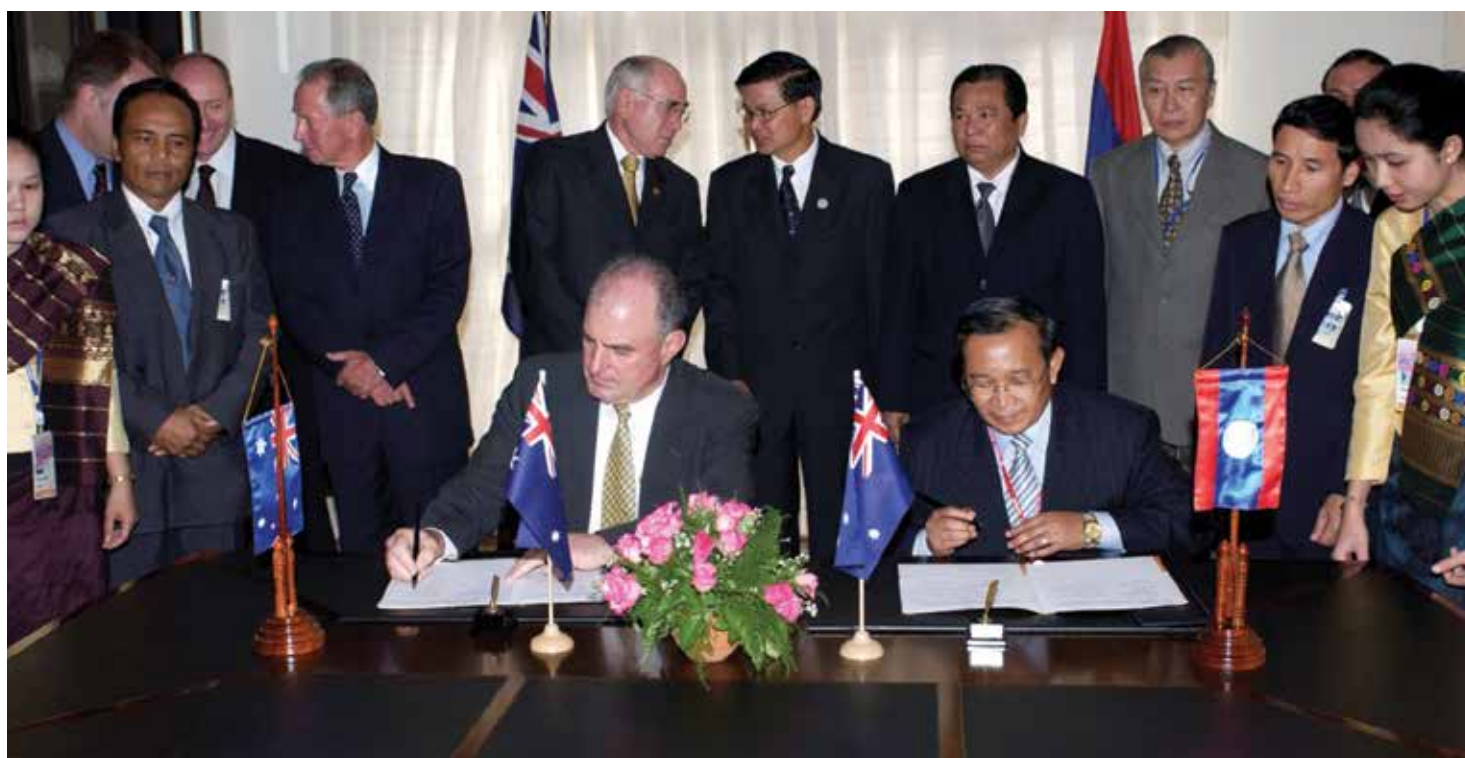
PanAust expected annual copper in concentrate production to continue to rise steadily over the next several years, as the average copper head grade increases and improving ore qualities lead to further gains in metallurgical recovery rates.

Annual production guidance of copper concentrate was expected to peak in 2018 and 2019 between about 85,000t to 90,000t before ore grade declines, with gold production expected to range between 70,000oz per annum (ozpa) and 80,000ozpa for the next five years.

MMG - Sepon

MMG's Sepon mine is located in Vilabouly district, Savannakhet province in southern Laos.

The Sepon gold project yielded its first gold and silver doré in December 2002. In early 2005, an expansion of the original gold processing facility was completed, doubling the capacity of the gold processing plant to 2.5 million tonnes of ore per annum.



During its operations, the Sepon gold operation had produced over 1.2moz of gold through open pit mining.

MMG ceased gold operations in December 2013 due to depleting ore reserves and lower

margins. The gold plant was placed on care and maintenance and operations at Sepon continued to focus on copper production.

In 2016 Sepon produced 78,492t of copper cathode, a drop of 12 per cent year-on-year.

This was in line with production forecasts, and MMG said it expected to produce between 65,000t and 75,000t of copper cathode in 2017 due to a continued transition to lower grades of ore being realised at the mine.

Industry insight

Phu Bia Mining managing director **Richard Taylor** spoke with journalist **Cameron Drummond** about the Lao mining industry.

Q. What are the tangible benefits of foreign miners setting up shop in Laos?

Laos has hosted two very successful originally Australian-owned start-ups.

The country has a history of being able to deliver a development pipeline from exploration to production.

In mainland South-East Asia, there are few other countries that have done so well in developing an industry that previously did not exist.

There are signs Laos is looking to renew exploration opportunities for companies, and Australia is well placed to be able to capitalise on any lifting of the moratorium on new concessions.

Australian companies are well regarded from a safety, health, environment and community perspective.

Laos has a modern history of exploration and mining going back 20 years, and there is a pool of well-trained local labour that means it is a cost effective jurisdiction for new market entrants.

Infrastructure is steadily improving — the Asian Highways network, hydropower electricity grid and rail opportunities make getting product to market relatively cheaper.

Proximity to major markets in China and India also gives local miners a shipping edge over more remote producers.

Q. What issues need to be addressed when doing so?

Patience and understanding that Laos is still developing its regulatory regime are both necessary and a virtue for companies setting up shop in Laos.

Some aspects of the regulatory regime still need to be tackled to make it an attractive investment destination.

Starting a business can be a long and time-consuming process. Getting the relevant approvals for construction and environmental permits, in particular, can be difficult, given the lack of capacity



Phu Bia managing director Richard Taylor (right) accompanied by Minister for Energy and Mines, H.E. Khammany Inthirath, on a 2016 visit to Phu Bia's Phu Kham copper-gold operation in Xaisomboun Province. Image: DFAT.

within government departments.

There remain labour shortages in some key disciplines such as IT, accounting and administration, which have been exacerbated by recent economic growth.

Apart from the moratorium on new concessions, the largest problem likely to be faced by new entrants is the delay in decision-making processes.

Strong environmental and social standards of performance will help secure the attention of government, and attract high-quality staff.

Good practice dictates the importance of having in place robust anti-bribery and corruption standards and training for

staff from the outset.

Q. Has foreign investment benefitted domestic mining companies?

There are relatively few mining operations outside of those already mentioned. However, there is a large and active small-scale and industrial minerals sector that exists separate to the major mines.

Lao companies have mostly benefited from the business opportunities provided by the major companies, with many local companies growing substantially from long-term partnerships with foreign investors.

These companies have benefited from exposure to international construction standards, safety systems and international business philosophies that readily transcend sectors.

These skills and learning opportunities have had spill-over effects to a variety of related sectors.

Local companies have also benefited from the skills and training programs provided by the major companies, and many ex-employees have established businesses in recent years utilising experience gained from working with Australian companies to Australian standards.



**“THIS INVESTMENT
FURTHERS OUR
PRODUCTIVITY
AGENDA, REDUCES
COSTS, RELEASES
LATENT EQUIPMENT
CAPACITY, AND
STRENGTHENS
OUR COAL
BUSINESS’ GLOBAL
COMPETITIVENESS.”**

The BHP Billiton Mitsubishi Alliance (BMA) is a 50/50 joint venture between BHP Billiton and Mitsubishi Development.

Image: BHP Billiton.

Productivity agenda

As the hangover from Cyclone Debbie subsides, BHP Billiton Mitsubishi Alliance (BMA) continues to push forward with investments across its Bowen Basins operations, including \$US204 million towards the Caval Ridge Southern Circuit (CRSC) capital growth project.

ELIZABETH FABRI

A JOINT venture between BHP Billiton and Mitsubishi Development, the BHP Billiton Mitsubishi Alliance (BMA) is Australia’s largest coal producer and supplier of seaborne metallurgical coal, accounting for about 28 per cent of the world’s seaborne met coal trade.

The coal giant owns nine mines covering a combined area of 75,000sqkm in the resource rich Bowen Basin in Central Queensland; seven of which are operational.

Its current portfolio of operating mines comprises Goonyella Riverside, Broadmeadow, Daunia, Peak Downs, Saraji, Blackwater, and Caval Ridge.

With the exception of the Broadmeadow underground longwall operation, the mines are all open-cut.

BMA also owns the Hay Point Coal Terminal, in the Bowen Basin, which was recently expanded to support increased exports.

In December 2015, the third berth at the terminal was officially opened, which included the construction of a new berth, and ship-loader, and replacement of the existing trestle conveyors, jetty, surge bins and linking conveyors.

The \$US3 billion project resulted in increased export capacity of an additional 11 million tonnes a year.

In the December 2016 quarter the joint venture achieved metallurgical coal production of 8.684mt, bringing its year to date production to 17.068mt compared to 16.294mt the year prior.

In the March quarter, BMA coal production dropped to 7.996mt, forcing BHP to lower its FY17 met coal guidance.

At Queensland Coal, record production was achieved at five mines, underpinned by improved stripping and mining performance, higher yields at Caval Ridge and Saraji, and increased wash-plant utilisation,” BHP stated in its March quarter report.

“This was partially offset by a planned longwall move at Broadmeadow and reduced rail capacity as a result of damage caused by Cyclone Debbie.

“Guidance for the 2017 financial year has been reduced to between 39 and 41 Mt as a result of damage caused by Cyclone Debbie to the network infrastructure of rail track provider Aurizon.”

Cyclone Debbie impact

In March, BHP was forced to suspend operations at five of its Queensland coal mines that were in the pathway of tropical Cyclone Debbie, including BMA’s Goonyella Riverside, Peak Downs, and Daunia operations.

While its remaining mines were still operational, the projects were running at reduced levels, resulting in a further loss of a production.

The Hay Point Coal Terminal was also temporarily closed.

“BHP Billiton confirms that force majeure has been declared for all BMA Coal and all BMC Coal products as a result of damage caused by Cyclone Debbie to the network infrastructure of rail track

provider Aurizon,” the company said.

“BHP Billiton continues to assess haulage options to manage access from mine sites to port and shipments to customers.

“We continue to monitor and work through the impacts to production and will provide updates over coming weeks and detail in the Operational Review.”

On 3 April, BMA confirmed crews would be returning to work at the coal mines and Hay Point Terminal.

“Dewatering infrastructure installed after the 2011 floods is working as designed and all sites are resuming operations with mine production ramping up,” BHP stated.

The business will continue to work through the impacts to production.

BHP’s coal business also committed \$250,000 to the Salvation Army to support Queenslanders impacted by the storm.

“This is far from over for the people of Queensland,” Acting BMA asset president Frans Knox said at the time.

“Many families have lost their homes and communities continue to be without power. “Communications are relying on organisations like the Salvation Army for help.”

**Project updates
Caval Ridge**

On 21 April, BMA announced it would invest \$US204m into the new Caval Ridge Southern Circuit (CRSC) capital growth project; an 11km overland conveyor system that would deliver coal from Peak Downs mine to the Coal Handling Preparation Plant (CHPP) at the nearby Caval Ridge project.

The project would also see a new stockpile pad and Run-of-Mine station developed at Peak Downs and at Caval Ridge, and investments in a new mining fleet, including excavators, and trucks.

The project was expected to generate 400 new construction jobs and lock in about 200 ongoing operational roles in the region.

BHP Billiton Minerals Australia president operations Mike Henry said the project “formed the missing link between the two mines”, and would accelerate growth and productivity.

“This investment furthers our productivity agenda, reduces costs, releases latent equipment capacity, and strengthens our coal business’ global competitiveness,” Mr Henry said.

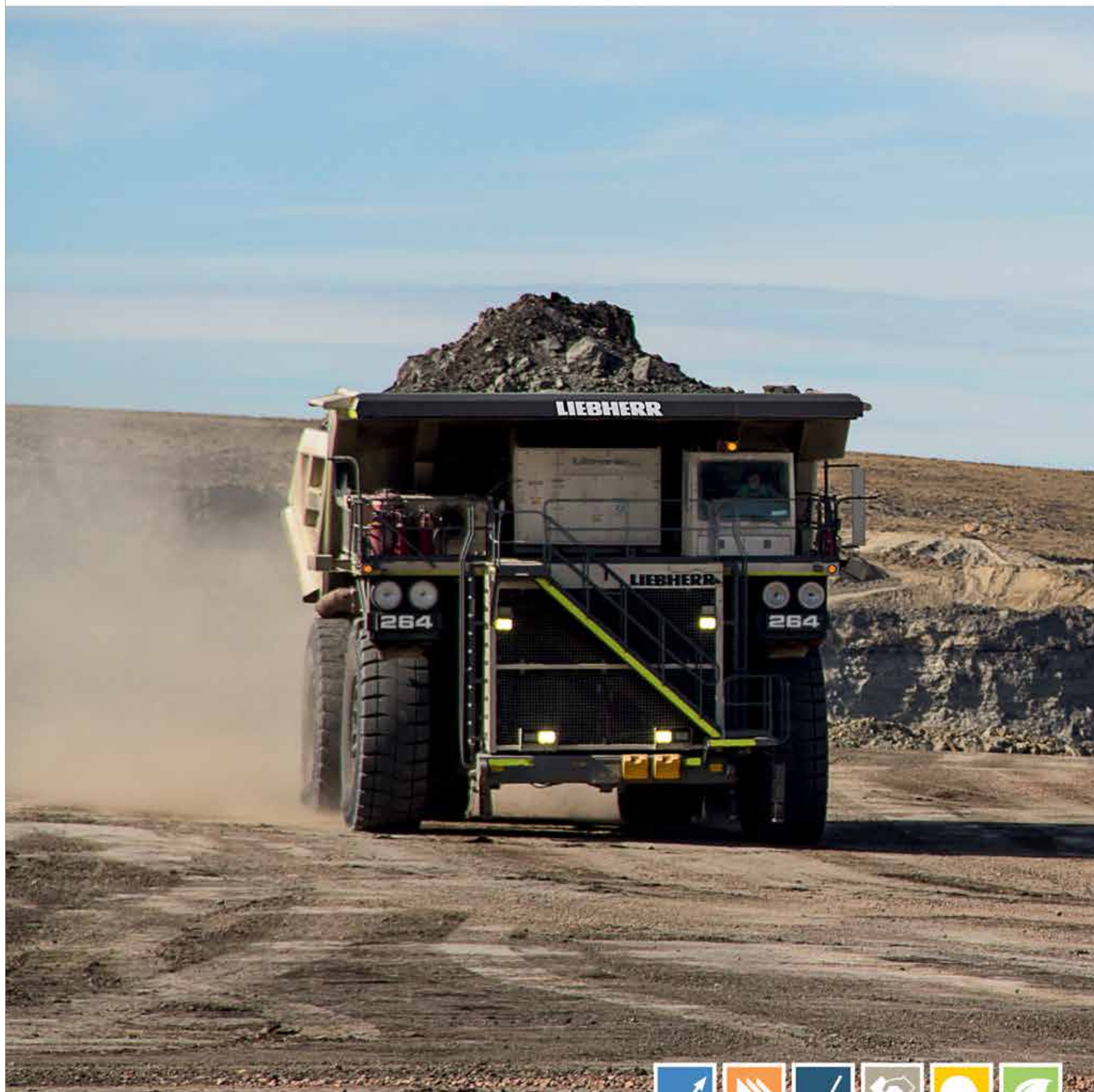
“We are committed to Queensland’s Bowen Basin and this project creates new employment opportunities during construction and locks in ongoing operational roles. The investment flowing from the project will help support the local community and State economy after what has been a difficult time in the region.”

Queensland Resources Council chief executive Ian Macfarlane said the project was great news for the Queensland coal industry, which had been struggling through the downturn.

“These investments are driven by companies willing to invest because they see the fundamental drivers of global demand for high-quality Queensland coal remain strong,” Mr Macfarlane said.

(CONTINUED ON PAGE 35)

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(CONTINUED FROM PAGE 33)

“We know demand remains strong as there is no viable substitute for coking coal in the production of blast-furnace steel – no ‘Uber’ process waiting in the wings.

“This announcement is great news for the coal sector and the benefits will flow into local communities and local businesses.”

Construction on the project was set to begin this year and would take about 18 months.

BHP said the CRSC project was set to increase the coal handling plant’s capacity throughput to 10mtpa.

Peak Downs and Saraji

Additional jobs were also announced at BMA’s Peak Downs and Saraji mines.

On 31 January, the business stated it would be employing 200 additional people across the two operations.

“This is another sign of green shoots for the Bowen Basin, an area which delivered much of the \$1.6 billion boost to royalties for the State Government,” Mr Macfarlane said.

“It follows on from the good news we are seeing right across the Queensland coal industry with record exports last year and new mines opening up.”

Located 30km south of Moranbah, Peak Downs was first developed in the early 1970s, and delivered first coal in April 1972.

Production at Saraji also dated back to the early 1970s, with first production in 1974.

Both mines were in close proximity to each other; only 24km apart.

The Peak Downs mine was praised recently for its high intake of young female mining apprentices.

On 6 February, BMA announced it was launching a four-week Work Readiness



BMA is one of Australia’s biggest exporters of metallurgical coal.

Program, of which 16 of the 31 apprentices were women.

The program, run in conjunction with the Queensland Minerals and Energy Academy (QMEA) and Moranbah State High School’s Coalfields Training Excellence Centre, prepared apprentices for their fulltime roles at six BMA mines.

BMA Peak Downs general manager Sean Milfull said the business was excited to be investing in the future, with the induction of 31 trade apprentices in 2017.

BMA Peak Downs Mine general manager Sean Milfull said the health, safety and wellbeing of its people was central to the organisation and the Work Readiness Program.

“In partnership with the QMEA we look forward to collectively providing a supportive learning and mentoring environment for our

new apprentices, with the Work Readiness Program offering the perfect starting point,” Mr Milfull said.

“This program ensures that from day one our new apprentices will work safely and be productive members of their maintenance teams.”

Community engagement

One of BMA’s latest initiatives included a science, technology, engineering and mathematics (STEM) tour for a group of Moranbah State High School students.

The tour, held over four days late March, saw 20 students attend events at the World Science Festival and visit BHP Billiton offices, as part of the ‘Building Pathways for Diverse Futures’ partnership between BMA and the school.

The \$450,000, three year extra-curricular program helped students develop their future career paths through mentoring and extended education and training.

BMA was also involved in similar programs at Dysart and Blackwater.

“This is going to be a wonderful opportunity for these students to touch, feel and see the possibilities for their future careers through maths and the sciences,” Moranbah State High School Coalfields Training Excellence Centre careers transition officer Tracy Mawson said.

“Their visit to BHP Billiton’s offices will showcase how cutting-edge technology is enabling advances in integration across BHP Billiton’s Bowen Basin coal operations that is leading the way in modern mining.”

In October last year, BMA also held its annual Make It Now in Engineering (MINE) challenge in Moranbah.

The program saw Year 11 and 12 students work alongside geologists, engineers and mine staff at Goonyella Riverside and Peak Downs, and stay in the Civeo Village for a week to experience life as a fly-in, fly-out worker.

Goonyella Riverside mine general manager Mark Swinnerton said the challenge enabled students to get hands on experience in the mining sector.

“The BMA MINE Challenge allows students to not only work with other students from around the state but also provides them with the unique opportunity to learn directly from those already working in the resources industry,” Mr Swinnerton said.

BMA will continue its work with the local school communities throughout 2017, as well as advancing innovation and collaboration with the industry and METS businesses in the sector.

Liebherr T 264: made for mining

FOR the first time since being unveiled at Bauma 2013, the 240 tonne Liebherr T 264 haul truck has been made available for sale in Australia, and initial reports from those who have inspected the truck have been positive.

Midway through 2016, five of the off-highway haul trucks arrived in Australia from the company’s dedicated truck factory in Newport News, USA; with one unit made available for inspection in the company’s Mackay branch.

With more than 30 years of proven design and operational experience – including the industry leading T 282 C Ultra Class haul truck – the T 264 is built for safety and reliability, and sized to match the Liebherr R 9800, R 996 B, and R 9400 hydraulic excavators, as well as wheel loaders.

The T 264 makes full use of the proven, efficient Liebherr-patented Litronic Plus AC drive system – one of the only OEMs to have a proprietary drive system.

Its high-power engine (up to 2700 HP/2013 kW) yields higher speeds on grade, while the hydraulic system offers efficient dump hoist performance for faster cycle times.

True to the company’s practice of vertical integration, the T 264’s front wheels, electronics and control technology, suspensions, and gear technology are all designed and manufactured within its German factories, while other components are replicated from the class-leading T 282 C.

Featuring high-powered and frictionless dynamic braking, the T 264’s AC drive system delivers up to 4425 HP / 3300 kW of electric dynamic braking, reducing engine loading and fuel consumption.



The T 264 is available for inspection at the company’s Mackay branch.

An integrated smart technology system monitors, records, and provides the user with vital truck health and performance data.

Data captured from operational Liebherr machines worldwide is continually fed into the company’s Troubleshoot Advisor software: a user-friendly system that guides

service personnel through diagnosing and detecting the source of the problem.

Designed for ease-of-access in inspection and maintenance, the T 264 has ground-level filling points for fuel, hydraulic oil, grease and coolant, as well as the hydraulic filters and battery isolation box, reducing exposure to unnecessary safety hazards.

By partnering with customers, Liebherr engineers mining equipment that owners and operators want.

The constant fine-tuning of proven, current technologies, and integrating advanced technological innovations drives Liebherr to create more productive, reliable, and safe machines.

Strength and flexibility

South32 delivered strong financial results for H1 FY17 on the back of higher prices for its commodities, reporting statutory profit of \$US620 million and announcing its first interim dividend.

REUBEN ADAMS

IT was a real trial by fire for South32.

Formed in May 2015, the ongoing commodity crisis quickly forced BHP Billiton's base metals spin-off to focus on consolidating its operations into lower-cost entities after recording a net loss of \$2.13 billion in its first full year as an ASX-listed miner.

The company was still able to reach record production at five mining projects during the 2016 financial year, while implementing cost cutting measures across all of its operations.

Now, South32 is enjoying the rewards of healthy cash generation and a strong balance sheet in the current financial year.

Underlying EBITDA increased by US\$522m to US\$1.1 billion for South32 in H1 FY17 as higher prices for the majority of its commodities offset lower volumes, giving rise to an increase in sales revenue of \$US240m.

This, combined with a continued focus on costs, resulted in an increase in South32's operating margin from 20 per cent to 37 per cent.

Underlying EBIT increased by \$US550m to \$US691m, benefitting from a reduction in depreciation and amortisation following the recognition of non-cash impairment charges in H1 FY16.

A significant increase in free cash flow was achieved despite a temporary build in working capital, as a number of shipments rolled into January, and trade and other receivables increased as a result of rising commodity prices.

South32 chief executive Graham Kerr said a disciplined application of South32's strategy and stronger commodity prices underpinned a significant improvement in financial performance.

"We generated free cash flow of \$US626m for a net cash position of \$US859m as we further optimised our operations and benefitted from our operating leverage," he said.

"We continue to unlock value through the accelerated development of La Esmeralda, the progression of the Klipspruit Life Extension project towards a final investment decision, the completion of the West Marradong mining access agreement and the commencement of exploration in the Southern Areas at GEMCO.

"Our strong balance sheet and simple capital management framework is designed to reward shareholders as financial performance improves.

"We have declared our first interim dividend of \$US192m and will continue to manage our financial position to ensure we retain the right balance of flexibility and efficiency."

On 27 March South32 announced intentions to return an additional \$US500m, or 4.5 per cent of its market cap, to shareholders.

This capital management program, which complemented the Group's dividend policy, would initially take the form of an on-market share buy-back in Australia.

Mr Kerr said the company's net cash balance continued to build, giving it the financial strength and flexibility to invest in existing operations, pursue opportunities, and return excess capital to shareholders.

"This \$US500m capital management program meaningfully increases shareholder returns and follows the recent announcement of our \$US192m interim dividend," he said.

The timing and number of shares purchased under the on-market share buy-back would be contingent upon the prevailing share price and market conditions, and would be funded from existing cash reserves.

All images: South32.



GE signed a three-year strategic partnership to assist in South32's digital transformation.

The program was expected to be completed over a 12 month period and all alternatives would continue to be assessed to ensure this capital would be returned in an efficient manner.

Outlook

In its H1 report released February, South32 noted that while Illawarra Metallurgical Coal saleable production guidance was revised in December 2016 to 7.9 million tonnes (mt) as a result of challenging ground conditions at Appin Area 9 and a moderation of mining rates at Appin Area 7, longwall availability and cutting rates were anticipated to improve during FY18.

The lower production rate in FY17 had, however, impacted the timing of longwall panel extraction and production guidance for FY18 had been revised accordingly.

Worsley Alumina saleable alumina production guidance remained unchanged with the refinery expected to produce at its nameplate capacity of 4.6 million tonnes per annum across FY17 and FY18.

Similarly, Brazil Alumina saleable production guidance for FY17 was unchanged at 1.32mt with a small increase in production anticipated in FY18.

At South Africa Energy Coal, total coal production guidance for FY17 and FY18 was unchanged and would benefit from additional capital investment at the Wolvekrans Middelburg Complex to open up new mining areas.

Payable nickel production guidance for Cerro Matoso was 36,000t for FY17 before the accelerated development of the higher grade La Esmeralda Mineral Resource increased production by 16 per cent in FY18 to approximately 42,000t.

Production from La Esmeralda was now expected to commence in the June 2017

quarter. Production guidance for Australia Manganese of 3.1mwmt in FY17 and FY18 remained unchanged, albeit with a greater proportion of Premium Concentrate ore (PC02) product. South32's optimised longer term mine plan at Cannington aimed at maximising total silver, lead and zinc extraction across the remaining years of the underground operation and reduce geotechnical risk by sequencing stope design.

FY17 production guidance (silver 19.05moz, lead 163,000t, zinc 80,000t) remained predicated on the extraction of the higher grade (silver/lead) 60 litre stope that is in close proximity to the existing underground crusher, while the development of the replacement underground crusher was expected to be commissioned in the March 2018 quarter.

South stated that guidance would be revised should geotechnical conditions dictate a change to the current stope sequence and the extraction of the 60L stope be deferred, albeit with no net loss of metal production in the forward plan.

On 6 April, South32 advised that an underground fire, which damaged load-out and shaft haulage infrastructure, had temporarily impacted mining extraction at Cannington.

Remediation work would be undertaken over a four week period, and extraction of the higher grade stope would be delayed.

"Based upon our initial assessment, payable silver, lead and zinc production of 16.5moz, 135,000t and 70,000t, respectively, is now anticipated in FY17 with revised mill throughput of approximately 3.1mt (previously 3.3mt)," the company said in a statement.

An update, including revised unit cost (including Sustaining capital expenditure) guidance, would be provided in the March 2017 Quarterly Report.

Metropolitan Colliery

In February, Mr Kerr announced that "the proposed \$US200m acquisition of the Metropolitan Colliery is expected to create additional value and realise unique synergies with Illawarra Metallurgical Coal".

However, on 18 April South32 canned the acquisition from Peabody Energy.

This followed a Statement of Issues from the Australian Competition and Consumer Commission (ACCC) on 23 February 2017, which was concerned that it would substantially lessen competition in the supply of metallurgical coal to Australian steelmakers.

South32 maintained that metallurgical coal was a globally traded commodity, which meant it was not prepared "to make significant concessions in favour of Australian steelmakers that would likely be required to mitigate the competition concerns".

Mr Kerr said South32's approach to acquisitions was always opportunistic and seen through the lens of creating value for shareholders.

"To proceed with the acquisition, in light of the anticipated concessions, would have compromised the merits of the transaction and this is not something we are prepared to do," he said.

Technology focus

On 4 April Mr Kerr announced changes to the South32 senior management team, creating the role of chief technology officer for then chief operating officer Ricus Grimbeek.

"We believe technology and innovation presents a real opportunity to deliver safety and productivity improvements throughout our business," Mr Kerr said.

"This role, which will sit on our Executive Committee, elevates technology and innovation, enabling us to adopt a whole of company approach as we look at new ways of working to optimise our operations and unlock their potential."

Just 6 days later South32 and GE announced the signing of a three-year strategic partnership to assist in the development of South32's technology roadmap and "activation of the company's digital transformation".

GE's Predix platform – connecting industrial equipment, data analysis and instant insights – would help the miner make fast, informed decisions and optimise entire operations rather than individualised assets and equipment.

"Bringing the world of operational technology and information technology together to monitor equipment and systems remotely and predict future behaviour is a game changer," Mr Kerr said.

"It has the potential to identify and solve a problem before it affects operations."

South32 chief technology officer Ricus Grimbeek added that "if we get this right, the result won't just be an incremental improvement but a new level of efficiency and performance".

GE chief executive and chairman Jeff Immelt said the future of mining was digital.

"With data and analytics, we can achieve greater levels of productivity, operational efficiencies, and improve safety," Mr Immelt said.

"We look forward to working with South32 to help them optimise their operations and accelerate the digital transformation of the mining industry at large."



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MINE BUG — 2 PERSON UTILITY RUNABOUT VEHICLE

- Designed for Underground Mine Maintenance, Surveillance and Management use
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- 3 Cylinder 900cc Diesel Engine c/w wet scrubber, Hydrostatic transmission & braking
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All images: FMG.

Sustainability focus

Iron ore surprised everyone by roaring back to life in 2016, but in 2017 – since its February peak – the spot price has pulled back more than 20 per cent. Yet Fortescue Metals is ‘making hay while the sun shines’ by continuing to pay down its debt pile and invest in the long term sustainability of its business.

REUBEN ADAMS

STRONG Chinese steel production and temporary supply disruptions have supported higher iron ore and metallurgical coal prices so far in 2016–17.

“The value of Australia’s resources and energy export earnings in 2016–17 has been revised up by \$12 billion since the December Resources and Energy Quarterly to \$215 billion,” the March *Resources and Energy Quarterly* from the Department of Industry, Innovation and Science stated.

“The upward revision largely reflects the unexpected increase in the price of iron ore, and the unexpected strength in thermal coal prices in the March quarter 2017.

“Export earnings in 2017–18 have been revised up by \$17 billion, because of upward revisions to iron ore, metallurgical coal and thermal coal prices.

“As a result of the revisions, 2016–17 and 2017–18 are expected to represent the highest level of resources and energy exports (in real terms) both on record and

“WE REMAIN ON TRACK TO DELIVER OUR GUIDANCE OF BETWEEN 165 AND 170 MILLION TONNES FOR THE FULL YEAR AT A C1 COST OF \$US12-13/WMT AND WILL CONTINUE OUR FOCUS ON FURTHER REPAYMENT OF DEBT, INVESTMENT IN OUR CORE IRON ORE BUSINESS AND RETURNS TO SHAREHOLDERS.”

over the outlook period.”

However, the price gains were not expected to last; since 5 March, when Chinese Premier Li Keqiang signalled cuts to his nation’s steel capacity, iron ore has slumped 30 per cent.

“Production of steel in China is expected to decline over the next five years, as construction activity slows, particularly in the residential sector,” the report stated.

Platts reported that the possibility of Chinese domestic iron ore output ramping up this year in response to higher prices, and subsequent downward pressure on seaborne prices, was a major talking point at the Global Iron Ore & Steel Forecast conference in Perth in March.

Rio Tinto Planning Integration and Assets managing director Kellie Parker said the prospect of China “rebooting” its iron ore production was one of the “biggest market uncertainties”, Platts reported.

A laser focus

In these uncertain economic times Fortescue Metals Group (FMG) has reiterated its focus on further repayment of debt, investment in its core iron ore business, and returns to shareholders.

Almost four years ago the company was in serious trouble; drowning under debt as high as \$US13 billion in 2013, as the iron ore price began its slow and steady decline to lows of \$US38/t in late 2015.

Some seriously good management, quality decision making, and a bit of good

fortune (see strong prices in 2016) have put the company in a position to make early repayments and substantially reduce the amount of annual interest incurred.

A February claim by media that FMG was using its growing cash pile towards a \$1b offer for Westfarmers 8.5mtpa Curragh coal mine in Queensland was quickly refuted by the company in a statement to the ASX.

“Fortescue Metals Group advises that media reports regarding the submission of an indicative bid for Westfarmers Curragh coal mine assets on Monday 27 February 2017 are incorrect,” it stated.

“We are focussed on debt repayment and capital flexibility, investment in the long term sustainability of our core iron ore assets, creating low cost future growth options and delivery of returns to our shareholders.”

FMG hasn’t neglected exploration and development though, with total FY17 expenditure estimated at \$US40 million.

In the March quarter exploration was primarily focused on iron ore in the Pilbara with expenditure of \$US10m.

(CONTINUED ON PAGE 46)



SEMI-MOBILE SIZING SOLUTIONS

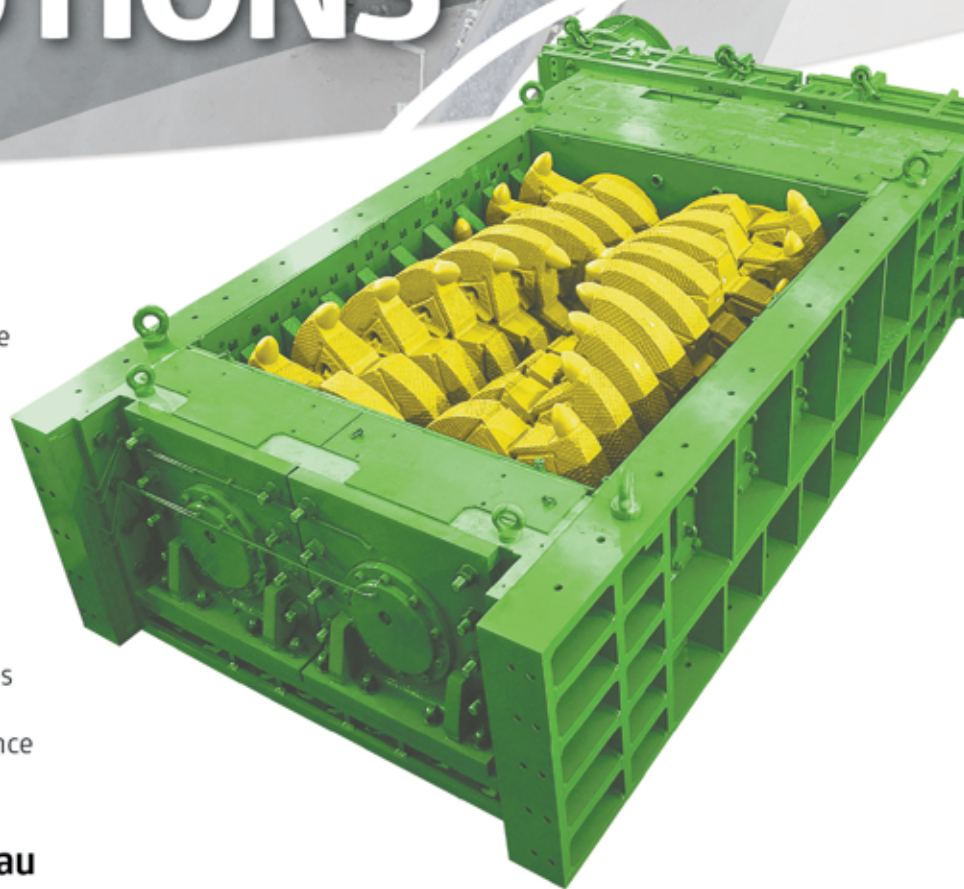
As open pits become deeper and haulage routes longer, In-Pit Sizing and Conveying (IPSC) is the effective answer to significantly reducing operating costs. Over the past three decades, MMD has developed a leading range of efficient semi-mobile sizing stations to take advantage of the cost-effective short haul truck and shovel mining method.

The MMD Twin Shaft MINERAL SIZER™ is at the heart of every Sizer station and proven capable of processing more than 80 different materials worldwide; from wet and sticky clays to hard and dry rock such as iron ore, zinc ore, copper ore and granite. Our success and expertise in innovating robust solutions to handle difficult materials, is leading the way for more mines to achieve improved efficiency and productivity.

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Cutting costs site wide

AUSTRALIAN mining is a cyclical industry that is prone to boom or bust.

It is an industry that requires investing wisely and looking at all available options when considering the set-up of a new plant or attempting to reduce costs in a brownfield operation.

Mining Machinery Developments (MMD) is a world leader in the design, manufacture and supply of mineral processing solutions and associated machinery serving the mining, quarrying and recycling industries.

For almost 40 years the company has delivered innovative solutions that improve the productivity, profitability and safety of its customers' operations, while minimising environmental impact.

"While mining can be a lucrative business, the set-up costs – defined as capital expenditure or CAPEX – can be huge, especially for mines in remote locations," MMD Australia managing director Lee Hillyer said.

"A company's investment in a mine site means that budgeting has to be precise."

One solution is MMD's Semi-Mobile Sizer Station; a moveable structure that carries out the same functionality and reliability as a fixed plant.

The MMD Semi-Mobile Sizer Station represents a common sense approach to mining in remote or difficult-to-reach areas, as it can be relocated to another mine or deposit, unlike a fixed plant, which is a fixed asset.

MMD's Semi-Mobile Sizer Station is fully automated with a number of field devices and sensors that monitor the condition and operational status of the equipment, from the condition of the bearings, gearbox oil levels, fluid coupling temperatures or motor rotational speeds.

MMD's Sizers and equipment are built to the highest quality and are fully supported globally by the company's dedicated site service specialists 24 hours a day.

All of MMD's equipment is also easily refurbished to continue operating for the life of the mine.



More information can be found at www.mmdsizers.com.au

"MMD recently refurbished a Sizer that first went into service in 1978 and is still operational today," Mr Hillyer said.

"The life of MMD equipment can last over 40 years if it is maintained properly."

Mr Hillyer said the MMD Semi-Mobile Sizer Station can easily be relocated using MMD's Atlas 500 tonne Transporter,

which has the capacity to lift large heavy structures and serve multiple units and equipment around a mine.

The company also specialises in fabricated twin or single truck bridges; an alternative to reinforced earth walls that are used in fixed plants.

"Rather than putting equipment next to

the bench, the truck bridge is either tied into or adjacent to the bench – therefore vastly reducing capital expenditure on installation, offering a large reduction in future rehabilitation costs and reducing the impact on the environment, which is core to MMD's drive for sustainable green mining solutions," Mr Hillyer said.

(CONTINUED FROM PAGE 44)

Fortescue was also granted 32 exploration areas in Ecuador, with formal consultation with the communities in the vicinity of these areas and baseline environmental studies having commenced.

The miner has also continued target definition work on the joint venture tenure near Orange, NSW, where detailed analysis and interpretation to define drill targets continues.

Results

Its H1 results reflected positive market conditions, and included a net profit after tax of \$US1.2b and underlying EBITDA of \$US2.6b.

FY17 guidance was maintained for iron ore shipments of between 165mt and 170mt with a C1 cost of US\$12-13 per wet metric tonne (wmt).

Its March quarter production report, released 13 April, was marred by slightly higher costs and lower shipments.

Yet FMG repaid a further \$US1b of debt, reducing its gross debt to \$US4.3b, inclusive of US\$0.7b of finance leases with US\$1.5b cash on hand at 31 March 2017.

This debt reduction lowered gross gearing to 31 per cent with net gearing of 22 per cent.

FMG chief executive Nev Power said the company had continued to deliver excellent results with improved safety performance and operating margins compared to first half results.



FMG chief executive Nev Power.

"The average realised iron ore price of \$US65 per dry metric tonne with a C1 cost of \$US13.06/wmt generated strong cash flows

which were applied to a further \$US1 billion debt repayment in March," he said.

"We remain on track to deliver our

guidance of between 165 and 170 million tonnes for the full year at a C1 cost of \$US12-13/wmt and will continue our focus on further repayment of debt, investment in our core iron ore business and returns to shareholders."

FMG stated that iron ore and steel demand remained strong during the March 2017, quarter driven by ongoing construction and infrastructure activity in China.

"Customers have continued to bid-up the price of higher grade ores to offset the impacts of coking coal prices, restrictions on steel mill production and to take advantage of high steel margins."

FMG Grace arrives

FMG welcomed its second Very Large Ore Carrier (VLOC), *'FMG Grace'* into Port Hedland in March.

Following the arrival of *FMG Nicola* in December 2016, *FMG Grace* is the second of four VLOCs from the Yangzijiang Shipyard in China.

Another four ore carriers are being built at Guangzhou Shipyard International, with the delivery of the final vessel expected in mid-2018.

The ships are designed to complement FMG's world class port infrastructure through maximising tonnage per ship, improved loading rates, and safe manoeuvring within the port and the channel.

When fully operational, the fleet will provide an estimated 12 per cent of Fortescue's total shipping requirements.



Desert mine expansion

Due for completion mid this year, the expansion of Newmont's Tanami gold project will add an extra 80,000oz to production and reduce mine costs by up to \$50 per ounce.

CAMERON DRUMMOND

NEWMONT bought its Tanami gold project in 2002 through the \$4.56 billion acquisition of Australia's largest gold producer at the time, Normandy Mining.

Located in the Tanami Desert in Central Northern Territory, it is one of the largest and most remote mining locations in Australia.

It covers 928,570 acres of exploration licenses and 12,840 acres of mining leases, with mine and plant on Aboriginal freehold land owned by the Warlpiri people and managed on their behalf by the Central Desert Aboriginal Lands Trust.

The operation employs about 1100 workers and contractors on a fly-in fly-out basis at the project's Dead Bullock Soak underground mine and Granites processing plant.

Currently, 48 percent of the mine's employees reside in the NT and Indigenous people make up 12 percent of its workforce.

In 2016, the mine produced 459,000oz of gold, up from 436,000oz in 2015; however all-in sustaining costs had increased \$US15/oz year-on-year to \$US739/oz due to lower ore grades mined during the period.

Expansion

In 2015, Newmont began its \$US120 million expansion of the Tanami gold mine, which would add 80,000oz to the yearly gold production of the mine and reduce costs by up to \$US50 per ounce.

The expansion included a second 3.2km decline in the mine which was completed in May last year, and incremental capacity in the plant to increase production and serve as a platform for future growth.

Once completed, the expansion would extend the life of the mine by three years and create a platform for further exploration of adjacent land.

Newmont Tanami general manager Francois Hardy gave an update on the expansion project.

"Engineering on all aspects of the project has been completed and the necessary



The Tanami project employs about 1000 personnel on a FIFO basis.

plans and other deliverables have all been provided to the appropriate contractors," he said.

Mr Hardy said the construction of the 3.2km decline into the Granites gold mine at the Tanami operation was completed in late April 2016, three months ahead of schedule.

"With two tunnels now leading underground, this will help to increase the output and lower costs," he said.

"Another key achievement was the first concrete pour at the Pre-Leach Thickener. It was completed safely, with 160 cubic meters poured continuously."

The laying of new fibre optic cables, the backbone of the mine's upgraded communications system, was also completed ahead of schedule.

Tanami's new ball mill was delivered in November 2016, and fabrication, inspection and delivery of the mine's new fuel tanks was proceeding on schedule.

Upgrades to the existing ventilation shaft as well as renovations to infrastructure at the Granites processing

plant were expected to be ready in time for production.

"As construction proceeds at the Tanami site, we will continue to work with the Central Land Council and traditional land owners.

"At the same time, we are developing a 10-year strategic plan that will help ensure that the longer mine life contributes lasting socio-economic value to the area."

"Since 2012, we've gotten ourselves into a position where we've improved [and] more than doubled our production," Mr Hardy said.

"We got our total cost down, which enabled us to put a plan forward that showed future growth."

Newmont said the expansion development was on track to reach commercial production by mid-2017 and would maintain Tanami's annual gold production at between 425,000oz and 475,000oz, at all-in sustaining costs (AISC) of between \$US700 and \$US750 per ounce for the first five years of production.

Overall AISC per ounce across all of Newmont's Australian operations was expected to increase from between \$US660 and \$US710 in 2017, to between \$US675 and \$US775 in 2018 and 2019.

The rise was forecast due to expected to lower grades at Tanami, lower grades as a result of stripping at Boddington and treatment of additional lower grade stockpile ore at Kalgoorlie in 2019.

Newmont in Australia

Newmont's other Australian assets are the two largest gold producing operations on the continent; the Boddington copper-gold mine and the Kalgoorlie Super Pit (50 per cent owned), both in WA.

Boddington, 120km east of Perth, has an annual production of about 800,000oz of gold and 77 million pounds of copper, and employs about 2000 personnel.

Gold production started in 1987; and in 2009, after a series of purchasing moves, Newmont became the 100 per cent owner of the project.

In the fourth quarter of 2015, Newmont announced it would provide full funding approval to begin a \$500m layback expansion of the mine's South Pit, and would play a pivotal role in the mine's life of mine plan.

The expansion was set to be completed by mid-2017.

The Kalgoorlie Super Pit, one of the largest open pit gold mines in the world has a current annual production rate of about 750,000oz of gold and employs about 1350 personnel.

The company's 50:50 joint venture partner in the project, Barrick Gold, had been manoeuvring for the sale of its share of the asset in the past 12 months, taking advantage of higher gold prices in order to pay off company debt.

In late November 2016, Barrick received an offer of \$1.35 billion from ASX-listed Minjar Gold, a subsidiary of Chinese property developer Shandong Tyan Home.

The move was welcomed by Barrick, however on 21 April 2017 the deal fell through after Shandong Tyan Home announced it would no longer pursue the project due to new capital and acquisition rules in China.

Leading provider keeping mines cool

ESTABLISHED in 1917, Gordon Brothers Industries (Gordon) is celebrating its 100th year of service.

With offices in all mainland States and offices in several regional areas, Gordon is a leading provider of industrial process cooling and freezing solutions to Australian and international mining, chemical, food and beverage industries.

Gordon's capabilities include design, manufacture, installation, parts supply and comprehensive servicing, together with 24-hour-a-day, seven-days-a-week breakdown and emergency response.

It provides specialised mine cooling solutions with enhanced reliability and reduced maintenance in typically harsh mining environments.

The company has designed, installed, modified and serviced many mine cooling plants between 1 megawatt (MW) and 25MW, including multiple turnkey solutions at mines across the country and in South East Asia.

Gordon is proud to have designed, installed and commissioned a 24MW mine cooling plant at Newmont's Tanami gold project in the Northern Territory.

The company considers all site requirements when custom-designing solutions for underground spot cooling, surface-mounted plants and surface-mounted plants with water reticulated to underground bulk air coolers.

Recently, Gordon installed the first absorption refrigeration system at a mine in Australia using waste heat from a mine power station to provide a significant proportion of the mine cooling plants' refrigeration requirements.



A 24MW cooling plant was installed by Gordon Brothers at Newmont's Tanami gold project.

This system has proven to be a reliable alternative to conventional electrical chillers, providing substantial power savings and reducing greenhouse gas emissions.

Energy efficiency and low-maintenance requirements are always paramount design

considerations for any solution.

To this end, Gordon has extensive experience providing solutions where water is unavailable, scarce, or of very poor quality.

An inherent feature of Gordon's operations has been continual product upgrades,

improving service ability, reliability and energy efficiency through research and development.

This has allowed the company to provide innovative solutions to complex mine heat problems, some using existing patents.

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A proud partnership with Newmont

FOLLOWING the acquisition of Ingersoll Rand's Australian Split Set Division in 2002, Phoenix Metalform has grown its mining division, Split Set Mining Systems (SSMS), into a leading manufacturer and supplier of ground support products and technical services.

Servicing the Australasian metalliferous underground mining industry, SSMS is making ground breaking progress in its development of the Resin Injection System (RIS) that is set to revolutionise the practice of resin bolting with development Jumbos.

This integrated system utilises bulk resins with a pumping and resin delivery system built into standard drilling Jumbos.

Worldwide alliances with other innovative ground support manufacturers keep SSMS at the forefront of technical advances in the mining industry and assist the team in making sure that SSMS deliver goods and services that are recognised as world's best practice in ground support.

Newmont's Tanami mine has been supplied by SSMS for 15 years and has enjoyed the benefits of recently developed products such as the Stiff Split Set; a system allowing operators to significantly increase the working loads on Split Set stabilisers via a system that pre grouts the Split Set stabilisers with cement cartridges.

More information can be found at: www.splitset.com.au.



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GVR is a logistical specialist for heavy haulage and oversized loads to the mining industry.

FAMILY-owned WA business GVR Transport, a subsidiary of G&V Roberts, has provided logistics and transport services to the mining industry for more than 22 years.

GVR is a remote freight specialist for general transport, heavy haulage, sensitive cargo, project construction support and plant relocations.

It carries more than 50 years' combined

experience working with road trains, single trailers and oversized loads, both locally and interstate.

It has proudly carried freight between WA and the Northern Territory for mining operations such as Newmont's Tanami gold project.

"At GVR we are committed to providing innovative and creative solutions to the

transport and logistics services for industry and mining," GVR manager John Pearsall said.

"Being a smaller business you can be assured of individual attention and the ability to meet your needs on a load by load basis.

"No job is too big, and we have experienced drivers and pilots who are able to safely transport oversized loads."

GVR is proud of its community footprint across the Northern Territory and Western Australia, with support to a variety of organisations such as the Royal Flying Doctor Service, Fitzroy Crossing Rodeo Club and Heartkids WA.

More information on GVR's transportation services can be found at: www.gvrtransport.com.au.

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**"THE QCOAL
FOUNDATION
COLLABORATES WITH
COMMUNITIES ACROSS
QLD TO DEVELOP
PROGRAMS TO
DELIVER SUSTAINABLE
IMPROVEMENTS TO
PEOPLE IN THE REGION."**



All Images: QCoal.

The Sonoma Mine washplant.

Community focused

On the road to doubling production capacity by 2020, QCoal is pushing ahead with its Byerwen joint venture coal project and remains one of the most active providers to the community in the Northern Bowen Basin region.

CAMERON DRUMMOND

INDEPENDENT Queensland-based mining company QCoal has been active in coal exploration, discovery and development since 1989.

The company holds coal tenements throughout QLD, however production is primarily focused on its Northern Hub tenements in the State's Bowen Basin.

The Northern Hub is comprised of four producing coal mines, Sonoma, Cows, Drake and Jax. Coal from these operations is transported via rail to Abbot Point Coal Terminal for export to Asian markets.

Employing about 250 personnel, Sonoma Mine, 6km south of Collinsville, produces up to 4 million tonnes per annum (mtpa) of hard coking and thermal coal, and has been in operation since 2008.

7km further south is the Cows Mine, which is operated by Sonoma and since 2013 has added up to 1mtpa.

Jax Mine, 2km south of Cows Mine, has capacity to produce up to 1.8mtpa but had been on care and maintenance since it was developed in 2012.

Employing more than 150 personnel, Drake Mine is 17km south of Collinsville, and since 2014 has produced up to 6mtpa.

Byerwen

Located 20km west of Glenden in the Bowen Basin, Byerwen is a \$1.76 billion open-cut coal project that, once completed,



would produce up to 10mtpa, taking the group's overall production capacity to about 20mtpa.

The project is a joint venture between QCoal (80 per cent) and Japanese company JFE Steel, a subsidiary of JFE Group.

Gaining government approval in 2014, then QLD minister Development, Infrastructure and Planning Jeff Seeney said that the development would lead to hundreds of jobs and boost local businesses.

"The Byerwen Coal project is expected to create up to 350 construction jobs for two years and up to 545 jobs when the

mine is fully operational," he said.

"The proponent, Byerwen Coal Pty Ltd, has committed to offering employment to locals from the nearby towns of Glenden, Nebo, Moranbah and Collinsville and from across the wider region.

"The project could also have flow-on benefits to nearby towns and businesses, creating even more local jobs."

The first mining leases were granted in 2015, and construction of Stage 1 of the project commenced in 2016.

QCoal said it was currently progressing the remaining mining leases through the

statutory approval process.

Community Service

QCoal Community Dental Service

QCoal Group's community program arm, the QCoal Foundation, collaborates with communities across QLD to develop programs to deliver sustainable improvements to people in the region.

The foundation's flagship program – The QCoal Community Dental Service – is a partnership with the Royal Flying Doctor Service (RFDS) to provide free dental care throughout QLD.

Comprised of two dental surgeries in a purpose-built semi-trailer, the service provides preventative dental care and emergency treatment in rural and remote Queensland communities where there is limited access to oral health services.

The program commenced in 2013, and is celebrating its fourth year of service.

"Travelling over 54,000 kilometres and treating over 8000 patients from 21 communities has not only proven the essential role of mobile service delivery but has highlighted the ongoing need for better oral health access, which has been echoed by the Commonwealth Government's recent announcement of funding to support service delivery in the regions," QCoal foundation director Christopher Wallin said.

(CONTINUED ON PAGE 48)

Sustaining remote mining communities

MORRIS Corporation is pleased to be a long term supplier to QCoal.

QCoal’s operational staff and contractors are accommodated in Morris’ Collinsville Village and have accommodated Byerwen project staff at the Glenden Motel.

They also provide cleaning services at the minesites.

Collinsville Village is located on the outskirts of Collinsville on Bowen Development Road and is in close proximity to the Sonoma Mine.

The Glenden Motel provides executive style accommodation solutions for those involved with the many mining projects in the Bowen Basin region.

With a rich history dating right back to 1861, Collinsville was settled as a grazing run and today has a close knit community of which Morris is an active participant.

The town has been a coal mining district since 1912 and Morris has been providing accommodation solutions to the working communities in the area since 1982.

With almost 50 years experience providing quality remote village and asset management services to the mining and construction sectors, Morris is proud to be a member of the local community in the region.

In 2016, Morris was named a finalist for a number of awards including the 2016 Australian Mining Prospect Awards – Community Interaction category and Queensland Mining Contractor Awards 2016 – Community Engagement Initiative category.

More information can be found at: www.morriscorp.com.au.



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For more information, email info@morriscorp.com.au or visit www.morriscorp.com.au

(CONTINUED FROM PAGE 46)

"We are very proud of the outcomes the Dental Service has achieved and acknowledge both the hard working Dental Team and the management of the RFDS who share our commitment to addressing the current imbalance between service delivery in metropolitan and regional areas.

"We hope with time, it will be 'smiles all round' as we reach more and more Queenslanders in the coming few years."

RFDS Queensland chairman Mark Gray said the partnership between the RFDS and the QCoal Foundation provides essential frontline services for those living and working in rural and remote communities where access to dental care is a major concern.

"RFDS is justifiably proud, that through its innovative collaboration with the QCoal Foundation, governments both state and federal are beginning to appreciate the effectiveness of tackling the issue of remote access to oral health care, by developing mobile services that have the flexibility to travel in and out of identified communities in need," Mr Gray said.

Education Programs

Established in 2015, the QCoal Foundation Scholarship was developed to support students who intend to commence study at James Cook University (JCU) in Townsville, with preference given to those from rural and remote communities in QLD.

The \$30,000 scholarship's aim is to provide a pathway to further education without the economic challenges that are associated with having to relocate to attend university.

The foundation is also a key partner of the Collinsville Regional Experience (REX) program, which brings students

from JCU to Collinsville to complete work experience placements as part of their studies. Students gain exposure to living and working in a regional rural community, and the town benefits from their skills and enthusiasm.

Now in its fourth year, students studying across a number of disciplines at JCU were recently hosted by various Collinsville businesses and organisations to gain practical experience in their chosen professions.

This placement saw participants working at the Northern Hub with Thiess (engineering) and at both the Collinsville State High School and St John Bosco Catholic School (education).


Community Grant Program

The 2020 community grant program was established to encourage community-led initiatives to improve liveability, health and education in communities throughout rural and remote QLD.

The objectives of the grant program are to make meaningful and positive contributions to support the development of vibrant, liveable and sustainable rural and remote communities; to foster productive partnerships with local communities and organisations that facilitate long-term, sustainable solutions to community needs; and to provide a simple and transparent process to receive project funding that benefits rural and remote communities.

The Community Spirit Grants are awarded three times a year, and provide up to \$2000 for short term or one-off projects that reflect the spirit and aspirations of the community.



The Community Growth Grant is an annual award that provides a grant of up to \$15,000 for larger-scale, medium to long term projects of an ongoing nature or larger scale community infrastructure.



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Commitment to excellence



SAB Mining has been providing mining contracting services to the industry since 2006.

SAB Mining is a privately owned mining services contractor that provides earthworks, mining, labour hire, equipment hire, open cut examiner coverage, dewatering and contractor management services to the resources sector.

Since 2010, the company has been contracting to QCoal's Sonoma mine, an open cut mine at the northern end of the Bowen Basin.

Its contract includes the removal of overburden and mining of coal at satellite

pits with SAB producing in the order of 1.2 million tonnes of coal per year.

"We have a proud reputation built on delivering results and are 2086 days LTI free," SAB Mining director Scott Browne said.

"Our reputation has developed in the recent downturn where cost effectiveness and high productivity are critical to the ongoing performance of the mine.

"This has led to our expansion in times when all other contractors and mining

houses are cutting back."

SAB Mining currently has a workforce of 75 people, who operate and maintain an earthmoving fleet consisting of excavators, trucks and ancillary equipment.

"We cannot achieve our aims without our people," Mr Browne said.

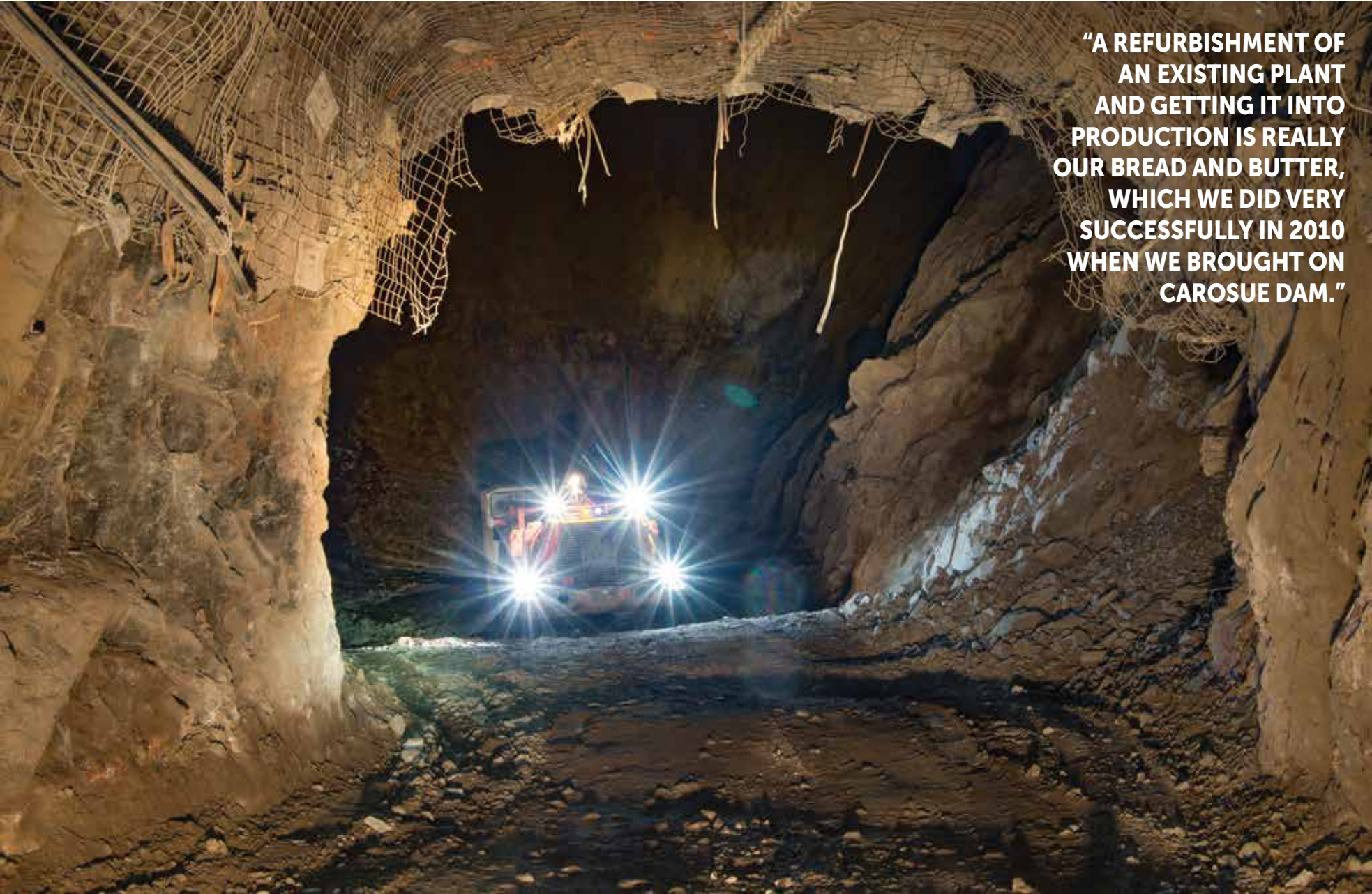
"We value them as indispensable participants in our business, which is why we have developed a THINK concept (Teamwork, Homelife, Never say never, Know what you are doing) to encourage

rosters to support a work/life balance; honest and open communication; a focus on learning, training and safety; and a can do attitude and commitment to clients."

SAB Mining is also a proud supporter of entry level 'green skin' and indigenous workers.

"We have an indigenous engagement of 23.6 per cent, where the industry average is 1.8 per cent," Mr Browne said.

More information can be found at: www.sabmining.com.au.



“A REFURBISHMENT OF AN EXISTING PLANT AND GETTING IT INTO PRODUCTION IS REALLY OUR BREAD AND BUTTER, WHICH WE DID VERY SUCCESSFULLY IN 2010 WHEN WE BROUGHT ON CAROSUE DAM.”

All images: Saracen Mineral Holdings.

Ramping up

Saracen Mineral Holdings is no longer ‘the new kid on the block’. After earning mid-tier status and an ASX-200 position in 2016, the company has become a miner to watch as it advances exploration, nears its 300,000 ounces per annum production rate, and awaits the results of a newly formed partnership with AngloGold.

ELIZABETH FABRI

FOUR months into 2017, and it’s safe to say this will be one of Saracen’s most significant years to date with a number of key milestones pencilled in across the miner’s Carosue Dam and Thunderbox operations.

The most notable of these will be meeting its long-awaited production target of 300,000ozpa of gold run rate in June.

And after producing 65,131oz in the March quarter, in the face of weather disruptions, and a record 66,222oz in the December quarter there is no doubt Saracen can step up to the task.

“We are well on track to achieving our twin goals of increasing production to 300,000ozpa and at the same time growing mine life at both Carosue Dam and Thunderbox,” Saracen managing director Raleigh Finlayson said.

“This year we’re on track to spend \$42 million on exploration, which is more than double what we spent in the previous two years combined, so there is a real ramp up with exploration across a number of our key assets, mainly Karari and Thunderbox underground,” he said.

The spend was Saracen’s highest exploration commitment in its 10 year history, and overshadows its \$14.3m spend in FY16.

Mr Finlayson said drilling had been highly



The Thunderbox mine was developed in just nine months, \$2m below budget.

successful to date with the company’s latest batch of drilling highlighting its potential to grow production and mine life.

“The drilling is delivering excellent results, and the work will continue into the June quarter with a continued emphasis on extensional work that aims to grow the mine life,” he said.

“Recent results at both Carosue Dam and Thunderbox bode very well for the Resource and Reserve update around August.”

Saracen was also investing in several new growth projects.

“In response to the growing mine life at Thunderbox we are constructing a pipeline to ensure reliable long term water supply to the mill,” he said.

“We have just commenced mining at the Kailis open pit which will boost the head grade and boost milling rates at Thunderbox.

“And we have just commenced development of an exploration drive at Whirling Dervish, Karari’s sister deposit also adjacent to the Carosue Dam mill.”

Carosue Dam

Saracen’s decision to purchase the mothballed Carosue Dam operation from St Barbara in 2006 was a wise one. The large-scale project, in the South Laverton gold field of WA, comprises the Karari, Whirling Dervish, Red October and Deep South open pits, with significant potential for future development.

While the operation was reopened in 2010, Saracen began development on the Deep South underground mine in October 2015, and in the September quarter last year achieved commercial production.

Since this time, the project has been performing well, producing 39,033oz of gold in the March quarter.

The last nine months had also seen drilling ramp up at the project following Saracen’s announcement it was tripling its exploration spend in FY17.

Mr Finlayson said drilling at Karari in particular was going strong with continued appreciation in the grade as the company drilled deeper.

(CONTINUED ON PAGE 51)

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“Every hole we’re drilling there is getting us more and more confident about the longevity of that project,” he said.

“All of the drilling in the last six months has been the conversion of resource into reserves and now we’re really starting to step out below that and probe out that seven years plus mine life so that’s a really exciting phase there.”

This year Saracen will also focus on Karari’s sister deposit, Whirling Dervish.

“What we’re looking at doing there is pushing those drill drives, and then starting an exploration program there from the June quarter for about 12 months,” he said.

“That’s really about trying to replicate Karari’s success at Whirling Dervish.”

As it stands, Whirling Dervish underground was not scheduled to begin production until FY20, so by progressing drilling now, there was a strong likelihood this could be brought forward.

“That’s really a short term focus for us and one that we see has dual benefits,” he said.

“One is to potentially increase annual production in excess of what we articulated in the 300,000oz per annum, and also to obviously continue to lower our costs.”

Thunderbox

Developed ahead of schedule and under budget, Saracen’s latest project Thunderbox also presented multiple growth opportunities for the company.

Located in the WA Goldfields, 45km south of Leinster, the mine was acquired from Russian miner Norilsk in January 2014 for a combination of cash and royalties totalling \$31.6 million.

Saracen has since poured \$63m into the redevelopment; \$2m less than its original budget.

First gold pour was achieved in February 2016, and by April the project was cash flow positive.

“I suppose a refurbishment of an existing plant and getting it into production is really our bread and butter, which we did very successfully in 2010 when we brought on Carosue Dam,” Mr Finlayson said.

“A lot of the guys that brought that project into production were part of the Thunderbox team; we’ve done it before so we were very comfortable with the ramp up with very minimal disruptions.

“Probably more importantly, we came in and developed the project inside nine months as opposed to the original 12 month schedule.”

Mr Finlayson said the project had potential for a 10 year mine life on the basis of Stage 1 of its current drill program that would be largely completed by June this year.

“We’ve basically got a five year plan articulated at the moment and that’s entirely from open pit, but a big motivation we’ve got this year and a big reasonable portion of

(CONTINUED FROM PAGE 49)



Exploration is ongoing at Saracen’s Carosue Dam operations.

the exploration spend of \$42m that we’ve committed to this year is allocated towards the Thunderbox underground,” he said.

“We’re basically doing a bunch of pattern drilling over that resource to convert that into reserve.

“We’ve also commissioned AMC Consultants to work on underground feasibility study there, and what we’re aiming at is around midyear putting out an inaugural underground reserve at Thunderbox with the view that we extend mine life out to potentially seven plus years and maybe get line of sight towards 10 and that’s really our ultimate goal.”

The miner was also working on pre-strip mining efforts at the Thunderbox C Zone pit, to deliver ore from the zone between FY 2018, 2019, and 2020.

Growth opportunities

In February, Saracen announced plans to acquire Bligh Resources’ Bundarra gold project, subject to shareholder approvals.

The Bundarra project is 30km south of the Thunderbox plant, and would increase Saracen’s mineral resources by 5 per cent to about 8.8moz.

“The financially robust open pit resources will immediately extend the mine life at the nearby Thunderbox mine, with high grade extensional results pointing to further growth,” Mr Finlayson said.

In addition, Saracen announced a partnership with global gold giant AngloGold in October last year to further exploration at its Butcher Well and Lake Carey tenements in Carosue Dam’s north.

The deal would enable AngloGold to spend up to \$25m in exploration over the next six years at the two tenements to earn a 70 per cent interest in the region which spanned 339.56sqkm.

The terms of the agreement required AngloGold to spend \$15m within the first 48

months to earn a 51 per cent stake, of which at least \$6m was to be spent at Lake Carey, and a further \$10m within 24 months to thereafter earn 70 per cent interest.

The farm-in excluded Saracen’s Red October and Deep South mines, but would enable AngloGold manager status of Butcher Well and Lake Carey.

“We recognise that its quite difficult exploration, in the sense that its predominantly covered by Lake Carey which has got technically between 60 and 100 metres of sediment cover,” Mr Finlayson said.

“But at the same time we recognise that there’s a reasonable probability that there’s something of scale below so we thought of a farm in with AngloGold, who can obviously supply the funding.

“We’re talking about potentially \$25 million being spent across those tenements which is probably realistically five times what we put into it, so that’s one of the motivations, and obviously their expertise in exploration in that region and commitment to that region.”

Mr Finlayson said while the company was potentially giving up a 70 per cent stake in this region, it would rather have 30 per cent of something significant rather than a project that was “simply an idea” because necessary funds couldn’t be allocated.

“Particularly, this year we have got higher priority targets in our own portfolio so that’s bringing forward the potential for that discovery maybe three or four years earlier than what we would have done ourselves, so that’s the main motivation there,” he said.

AngloGold Ashanti senior vice president of greenfields exploration Rex Brommecker said the company was pleased to work together with Saracen to explore the large and “highly prospective land package” close to its existing Sunrise Dam operation.

“This package, when combined with our own package of tenements on and around Lake Carey, gives us an opportunity to build

on and integrate our extensive knowledge of the geology of the district to be uniquely positioned to make the next big discovery in the area,” Mr Brommecker said.

Furthermore, Saracen was currently undergoing a strategic review of its non-core mines King of the Hills and Red October, with a potential sale on the cards at both operations.

At the end of February, the company stated mining at King of the Hills had currently ceased, while Red October’s current mining schedule would be complete in the June quarter.

“The strategic review is one of a number of broader portfolio optimisation initiatives that are underway to capitalise on recent production and drilling success,” Mr Finlayson said.

“We are experiencing outstanding growth at Karari (next door to the Carosue Dam mill) and at Thunderbox A Zone (next door to the Thunderbox mill).

“This growth has resulted in the King of the Hills and Red October satellite deposits moving from “core” to “non-core” within our portfolio.

“Both deposits are profitable, but their output is being displaced by the abundance of higher margin ore closer to milling infrastructure.”

Outlook

Saracen’s primary focus for the 2017 year will be working towards doubling its production.

“I think the key catalyst would be reaching that 300,000oz production mark in June,” Mr Finlayson said.

“I suppose in our mind that really puts us into that mid tier space, as opposed to junior explorer.”

To meet this goal, Saracen had set its June quarter production guidance to 80,000oz, and said production was “on track”.

The next step was continuing its progressive exploration program, and updating both its resources and reserves figures in July.

“I’d expect quite a sizable increase in resources,” he said.

“That’s really about adding in additional drilling, particularly at Karari and Thunderbox, so we will see that step up, but probably the bigger one in percentage too is quite a large increase in reserves across the portfolio, largely driven again by Thunderbox.

“If we can get to a 10 year mine life between the open pit, underground, and a couple of satellite operations, that would be our goal over the next 18 months.”

In FY2018 Saracen will also be focused on increasing profits and cash generation.

“Our expanded production will bring in more revenue in a very strong gold price environment, and our costs are anticipated to decline significantly,” Mr Finlayson said.



**“THIS YEAR WE’RE
ON TRACK TO SPEND
\$42 MILLION ON
EXPLORATION WHICH
IS MORE THAN DOUBLE
WHAT WE SPENT IN THE
PREVIOUS TWO YEARS
COMBINED.”**

Deep South achieved commercial production in the September quarter of 2016.



All images: Northern Star Resources.

Big spender

WA miner Northern Star Resources is directing its efforts on further development and exploration activities during FY17 with a mammoth \$130m spend.

CAMERON DRUMMOND

AUSTRALIA'S third-largest gold producer Northern Star Resources is set to utilise bumper profits to ramp up development of its key gold resources in WA and the Northern Territory.

The company is already an ASX100 gold producer with a mineral resource of 7.55 million ounces (moz) and reserves of 1.8moz across its three WA mining operations.

The miner currently operates the Jundee, Kundana, Kanowna Belle and Paulsens gold projects, with development underway at its Central Tanami project in the Northern Territory.

Northern Star said it was well on track to deliver between 485,000oz and 515,000oz for the 2017 financial year.

In October last year the company sold a fifth gold project, Plutonic, to Billabong Gold for \$66.2 million to add to its exploration and development war chest.

"The terms of the sale are attractive for Northern Star Shareholders both in terms of the price we have received and the continuing exposure we have to Plutonic's growth," Northern Star executive chairman Bill Beament said at the time of the sale.

"It also allows us to focus our resources on our four concentrated centres while maintaining downward pressure on our already-low overall cost profile."

Exploration and Development

Northern Star continued to enjoy outstanding exploration success during the March quarter – particularly at Jundee and Kalgoorlie – as part of its strategy to grow production to 600,000ozpa next financial year from organic sources.

As well as identifying new mineralisation at and around its existing operations, the company continued to make headway in developing new sources of production.

This included the ongoing construction of its 50,000ozpa Millennium underground mine in Kalgoorlie, which was ahead of schedule and under budget.

First development ore from Millennium was expected to be produced during the September 2017 quarter.

Kalgoorlie

The Kalgoorlie operations encompass the Kundana, Kanowna Belle and Millennium



Jundee was acquired in July 2014 for \$82.5m.

mines, where intensive exploration and development was ongoing during H1 FY17.

At Kanowna Belle, two underground diamond rigs focused on infill and extensional drilling at the Velvet and Lowes ore bodies.

Resource and exploration drilling also continued at Kundana's Rubicon-Hornet-Pegasus lodes, as well as the Raleigh underground development.

Together, the mines produced 102,719oz of saleable gold at an AISC of A\$989/oz, in line with full year guidance of between 200,000oz and 210,000oz.

Jundee

The Jundee underground mine is in the Northern Goldfields region of WA, about 45km north east of Wiluna.

Northern Star acquired the mine from Newmont Mining in July 2014 for \$82.5m, which included the underground operation and CIL plant to process ore at a rate of 1.7mtpa.

The mine has consistently produced upward of 200,000ozpa and has 1.7moz of resources and 720,000oz of reserves.

During H1 FY17 Jundee produced 93,748oz of saleable gold at an AISC of A\$1057/oz, and was on track to meeting

full year guidance of between 220,000oz and 230,000oz.

Northern Star said it would continue with ongoing drilling programs aimed at expanding Jundee's mine life.

During the March 2017 quarter, nine underground diamond drilling rigs continued to focus on resource conversion and exploration programs within the underground mine, with a single RC drill rig completing the open pit resource definition programs at Vause.

As part of Vause's future open pit development, 34,000m of RC drilling was successful in defining extensions at historically mined open pits.

Paulsens

Purchased from Toronto-based Intrepid Mines in 2010 for cash and royalties of \$27m, the Paulsens mine was Northern Star's first foray into the gold sector.

The underground operation is 180km west of Paraburdoo in the Pilbara region of WA, and has a mineral resource of 328,000oz, with 26,000oz of reserves.

In H1 FY17 Paulsens produced 30,141oz at an AISC of \$1434/oz, and was due to meet its guidance of between 65,000oz and 75,000oz.

Financials

In the second half of FY17 Northern Star sold 226,608oz of gold at an AISC of \$1,076/oz, returning an after tax profit of \$104.6m – a 61 per cent increase year-on-year.

The increase in net profit after tax was largely driven by the \$19.9m profit from discontinued operations – including a \$15.3m gain on the sale of the Plutonic gold operations, compared to the \$7.2m loss recorded for discontinued operations during the prior period.

Northern Star Resources executive chairman Bill Beament said it was an outstanding result that showed the company was achieving both its short and long-term objectives at the same time.

"We have generated significant profit growth and maintained some of the highest financial returns on the ASX while investing heavily in our expansion strategy," Mr Beament said.

"The organic growth strategy is aimed at increasing our total cashflow and profit while maintaining these high rates of return.

Of the \$130m flagged for exploration for FY17, \$60m had been flagged for targeted drilling to add more resources to current mine plans, with the remaining \$70m to be used as expansion capital to bring future deposits online and lift group production to 600,000ozpa in the next financial year.

"We are very confident that we will generate both strong returns on the capital we are investing in these growth projects and significant increases in overall cashflow as we ramp-up to 600,000ozpa next year."

Mr Beament said the strength of the underlying performance was also reflected in Northern Star's ability to declare another three cent fully-franked interim dividend while investing \$61m in its organic growth strategy.

"We are retaining a robust cash balance and maintaining our dividend track record while funding the growth projects that will take our production to 600,000ozpa," he said.

"Northern Star will emerge from this process with an enviable balance sheet and having unlocked the value of its assets to provide longer mine lives and increased production and cashflow."

Cost-effective drilling services

FROM surface drilling to large-scale underground operations, LHS Rocktools has been servicing the Australian mining industry for more than 16 years.

In this time the company has established a large customer base across Australia, New Zealand, UK, Thailand, Malaysia, Egypt and Ghana, and a reputation for providing quality manufacturing that combines both value and performance.

The company's product range includes top hammer for both surface and underground mining; DTH products for open pit mining; and R/C product range for exploration and grade control requirements; and rotary bits and accessories for the iron ore and coal mining industries.

These are all supported by bit sharpening services at LHS's branch locations in Australia and New Zealand, along with on-site sharpening as required.

"This and our technical support on the job are second to none and have given us a well-respected name in the industry," LHS Rocktools Australia general manager Mike Huxtable said.

"Our services allow our customers to achieve the best possible results from the drill string and offer total cost per drilled metre value."

"Our technical team are continually working on product development improvements to give more life at better drilling rates to support the industry and will develop new product requirements for those challenging drilling conditions that the industry face – it's what we do."



LHS has the latest equipment in its sharpening workshops to give the required result every time.



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With more than 15 years experience in supplying and servicing the mining and drilling industry, LHS Rocktools has developed a strong reputation in manufacturing high quality products, and providing exceptional services. With our recently established metallurgical facilities and technical team, LHS Rocktools is aiming to provide customers with the most cost-effective drilling solutions and comprehensive customer service plans to suit all drilling conditions.

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OILFIELD Traders Australia (OTA) specialises in the procurement and supply of new and used steel pipes to many industries, including mining.

Its broad range of products includes large diameter heavy wall steel pipe, drill pipe and casing ideally suited for dewatering – slotted or plain.

The company has expertly refurbished all sizes of steel pipe and casing for many years, building a reputation as a go-to nationwide service provider.

OTA's linishing, coating and complete refurbishing capabilities provides clients with an excellent way of maintaining pipe integrity, while also offering alternatives to purchasing new stock.

Many clients engage OTA in order to prepare their tubing or casing requirements to ensure all elements are fit-for-purpose. This results in projects being completed more efficiently and to budget.

The refurbishing service also includes data collation capabilities to assist in the loading and transport manifests.

The company's onsite fleet includes all the necessary equipment to safely and efficiently complete all unloading and reloading works; and can provide transport options if required.

OTA also provides a range of project support services to the drilling, marine and mining industries, supported by its 30,000sqm general industrial zoned block in Perth, WA.

It has fully qualified, in-house boilermakers with the capacity to professionally and efficiently complete any fabrication works at competitive prices.

Whether it's third party logistics,



OTA provides new and refurbished piping and casing for use in the resources sector.

refurbishing or boilermaking/fabrication, OTA's expert team will have the job completed on-time and to specification.

OTA has grown its professional network through providing mutually beneficial solutions with clients, while

maintaining superior service quality.

More information can be found at: www.oilfieldtraders.com.au.

Abergeldie purchases ASM

ABERGELDIE Complex Infrastructure has reached agreement to buy the remaining 50 per cent share of ASM Fabrications.

ASM had been an important supply partner to Abergeldie since 1996, providing most of the structural steelwork installed by Abergeldie throughout its NSW projects.

ASM has already changed its name to Abergeldie Structural Fabrications, with the transaction due for completion in July.

"Working closely with [former owner of ASM] Mukesh Handa has been one of the highlights of my professional life," incoming Abergeldie Structural Fabrications managing director Mick Boyle said.

"ASM Fabrications has provided Abergeldie Complex Infrastructure with high quality steelwork at commercially competitive prices for over 20 years.

"The strategic partnership with ASM has not been an unimportant factor in the success and growth of Abergeldie."

In early March, Abergeldie also completed the transaction to purchase New Zealand tunnelling and micro tunnelling specialist Harker Underground.

Mine maintenance a blast

AUSTRALIAN Pump Industries (Aussie Pumps) has released a big Kohler air cooled diesel engine powered 5000 psi Hydroblaster.

Designed specifically for the mining and construction industry, the high pressure washer offers operators tremendous cleaning power with minimal use of water.

"The 5000psi Aussie Predator saves time, saves water and provides operators with significantly faster cleaning," Aussie Pumps operations manager Hamish Lorenz said.

The heart of the system is a heavy duty "Big Berty" Bertolini triplex pump that develops 20 litres per minute flow at 5000psi.

The Predator also offers an effective working pressure with the Aussie Turbomaster turbo lance at 8500 psi.

The whole machine comes in a sturdy galvanised steel trolley with four pneumatic tyred wheels making it manoeuvrable on site.

A hose reel and 60 metres of hose fits easily to the frame so that the hose is stored tidily, prolonging the hose life and minimising the trip hazards.

Like all Aussie heavy duty industrial engine drive pressure cleaners, the Hydroblaster is equipped with free



The compact Aussie Predator easily adapts to infield maintenance.

Aussie Safety Protection (ASP).

The ASP system consists of a safety valve that protects the operator and machine from spikes in the system.

A thermal dump valve is incorporated

to protect the machine from overheating due to bypass running.

"The big 23 HP Kohler diesel was chosen because of its reliability, power and torque characteristics; ease of serviceability in the field is another bonus," Mr Lorenz said.

"Kohler parts are also easily available from distributors from all around Australia and their warranty and aftermarket support is second to none."

The Predator is rated as a B class machine under the new Australian safety standards.

As such, it is fitted with both an emergency stop and is supplied with a 500 bar hose shroud. An optional foot valve is also available.

"Because we make the Predator in volume, the price is a fraction of the equivalent of imported machines that are designed for far less demanding European conditions," Mr Lorenz said.

"The Predator is living proof that Australia's machines are as good as any in the world and are priced competitively."

Further information, including a free document pack on the Aussie Predator with video, is available from Australian Pump Industries or Aussie Pump distributors throughout Australia.

Experienced roller manufacturer



Broons rollers pave the way to minimising tyre damage.

FOR close to 50 years South Australian roller specialist Broons has continued to perfect its towed grid roller.

Reliable, durable and delivering real profitability through tyre preservation, it's no wonder this simple machine is as relevant today as it was almost five decades ago.

Weighing 14 tonnes when fully ballasted, the Broons BH-14 grid roller is ideal for mine sites.

Crushing sharp rocks on haul roads, pit floors and tip heads is the prime reason for engaging this effective tool and by

systematically rolling the offending areas, mines can dramatically reduce costly tyre damage.

Towed behind a tractor, the Broons BH-14 requires minimal maintenance and at speeds of up to 10kph it covers significantly more ground than any alternative.

When it comes to durability, Broons has engaged sophisticated stress analysis software to guarantee reliability.

A heavy duty reinforced main frame and wear resistant cast grid rings ensure ground maintenance programs keep rolling on.

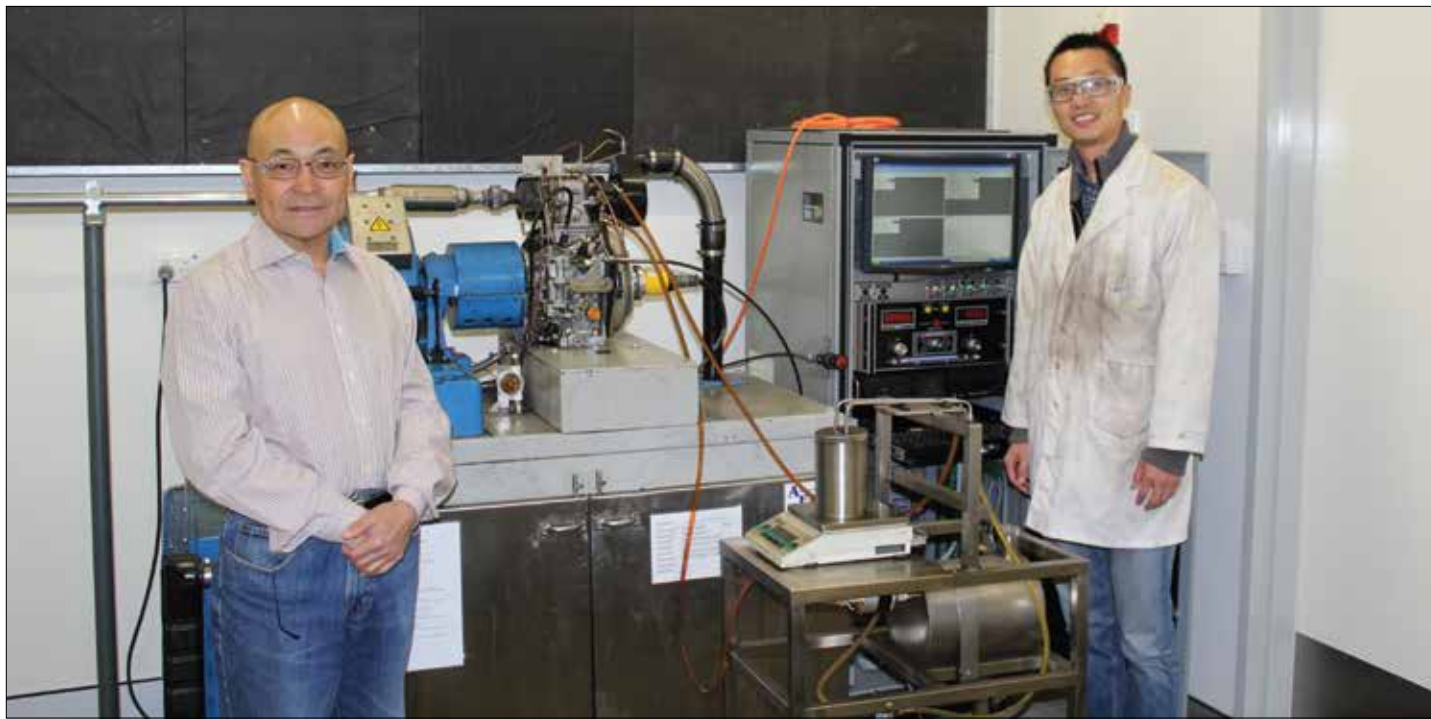
Available Australia-wide, the roller can be matched to a suitable tow tractor for hire or outright ownership.

As Australia's most experienced manufacturer of grid rollers, Broons has the expertise to train onsite staff in all OH&S and maintenance requirements.

Further information on the Broons GH-14 Grid Roller can be found by calling (08) 8268 1988 or via email at info@broons.com.

A brochure can also be downloaded at: www.broons.com/grid.

Improving fuel efficiency, reducing emissions



Professor Dongke Zhang and Research Fellow Dr Mingming Zhu at the UWA Centre for Energy.

THE University of Western Australia Centre for Energy director Professor Dongke Zhang is a leading energy expert and passionate about improving efficiencies and lessening environmental impact for large Australian industries.

Professor Zhang stated that research proving a combustion catalyst named FPC – manufactured by Australian company Fuel Technology – had produced impressive results.

When added to diesel fuel, FPC enhances the combustion phase by promoting a faster and more complete burn in compression ignition (diesel) engines, resulting in greater fuel efficiencies and reduced emissions.

Professor Zhang and his team were engaged by a major mining company to systematically study the effects of FPC.

An initial desktop study showed promising results, leading to a four-year research program predominantly funded by

the Australian Research Council.

Professor Zhang stated that FPC is a rather unique product, acting on the combustion process itself, unlike many products which are simply detergents or oxygenated hydrocarbons.

The research determined that the addition of FPC to diesel fuel at the recommended ratio did not alter fuel specifications, therefore negating any OEM warranty concerns.

Controlled laboratory and dynamometer testing then provided scientific evidence of reduced fuel consumption of up to 4.2 per cent, reduced greenhouse gas emissions of up to 22 per cent and smoke reductions of up to 39 per cent.

Professor Zhang stated that as these tests were conducted on as-new engines, greater efficiencies can be seen with real engines in the field.

"For large diesel users, these reductions

can mean significant savings," Professor Zhang said.

With further studies conducted on diesel soot, results showed significant reductions in soot particle numbers and size due to FPC providing a more complete combustion.

"Reduced soot in engine oil promotes longer engine life between rebuilds," he said.

"The financial benefits in reduced maintenance could equal or even exceed the financial benefits in fuel savings.

"However, most importantly, a price cannot be placed on providing cleaner air for site personnel.

"Companies should be much more open towards using proven Australian products such as FPC.

"The Australian Government should also be looking at providing greater support for the use of fuel and emission reducing products."

Pressure cleaners hit the mark

BASED in Townsville, North Queensland, Airless and Pressure Cleaner Services (APCS) is a leading independent specialist provider of pressure cleaners, airless spray equipment, and Husky process equipment.

For more than 35 years APCS has provided an extensive range of products to the mining, commercial and marine industries.

The APCS team provide a truly dedicated supply, service, spare parts and specialist hire centre for painting and high pressure cleaning (waterblasting) needs.

Its workshop is comprised of a team of experienced professionals that deliver quick turnarounds on all service and repair work; with an extensive range of in stock parts and accessories for all major brands including Graco, Wagner, PA, Interpump Group, General Pump, Jetters Edge, Mustang Nozzles, Bertolini Pumps, and Spitwater.

The company strives to provide the best products available at the most competitive price, while at the same time providing a quality service and spare parts back up service.

APCS provides all the benefits a business can enjoy when working with the most reliable and efficient airless spray and cleaner products on the market.

More information on APCS' highly specialised equipment can be found at: www.airlesstownsville.com.au.

TAFE SA supports hydrocarbons industry

The Onshore Petroleum Centre of Excellence (OPCE) at TAFE SA Tonsley continues to build strong links within the energy industry.

The OPCE provides a low hazard, interactive training environment utilising operational upstream field plant and equipment.

The specialised hydrocarbons training available includes nationally accredited and customised options to meet an organisations' requirements.

Training focuses on up-skilling and knowledge development to meet specific company needs.

Recently, the OPCE team developed a course in collaboration with Santos to provide extra skills for field operators.

The training gave operators the knowledge and skill required to perform basic maintenance on the equipment they control.

Ongoing OPCE projects with other energy companies include the development of schematic drawing interpretation, pigging, gas detection and flange management training led by TAFE SA lecturer Paul Sargent who has more than 30 years of experience within the oil and gas industry.

The live plant, combined with excellent simulation packages that replicate console operations can make training in compression, separation and other process operations more relevant for staff.

For companies that have previously used expensive overseas trainers, the OPCE may be a more viable and local alternative.

By working closely with organisations, the OPCE team can tailor training to suit specific requirements.

More information on the range of courses can be found at the TAFE SA website: www.tafesa.edu.au/onshore-petroleum-centre-of-excellence.

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Network International has assets available all over the world.

Currently available for purchase in Australia are: continuous duty

generators, 2600kVA generators, heat exchangers, pumps, a tank refueling station, fire trucks and a variety of vessels to name a few.

The company can also sell a business's energy surplus.

The services offered through Network International are valuation, asset management, marketing, sales, program management, warehousing and transportation support, buyer customer support, compliance and risk mitigation.

More information on Network International's offerings can be found at: www.networkintl.com.

Grays launches online auction platform

IN a bid to offer Middle Eastern customers direct access to commercial equipment on sale by contractors the world over, Grays Mideast Plant announced the launch of its full end-to-end online auctions on www.graysmideastplant.com.

The strategic announcement included both the launch of its unparalleled website for online auctions as well as its first construction and earthmoving equipment sale for the region.

The online auction platform offers a unique opportunity for equipment owners, contractors and dealers worldwide to target thousands of potential customers in the Middle East, Africa, South East Asia and Australasia.

The new plant and equipment online marketplace was created by joining GraysOnline, Australasia's largest online auctioneer, with experienced regional partners Glen Day and Ali Odeh.

As an established leader in online industrial auctions in Australasia, GraysOnline brings significant assets to the partnership; including a customer database numbering more than two million and a sophisticated online auction platform facilitating thousands of sales each day.

Through the company's flagship website www.graysonline.com, thousands of vendors rely on GraysOnline for comprehensive auction solutions to tap into highly targeted industrial markets.

Drawing on the GraysOnline network and the combined 50 years' experience of its regional partners in plant and equipment marketing in the Middle East and Africa, Grays Mideast Plant is set to be a reliable, extensive and valuable online marketplace of plant and equipment listings, featuring local



An asset from the first Grays Mideast Plant online auction.

and global auctions.

Through the transparent and user-friendly auction process, buyers can research equipment for sale, arrange inspections, bid directly, and complete the purchase online.

Sellers can also tap into a vast and highly targeted audience of powerful buyers leveraging GraysOnline's established industry presence.

"Our regional partners complement us so well because of their well-established

networks; and through through Glen and Ali, Grays Mideast Plant has unrivalled access to used plant & equipment owners, dealers, contractors and buyers across the region," GraysOnline executive general manager B2B Josh Sanders said.

The first Grays Mideast Plant sale features a broad range of earthmoving and construction equipment in multiple locations across the Middle East.

The sale began on 26 April this year and closes on 3 May.

Interested buyers need to be registered prior to the commencement of auction.

The portal has kept the process of registering simple and can be completed in just minutes.

Potential buyers are encouraged to visit www.graysmideastplant.com today and register to be informed of upcoming auctions.

Sellers can learn more on the site on the Grays Mideast Plant Seller's page www.graysmideastplant.com/sellers.

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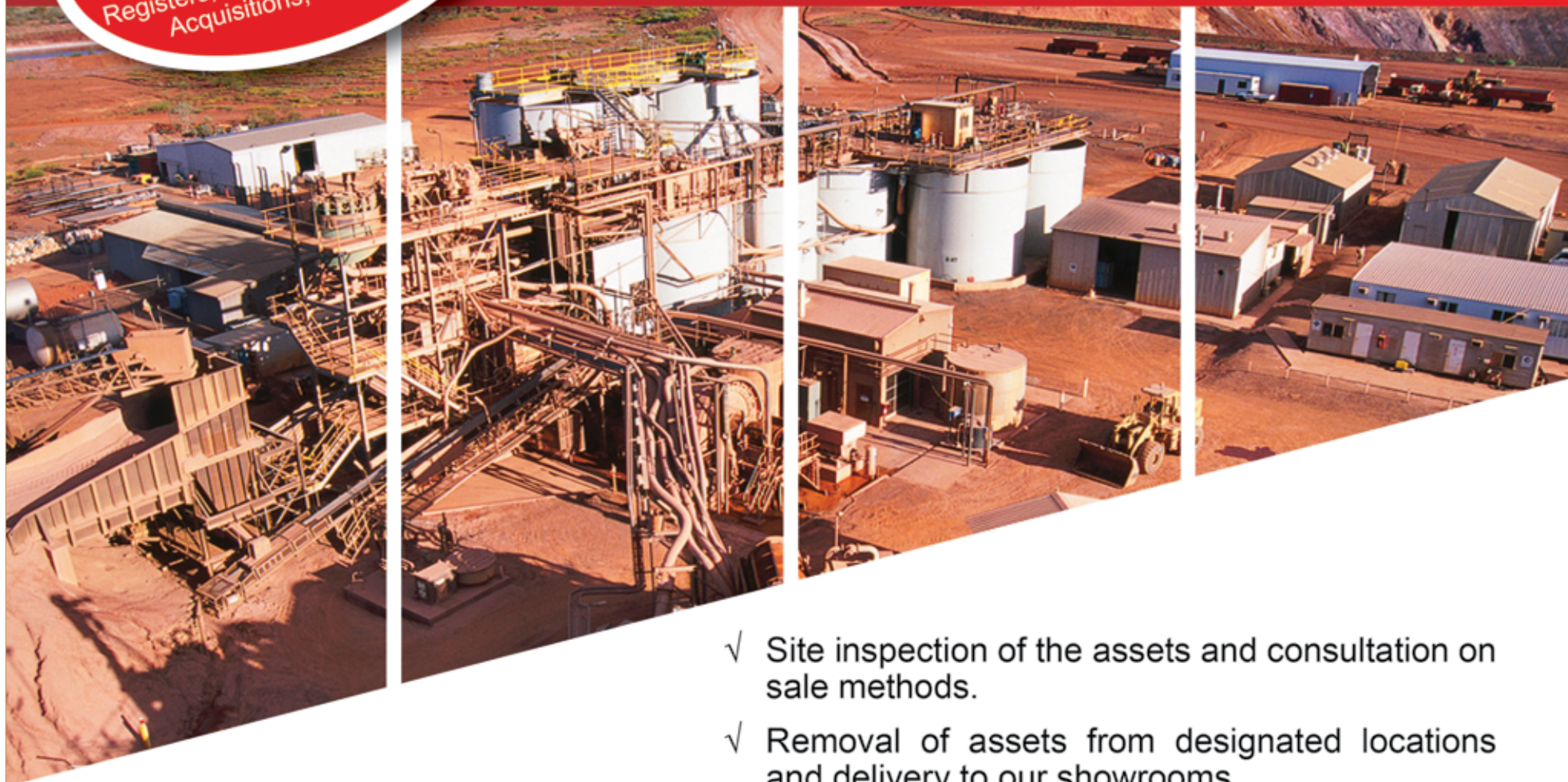
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Autronics disrupts industry

IN the face of high local labour costs and the need to drive efficiencies, automating processes is now considered essential to compete both on a regional and international level.

It is well known that three quarters of Australian manufacturers plan to invest in automation.

For this reason, WA-based Autronics has become increasingly popular by helping Australian businesses drive down costs with cutting-edge automation and robotics solutions.

While an independent business, the company has substantial backing as part of the Wintech Group, a renowned brand for 32 years with more than 500 machines in 35 countries.

Autronics applies its engineering skills to whatever project a business may have at hand, with a team of dedicated staff that have a wealth of experience in many industries; from mining, light fabrication and sheet metal, to automotive and food and beverage.

Autronics aims to use this experience to promote automation within Australia, and provide the cost, productivity, and OH&S benefits to businesses.

The company has an impressive manufacturing capability to develop the



Automation is a disruptive technology that is changing the way the industry operates.

right products made to a client's specific needs.

Recent projects include robotic cells, conveying lines and bespoke applications.

Autronics is a company with a difference; offering technical consulting, project management, 3D engineering drawings, speedy manufacture, robotic

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More information can be found at: www.autronics.com.au.



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Autonomous haulage system sets benchmark

OVER the past decade, global mining and construction equipment giant Komatsu has pioneered the use of autonomous trucks in large mining operations, with its FrontRunner autonomous trucks safely and efficiently moving hundreds of millions of tonnes of material.

Based on conventional large mining trucks, Komatsu's FrontRunner trucks run completely autonomously – they are not remotely controlled – with a full truck fleet able to be monitored by a single controller located up to thousands of kilometres away.

They are able to operate 24 hours a day, seven days a week; delivering significant safety, productivity, reliability, performance and operational benefits to mine fleet owners.

Komatsu Australia Mining and Construction general manager Leo Kaloglou said the company leads the way globally in the successful implementation of autonomous haulage systems in production mining.

"No other manufacturer has our depth of experience, and successful production record in autonomous haulage," Mr Kaloglou said.

"Komatsu FrontRunner trucks are typically loaded by conventionally operated manned loading tools – such as shovels or front-end loaders – hauling either overburden to waste dumps or paddock dumps for spreading, or mined resources to the crusher area or stockpiles.

"Each truck incorporates a combination of vehicle controllers, precision GPS, an obstacle detection system (ODS) using radar and laser, and a wireless network system developed by Komatsu."



The Komatsu FrontRunner automated truck.

Safety had been Komatsu's first priority in developing the FrontRunner system.

"The FrontRunner is designed with

multiple layers of safety systems to protect the operators in the mine; the trucks' ODS (is an example of one of these systems) that enables the trucks

to detect light mine vehicles and other mobile equipment — slowing or stopping the FrontRunner trucks when required," Mr Kaloglou said.



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Project Scope The ContiTech West Australian Service Team from Karratha had to set up and execute the replacement of a 20,548 m 1050 mm wide ST2786 9x5 DIN-X SLL overland conveyor belt in the Pilbara for a major iron ore miner.

Key Data • Motive force provided was from the ContiTech belt puller and 100 t belt winder. The belt winder was operating in tension/slave mode behind the belt puller. This combination provided an efficient and controlled means of belt movement and winding. The maximum diameter of the racetrack reels was 6.8 m. • 32 lengths of belt at 650 m were installed and reeled during the replacement work. The belt movement operations were completed continuously over 72 hours with an approximate belt speed of 17 m/min. • The belt flake length was 450 m. • The belt was guided safely and controllably onto the conveyor system from the flake through two ContiTech 90° turning frames. • Lower than expected pulling forces were recorded during the replacement operations. The recorded values indicated a DIN friction factor of around $f=0.010$

Summary An additional, unscheduled conveyor job was also carried out by the team while their specially developed equipment was nearby. This was also completed early and incident free. The client advised they were extremely happy with ContiTech's safety and performance, indicating they would like to continue the working relationship moving forward.

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They have more than 75 combined years professional experience in relevant fields, such as forensic crash investigation and reconstruction, biomechanics and crash injury causation, vehicle crashworthiness, rollover risk, roadside barriers, mechanical engineering, crash and injury data analysis, fleet management and computer simulation.

GRA can help investigate crashes, analyse data, conduct road and fleet safety reviews and more, to identify weaknesses in business equipment and workplace practices and identify effective improvements.

GRA use the international best practice Safe System Approach to provide evidence based, scientific road safety advice.

Road safety is not expensive, but the lack of it is.

Equipment damage, insurance premiums, product and productivity losses, investigations and legal fees and liability are some of the costs to a business from road crashes and road safety related workplace injuries – let alone the huge human cost.



GRA staff at an inspection of a heavy equipment maintenance facility in Laos, as part of a fleet safety review for a major mining company.

Fleet safety is an investment in business success and in personnel and community well being. George Rechnitzer and Associates can be contacted for expert advice to help make zero harm in the workplace a reality.



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Dr George Rechnitzer

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Dr Raphael Grzebieta

B.E (Hons 1), M.Eng.Sci., PhD, FIEAust, CPEng., (NPER), MSAEA, MSAE, FRACS, RRSP



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Dr Penny Stewart

PETRA Data Science founder

Dr Stewart, one of Australia’s leading data science minds, sat down with **Cameron Drummond** to share her views on the importance of applying data science to the resources sector and her outlook for the future of the mining industry.

.....
THE INTERVIEW PAGE 79





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2017 marks SCF Shipping Containers' 25th year in business leasing, selling and innovating shipping containers in Australia.

The benefits of leasing equipment are clear; it helps preserve cashflow and working capital, allowing clients to match equipment needs to the term of the project and remove residual value risk.

From its beginning as a supplier

leasing shipping containers to the furniture removals industry, SCF's portfolio of containerised equipment now provides transport and storage solutions to a diverse range of industries including some of Australia's largest and most remote resource projects, such as the Barrow Island, Curtis Island and Cooper Basin projects.

Specialised equipment deployed on

these sites include bulk liquid storage tanks to provide a cost-effective solution for transitory bulk chemical storage; and dangerous goods storage containers which have been developed to contain any cargo spillages and ensure no adverse affect to the user, business or environment.

Alongside this specialised equipment sits a fleet of more than 13,000 shipping containers, including market leading

intermodal containers and tank containers enabling efficiencies to be gained in logistic supply chains.

SCF's national depot network provides support at a local level, with a team of qualified and certified tradesmen providing surety of quality and reliability.

More information on SCF shipping containers can be found at: www.scf.com.au.

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Pictures worth a thousand words

ADEPT Turnkey is a long-standing and successful supplier of sensing solutions for the mining industry.

The company is Australia's largest independent technology resource for machine vision and imaging, and all of its solutions incorporate this technology.

With an extremely broad range of industrial cameras on offer matched to optics, lighting, and software, Adept Turnkey has an optimal solution for most applications.

The company also offers customised sensing solutions for a variety of applications suited to exploration, mining and processing.

These include hyperspectral cameras for minerals detection; particle sizing systems for online size analysis; and high speed cameras for explosives testing and blast optimisation as well as safety analysis.

The company's hyperspectral solutions are designed to detect minerals and associated waste materials using chemical imaging techniques.

They are deployed from the air in manned aircraft and UAV's for exploration or mine mapping, and used in mines to scan mine wall faces to optimise digging and hauling.

This is a technology that has attracted more focus in recent times.

The Ore3D particle sizing system uses a 3D imaging technique to measure the size distribution of ore on moving conveyors and has proven to be very successful in the past decade.

It is an online and automatic ore-sizing instrument offering high-speed and continuous size distribution measures, oversize and accurate fines detection as well as volume and bulk density measures.

The system is typically used for the



Adept Turnkey's Hyperspectral Camera for mine-wall scanning and for localisation of minerals and waste.

optimisation of mill feed to increase throughput and productivity as well as for detecting oversize for quality; or for maintenance purposes such as the detection of screen wear or popping.

Adept Turnkey's high speed cameras are used for explosives testing, blast optimisation, detonator validation and stemming testing. They are built with the features and rugged durability required in

harsh mining environments.

Adept Turnkey leverages its broad portfolio of industrial cameras from world-class manufacturers and commits to providing the best and most cost-effective solutions.

Its team of engineers – all experts in machine vision – assist in the preliminary design stage and conduct feasibility testing of applications; while technical staff provides

product and technology training, on-site support and software/trouble-shooting support via remote desktop sharing.

The company remains with its clients from project conception, through to completion and beyond; and because Adept Turnkey offers a comprehensive range of products, its advice is completely independent in order to provide an individualised tailored service.

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- Particle size distribution on moving conveyors – Ore3D
- High speed cameras for blast analysis, blast optimisation, detonator testing, stemming analysis.

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ESTABLISHED in 1987, DMM Engineering provides local, interstate and overseas industries with a diverse range of services including line boring, flange facing, keyway cutting, milling, pipe sever and bevelling, honing large diameters, fabrication and CNC machining.

As one of the first companies to branch into on site in situ machining 30 years ago, DMM's vast experience has enabled it to carry out the hard jobs others may not have expertise in.

One of DMM's strengths is its ability to manufacture individual jigs/frames to achieve the best result for each job, and being skilled in fabricating and CNC machining to design for each customer's needs.

DMM has the correct equipment and expertise to overcome the most complex situations, and the ability to do test runs in the workshop before attending site to make sure the methodology is safe and sound.

The result is the client gets the job done to a very high standard; safely and efficiently.

The company also drafts all jigs/frames in 3D to guarantee the process and method.

DMM founding director Gerard Vermazen built the business around a reputation for quality and cost-effective services, always taking into consideration cost, downtime, and excellence for all customers.

Brendan Pyle joined the business as a director and co-owner in 2012, to support its future growth and capabilities.

Together, the team has successfully performed work throughout Australia and overseas on a wide variety of both fixed and mobile plant and equipment.

Its services include the complete overhauls of large items of plant and machinery involving



A line boring crusher in situ.

safety; engineering jigs and fixtures; in-situ machining of swing jaws, steam valves, sole plates, bearing sole plates; and numerous activities on coal dredging machinery.

DMM has also invested significant time and money into applying for and achieving independent certification in ISO 9001, ISO

14001, AS4801 and OHSAS 18001.

The DMM team has a combined experience of 100 years in plant maintenance, heavy mechanical equipment, plant installation or relocation, plant upgrades, onsite in-situ services with rapid response, and emergency breakdown repairs.

The fact that clients keep coming back is testament to the training of all staff, tradesman and apprentices alike, while the fact that many apprentices are still employed at DMM as tradesman shows the strength and special culture of the company.

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ISG becomes global player

INTERMODAL Solutions Group (ISG) has provided a dust free logistic and loading system in Australia for six years; and in the past four years has expanded its operations to the international arena with outstanding results.

The company now has an impressive number of blue chip customers in various countries around the world using its loading system to move commodities from the mine site into the ships hold, without losing any valuable product into the atmosphere.

“We decided to look around the world at countries that we thought may be able to use our system, and found there was a need in Chile to get away from the expensive conventional conveyor loading and shed operations,” ISG managing director Garry Pinder said.

Chile needed a road transport mode from the mine site to the ships hold, and ISG’s unique loading system was a perfect fit.

Another operator in Chile had a rail component, and once again the ISG system fitted this model. Instead of using expensive labour intensive and dust generated sheds, the product is stored at the quay side in sealed containers.

When the ship arrives, containers are taken over to the ship and loaded with a tippler device that ISG has a lid lifting patent for.

The lid lifter allows the lids to be taken off automatically inside the ships hold without the need for human interaction.

ISG is currently operating in four ports in Chile with outstanding results.

“It’s a great system and environmentally friendly – it ticks all the boxes; once the



ISG’s logistic systems can reduce the transportation costs of delivering product from mine to port.

product is loaded at the mine site it is not opened again until it’s in the ships hold,” Mr Pinder said.

ISG’s dust free system was then implemented in Peru, on a road and rail operation that saw copper moved from 4000 metres above sea level into the port for another copper miner.

Trucks would load at mine site, and then travel down road through the mountains

until the trucks reach the rail siding then load onto the train. Once at the port the containers were emptied and sent back to start the cycle again.

ISG then implemented its system at two export ports in Mexico; a grain loading operation at Argentina’s Port of Rosario; Urea export from Bolivia; coal loading in Mozambique; and at iron ore operations in the Democratic Republic of Congo.

Here in Australia, ISG has implemented its system at three major ports for copper and mineral sands operations.

ISG has a network of agents around the world and utilises the expertise of the largest container manufacture in China to build its patented container designs.

Videos of ISG’s dust free logistics system in operation around the world can be found on at: www.pittoship.com.

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Tackling mining sector challenges

THE mining sector is battling fluctuating demand and commodity prices, heightened stakeholder expectations, and the need to maximise productivity and profitability.

This means companies are faced with some difficult decisions and require a new approach to management.

Since the mining industry is in a constant state of evolution, it is a requisite that new and more cost-effective equipment is developed.

With cutting-edge automation solutions to meet the challenges of the mining industry, Autronics has become a preferred manufacturer of material handling automation.

Autronics is helping companies manage their operations with creative solutions that give increased returns on investment, better productivity and more enhanced OH&S systems.

The company boasts a team of technical specialists eager to tackle the challenges, which many companies deem impossible.

Some of Autronics past projects include safety, pick and place, conveying, screening, stacking and sensing and measuring systems.

Autronics is one of the few companies with sufficient know-how and a full in-house system that allows clients to see their projects as they progress.

Factory acceptance testing is also conducted to ensure they meet client expectations.

More information can be found at: www.autronics.com.au.



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ISG Pit to Ship Solutions™

CAPEX or OPEX Dust Free Logistic and Loading Solution



Fertilizer Grade Container



Tippler Loading



Copper Grade Container

Thank You...

for taking the time to allow us to introduce the 'ISG DUST FREE PIT TO SHIP SOLUTION'.

Pit to Ship Solutions has designed specialised containers for commodities to transport products from the mine site to the ship's hull. These containers are also used as storage sheds providing a dust free environment.

ISG has a patented lid lifter that is licenced to tippler suppliers. The four different tippler types allow the containers to be rotated either by ships crane, port crane or reach stacker.

A patented lid lifter allows the customers to have the lid lifted inside the ship's hull, in conjunction with a water suppressant, providing a dust free environment giving this process the **Green tick of approval**.

The conventional process cost 60-80 million USD using expensive sheds and dust problems.

The dust free pit to ship solution costs around 10 million dollars depending on the amount of containers required.

So, if you have a commodity that needs to be moved from Pit to Ship, call the experts and they can arrange a visit to a port where this process is currently being operated.

The system can be purchased or leased providing and **OPEX** or **CAPEX** to your project.



Pit to Ship Solutions™

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The Desks ETC team create bespoke furniture to suit all design requirements and budgets.

Custom furniture to suit needs

FURNITURE plays a dual role in an office environment: to aid productivity in workers, creating functional spaces where workers can carry out day-to-day tasks, and establishing the overall mood and look of office aesthetics.

Established in 1986, Desks ETC is a leading furniture manufacturer with expanded design and making capabilities beyond timber desks, boardroom tables and office furniture to wall units, bookcases and buffets.

The Queensland-based business specialises in a range of traditional and contemporary style furniture that it designs and builds for commercial and residential purposes.

Its mission is to provide organisations and individuals with customised furniture as cost effectively as possible, turning client ideas into furniture that is both useful and beautiful.

“Our vision is of a world where style, taste and practical needs are fulfilled and expressed in work spaces,” Desks ETC owner Mark Bell said.

“Our values are honesty and integrity in all our dealings with customers, suppliers and team members.

“So whatever your commercial or home office furniture needs and budget, you can draw on the design and making skills of a long established team.”

Mr Bell said customers looking for ideas could draw inspiration from the business furniture range in the showroom, including the Infinity range, Ascot, Colonial, or Victorian collection.

“From custom wall units for bespoke home offices and studies to commercial offices and contemporary meeting and consulting rooms, our experienced team undertake a wide portfolio of work,” he said.

“Working collaboratively with clients and their interior designers to bring out the best in timber is a constant theme.”

More information can be found at www.desksetc.com.au or by calling (07) 3397 4999.



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Girls flourish at Perth College

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Through its InsideOut self-leadership program, students develop resilience and confidence, discover their strengths, and gain the knowledge and skills to flourish.

The curriculum is underpinned by leading research in learning, and teaching girls to push intellectual boundaries, enjoy the freedom to experiment, and learn to overcome challenges, particularly through STEaM subjects and activities, which promote problem-solving and higher-order thinking.

The diverse co-curricular program, from debating to rowing, appeals to girls of all ages and abilities.

Based in Mount Lawley, Perth College has 1100 students from Kindergarten to Year 12, including 100 boarders from regional WA.

Places are now available for Kindergarten, Years 5 and 7, and boarding in 2018.



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Dr Penny Stewart

PETRA Data Science founder

Dr Stewart, one of Australia's leading data science minds, sat down with **Cameron Drummond** to share her views on the importance of applying data science to the resources sector and her outlook for the future of the mining industry.

Q. What is your professional history?

I call myself an “entrepreneurial mining professional”, specialising in applying data science to mining industry challenges. I started out working on mine sites for five years before getting my Queensland 1st Class Mine Managers' Certificate of Competency in 2000.

That same year I commenced PhD studies in engineering at UQ's Julius Kruttschnitt Mineral Research Centre.

While studying my PhD, I received the Ian Morley prize for Best Minerals Engineering Postgraduate student for my work in developing an original statistical method.

After graduating from the PhD program, I worked as a Senior Innovation Engineer at Newcrest Mining from 2011-2013 and I was an Associate Professor at UQ's Geotechnical Engineering Centre from 2014-2016.

Q. Why did you establish PETRA Data Science?

Firstly, I must admit that I love data, and always have; just ask anyone I have worked with over the past twenty years.

But the reason I took a leap of faith and founded PETRA in June 2015 was because I believe engineers and scientists with data science skills are vital to realising the billions of dollars in value hidden in the petabytes to zettabytes of mining data collected each year.

Data that includes everything: petabytes of hyperspectral rock core images to the tens of thousands of processing plant Internet of things (IoT) signals.

Q. How important is the application of data science to the mining process?

Data science is how value is extracted from mining data. Data science isn't actually new to mining. For example, geostatistics is a type of data science and has been around for several decades.

So, what is data science you may ask? In a mining context, data science provides opportunities to create new value by bringing IT and engineering functions together as engineered data science.

While data scientists without domain expertise can and do uncover patterns in data, they need to know which patterns matter and why.

Knowing how to integrate data across an operation is especially important in mining because, unlike manufacturing and oil and gas industries, location and time are both important features of our data, and we have disconnected process like truck and shovel operations as well as stockpiles.

Almost all mining data exists in data silos and it requires understanding of the mining process to integrate that data and enable value chain optimisation.

PETRA's PRODFINDER data integration has solved that problem, and we can now integrate years of weather, truck & shovel, process control, blasting and geological data very quickly.

Q. What does innovation and collaboration mean to the mining industry?



"I BELIEVE THERE IS HUGE VALUE IN MINING COMPANIES, AND HOPEFULLY UNIVERSITIES AND RESEARCH PROVIDERS, REORGANISING THEIR STRUCTURE AROUND 'CHALLENGES' RATHER THAN DOMAIN EXPERTISE."

The adoption of innovation and collaboration in the mining industry is the only way to ensure future gains in efficiency and competitiveness in this critical sector of the Australian economy. Interestingly, I find old fashioned values like trust and courage are vital to successful collaboration.

When I speak to fellow small METS companies about what makes collaboration successful, the word “trust” often comes up, especially when it comes to IP.

Some people operate under the principle that if they can get away with it legally, then ‘that’s business’, while others have strong sense of personal ethics around what is fair.

Courage is essential too, because without courageous innovation champions – like Andrew Logan from Newcrest and Tony Swierczuk from Fortescue Metals Group – innovation wouldn't happen. People with the courage to be first.

Q. What can Australian miners learn from your presentation(s) at Austmine 2017?

I hope to share our experience in applying machine learning to mining industry challenges. The topic for my talk, Silent

Music: Mining Case Studies in Machine Learning, will provide real case studies that will provide insight into how PETRA assists resource companies predict downtime hours before it occurs - not just for a single piece of equipment, but for whole systems and hundreds of similar pieces of equipment.

I think of a machine learning algorithm like a mathematical “ear”; listening to IoT music to find something wrong with the notes, before the orchestra gets too far out of time.

Q. What is your outlook for the Australia's mining industry?

I think transdisciplinary teams are important for delivering the best outcomes. In the case of digital transformation, diversity is most powerful when we develop teams who think and act beyond traditional silos of domain expertise.

Traditionally companies have organised themselves into areas of domain knowledge such as mining, processing, engineering, environmental because it was difficult to access knowledge.

Now that knowledge is easier to attain

and is commoditised, we can generate value by transcending these traditional knowledge domains, and fostering internal collaboration as well as strategic external partnerships.

I believe there is huge value in mining companies, and hopefully universities and research providers, reorganising their structure around ‘challenges’ rather than domain expertise.

As a start-up company, PETRA has done this from the outset. Yes, it's uncomfortable and often humbling to talk to people outside of our domains, but those conversations where I've felt ignorant and asked ‘stupid’ questions, are some of the most productive conversations of my career.

Machine learning and artificial intelligence can automate routine tasks, but no AI has the capacity for creative collaboration which is a distinctly human endeavour.

For example; while artificial intelligence using drone data is already finding applications in the mining sector, it is through people creatively solving problems using this technology that value is generated.

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