AUSTRALIAN CAPABILITY ACROSS THE COAL SUPPLY CHAIN
OVERVIEW

Australia’s coal sector offers leading products and services that span the entire supply chain, as well as research and innovation to help maximise productivity, efficiency and sustainability.

Australia’s coal industry has been built on over 200 years of growth and innovation. Through continuous developments in mining technology, health and safety and environmental management, the Australian coal sector has established itself as a sophisticated, high-tech industry. Australia is a leading global supplier of high-quality thermal and metallurgical coals.

Coal mining began in New South Wales (NSW) in the 1790s. Today, Newcastle is the world’s largest coal export port and is considered the pricing benchmark for seaborne thermal coal in the Asia-Pacific region.¹

The surrounding Hunter region of NSW is one of Australia’s major mining regions, accounting for over half of NSW’s black coal production.² Mining and mining equipment, technology and services activity in the Hunter region directly and indirectly contributed an estimated $15.2 billion and 93,554 full-time equivalent jobs to the regional economy in 2015–16.³

The Bowen-Surat region in central and south-west Queensland is the other leading black coal region of Australia, directly and indirectly contributing $11.3 billion to the regional economy and supporting around 49,200 employees in 2015–16. Most of Queensland’s operating coal mines are in the Bowen Basin⁴, which contains Australia’s largest reserves of coal, particularly high-quality metallurgical coal. A number of ports, including Abbot Point, Hay Point and Gladstone, service the region, helping make Queensland the world’s largest exporter of seaborne-traded metallurgical coal.⁵

Australia also has significant brown coal resources, although these have much lower energy content. Brown coal is located mainly in Victoria.

Australia’s position as a major coal producer and exporter is underpinned by a thriving equipment and services sector. Australia is globally recognised for expertise in the design, construction and operation of mines, transport systems and loading facilities, as well as training, technical support and project management.

Australian companies can offer high-level equipment, technology and services across the entire coal supply chain, including in:

› exploration
› mine development – design, construction and operation of underground and open-cut coal mines
› engineering
› mineral processing
› rail transport, pit-to-port handling and logistics
› port operations
› power generation
› technical support and project management
› safety
› environmental management
› community engagement
› research and development (R&D)
› education and training
› automation and digital solutions.

In addition, Australia’s strong economy, proximity to the energy-hungry markets of Asia, the country’s rich intellectual capital and a supportive government, make Australia attractive to investors and new market entrants seeking sustainable, long-term returns.

Talk to your local Austrade representative for tailored information about connecting and partnering with the Australian coal supply chain industry.
While global energy markets are undergoing rapid changes, coal power plants remain a significant contributor to baseload energy for the foreseeable future. Australia’s coal industry has a wide range of capabilities that are increasingly important in the current global environment. These span the whole of the coal supply chain, from surface and underground operations, through to coal preparation and materials handling, port and logistics technologies and power generation.

The industry has earned an international reputation not only for resilience, but also for its demonstrated ability to boost production, reduce costs, improve safety and environmental performance, and eliminate bottlenecks across the entire coal supply chain. 6

**Coal production and export**

In 2017–18, Australian metallurgical coal exports are forecast to be 192 million tonnes, with export earnings of $35.3 billion. 7 Australia’s exports of thermal coal are forecast at 203 million tonnes in 2018–19, with export earnings forecast to rise by 7.7 per cent in 2017–18 to $20.4 billion. 8

Australia has the fourth largest share of coal reserves in the world, estimated at more than 100 years of production for black coal and over 400 years for lignite (brown coal). 9

The majority of Australian coal production is exported. Australia is a leading supplier of high-quality coal to both mature and emerging markets, supplying an estimated 54 per cent of world trade in metallurgical coal and 24 per cent of world trade in thermal coal. 10

Australia’s high-energy, low-ash coal is valued for its suitability for advanced coal-generation technologies, low levels of other elements and reduced emissions per unit of energy produced. Australian metallurgical coal is considered to be among the best options for steelmaking, yielding strong cokes with low reactivity and low levels of sulphur and phosphorus. 11

**The Bowen Basin**

The Bowen Basin is an area of coal reserves and mining-related communities that extends over approximately 60,000 square kilometres of central Queensland.

The Bowen Basin is the largest coal reserve in Australia. It contains most of Queensland’s high-quality metallurgical coal reserves, as well as significant deposits of thermal coal. As of June 2016, there were 41 active coal-mining operations and two metalliferous mines. In 2016, the Bowen Basin mines exported a record 221 million metric tonnes of coal 12, which represented 83 per cent of Queensland’s total coal production.

In addition, the Carmichael coal mine project in the north Galilee Basin is set to become Australia’s largest thermal coal mine. The Carmichael project will be built on the world’s largest single coal tenement, with the capacity to produce up to 60 million tonnes per annum at full production. 13 It is scheduled to make its first coal shipment by early 2021. The project will be linked by a new 388-kilometre standard gauge rail line to Abbot Point Port near Bowen.

The Port of Hay Point is one of the largest coal export ports in the world 14, and is situated about 40 kilometres south of Mackay. The port comprises two separate coal export terminals with a combined capacity of 140 million tonnes per annum. Mines are linked to the port terminals through an integrated rail port network.
AUSTRALIA’S MAJOR COAL PRODUCING REGIONS

Black Coal Deposits in Queensland (in-situ resources)

Scale 1:5 500 000 250km

GEOGRAPHIC PROJECTION
Geocentric Datum of Australia

- Basin with black coal resources
- Major railway
- Coal-related railway
- Bathymetry (depth in metres)
- Coal port

Note: Coal-related railways shown on the map are preliminary and is subject to confirmation and possible amendment.

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Black Coal Deposits in New South Wales (in-situ resources)

Scale 1:4 500 000 200km

GEOGRAPHIC PROJECTION
Geocentric Datum of Australia

- Basin with black coal resources
- Major railway
- Coal-related railway
- Bathymetry (depth in metres)
- Coal port

Note: Coal-related railways shown on the map are preliminary and is subject to confirmation and possible amendment.

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The Goonyella railway line, with a capacity of 11 million tonnes per annum, is the main route for exports out of Hay Point. Coal is also exported from the Port of Gladstone, which has three multi-user terminals with a combined capacity of 100 million tonnes per annum.

The Port of Abbot Point, located 25 kilometres north of Bowen, is one of Australia’s most important emerging bulk ports. It is undergoing a major transformation into a port precinct of global importance. The port has a nominal export capacity of 50 million tonnes per annum.15 It comprises rail in-loading facilities, coal-handling and stockpiling areas. A single trestle jetty and conveyor connect to two offshore berths and two ship loaders, all 2.8 kilometres offshore.

The Hunter Valley

The Hunter Valley region in NSW is Australia’s largest regional economy and home to one of the most complex and sophisticated coal supply chains in the world. The Hunter Valley coal supply chain plays a critical role in productivity, efficiency and optimisation improvements. It comprises leading suppliers of innovative METS solutions, rail transport technology, and port solutions support.

Many products and services used by the global mining industry were developed in the Hunter Valley. Mining has been a feature of the region for over 200 years, and over the past decade, it has been the fastest-growing area of coal production in NSW with the greatest expansion of mining operations. It currently provides 64 per cent of coal production for NSW, and exported nearly 163 million tonnes in 2016–17.16

The Hunter Valley coal supply chain comprises 11 coal producers, 35 mines, 31 rail load points, and 15,000 loaded rail trips each year, ending at the Port of Newcastle.17 The Port of Newcastle is the biggest coal exporting port in the world, handling the movement and loading of more than 1,400 coal vessels per year and exporting over 160 million tonnes of coal.

The Port’s facilities include three coal-loading facilities with a maximum capacity of 211 million tonnes per annum, operated by Port Waratah Coal Services and Newcastle Coal Infrastructure Group.18

The Hunter Coalfield contains significant reserves of export-quality low-ash, high-energy thermal coals and low-ash soft coking coals. A significant proportion of the coal is at comparatively shallow depths, making it suitable for large-scale, multi-seam open-cut mining operations.

Austrade facilitated visit programs

Visiting major regional sites is an excellent way to gain first-hand understanding of Australia’s coal supply-chain capabilities. Austrade can assist in creating a visit program tailored to specific areas of interest and connect interested companies with METS suppliers and partners.

Two sample visit programs have been created to illustrate the breadth of expertise available in the Hunter Valley in NSW and the Bowen Basin in Queensland. Please note, these sample visit programs are examples only and all site visits must be arranged in advance by mutual agreement.

View the sample program below, or contact your local Austrade representative for more information.

austrade.gov.au/mets
Coal power generation

Although the technology mix is changing, coal remains Australia’s major energy source for electricity generation, accounting for 63 per cent of total generation.19 Meanwhile, increasingly strict Australian emission policies and environmental performance standards provide a background for continuous evolution and enhancement of the operational and environmental performance of coal-fired plants.

Australian capabilities in power generation include turnkey engineering, procurement and construction of steam cycle and boiler technologies, and the design, supply, installation and servicing of engineered conveyor products, fuel-handling equipment and services, and combustion technologies.

Australian companies can deliver all levels and stages of projects from concept design and feasibility studies through to asset management.

Considerable experience and technical expertise exists in materials handling, flow design, milling, combustion technology, testing and analysis. Australia has longstanding experience in electrostatic and fabric filter dust collection technologies, ash processing and research into ash reuse.

Beneficial use of coal combustion by-products is important for the sustainable use of coal. Fly-ash products can potentially displace the use of other energy-intensive raw materials. The Ash Development Association of Australia comprises producers and marketers of power station ash; its objective is investigating and expanding market opportunities for the use of these materials in construction, agriculture and manufacturing.

Over the past decade, considerable effort has been directed to developing low-emission fossil fuel technologies in Australia and internationally. The Australian Government is engaged in domestic carbon capture and sequestration (CCS) programs and international collaborative activities to accelerate the development and deployment of CCS. An independent report commissioned by government, industry and research organisations has laid down a comprehensive plan for CCS deployment in Australia.


Environmental management and sustainable mining

The Australian mining industry has considerable experience in bringing together environmental accountability, social responsibility and commercial success. Sustainable mining depends on excellence in mine safety and health as well as optimising the extraction of the mineral resource, or resource efficiency.

Australia is a world leader in sustainable mining thanks to a combination of a long history of implementing strong environmental and safety regulations, as well as adopting voluntary codes of practice and standards.

The Minerals Council of Australia’s Enduring Value Framework for Sustainable Development provides critical guidance to mining companies on applying the International Council on Mining and Metals’ Sustainable Development Framework Principles at an operational level. Australian mining companies recognise the need to manage their mining and mineral projects in an environmentally and socially responsible manner. They have developed a range of initiatives and protocols that cover all stages of the mining process, from initial exploration to mine rehabilitation and closure. In addition, all member companies of the Council are required to sign off on the Enduring Value framework.


Underground mining technologies and solutions

Australian underground coal mine safety and productivity benchmarks are among the world’s best. The industry has developed innovative products and services, such as automation technologies and power and safety systems that are delivering safety, efficiency and cost benefits at mines around the world.

Longwall mining, which accounts for over 90 per cent of Australia’s underground coal production20, is a particular area of focus. The Australian industry is committed to optimising health, safety and productivity around the longwall process.

CASE STUDY
CSIRO’S LONGWALL AUTOMATION TECHNOLOGY IMPROVES
PRODUCTIVITY AND PROTECTS LIVES

Underground mine operators constantly seek to improve longwall productivity and safety, and increase the speed of roadway development, a limiting factor to longwall operation.

Developed in partnership with the coal industry, CSIRO’s Landmark Automation Steering Committee (LASC) automation technology is designed to separate personnel from hazards while improving productivity.

The system uses sophisticated remote guidance technology to plot the position of critical equipment in underground longwall and roadway development mining processes in three dimensions. This allows miners to steer the equipment and control core functions, such as longwall face alignment, horizon control and continuous miner navigation, without having to be in hazardous areas.

Previous systems required mining operations to be stopped to correct positioning, whereas the LASC technology allows for continuous steering. The real-time progress of the longwall can also be monitored via the internet from anywhere in the world, leading to further gains in efficiency.

The LASC automation technology has been shown to:

› increase longwall coal productivity by at least 5 per cent
› improve working conditions and employee safety
› reduce environmental disruption and rehabilitation costs by using more accurate selective resource recovery on longwall mining operations.
The LASC automation technology is used at 60 per cent of all Australian underground mines, as part of the equipment supplied by all major longwall original equipment manufacturers (OEMs), under technology licensing agreements with CSIRO. Each OEM has integrated the LASC open intercommunication standards into its proprietary control system architecture, as well as completed hardware integration of the inertial navigation system into the relevant equipment.

Major global longwall equipment manufacturers such as Komatsu, Eickhoff and Caterpillar have also integrated the CSIRO technology. The technology is also being deployed in working implementations in North America, Europe and China.

CSIRO’s longwall automation research is focusing on new in-house navigation and guidance technology development to meet the specific requirements of international markets. Work is also being undertaken to embed instrumentation, such as explosion-protected 360-degree scanning laser sensors, into mining automation systems.

csiro.au
CASE STUDY
NEPEAN LONGWALL DELIVERS COMPLETE LONGWALL MINING SYSTEMS

NEPEAN Longwall is Australia’s largest privately owned engineering, mining services and industrial manufacturing organisation. Through its three specialist businesses – NEPEAN Conveyors, NEPEAN Longwall and NEPEAN Power – the company supplies fully integrated mining systems, servicing and overhaul services.

NEPEAN Longwall designs, engineers, integrates and supports longwall equipment and systems. The company completed the first Australian installation of the Landmark Automation Steering Committee technology, which features a positioning measurement system for the longwall shearer, automated face alignment via a roof support control system, shearer horizon control and real-time monitoring. The equipment has a nameplate capacity of 4,000 tonnes per hour.

The company also designed, engineered, manufactured, tested, delivered and commissioned a complete longwall mining system for an underground colliery in central Queensland. The project set new benchmarks for longwall capital equipment lead times and was the first longwall system supplied and commissioned in Australia at nil price variation.

Designed to address the unique roof and floor conditions at the mine, the equipment safely and reliably controlled the expected mining environment – which included above-seam prior workings and soft floor – and operated with a narrow 700-millimetre cutting web. It also utilised a 1,200-tonne-rated roof support with features to tightly control the tip-to-face distance.

nepean.com
CASE STUDY
AMPCONTROL DEVELOPS WORLD-FIRST 11KV ELECTRICAL LONGWALL SYSTEM

Ampcontrol provides integrated electrical, monitoring and control solutions for above-ground and underground hard rock and coal mining applications. The company has offices in Australia, the UK, France, India, China, Hong Kong and Singapore, supporting mining OEMs, major mining companies and contractors including BHP, John Holland, Anglo American, Komatsu Mining, Cat, Downer and Sandvik.

Ampcontrol’s pit-to-port solutions include above-ground and underground electrical systems, high-voltage infrastructure, gas detection, conveyor monitoring and control, automation, lighting, networking and communications. These capabilities are delivered via in-house engineering teams and manufacturing facilities and supported by field service crews specialising in both above-ground and underground mining environments.

Ampcontrol produced the world’s first 11kV Armoured Face Conveyor (AFC) longwall system for installation in Zone 1 hazardous areas. An 11kV electrical system for powering the longwall AFC had never been used in underground coal mining anywhere in the world.

Due to the hazardous zone rating of the mine site, Ampcontrol developed world-first 11kV products to suit the application and environment. The company also took extensive engineering design review, calculation and verification testing to prove it was safe to use 11kV electrical circuitry in the hazardous zones. It also developed a new Intrinsically Safe (IS) LED lighting system, an innovative 11kV protection scheme and a SIL-3 rated high-integrity isolation system.

Ampcontrol, together with its project partners, was awarded a 2010 National Engineers Australia Engineering Excellence Award for this project.

ampcontrol.com.au
Automation technologies

To stay competitive in constantly changing global and domestic markets, many Australian companies have devised new ways to enhance productivity and efficiency. In an environment of fluctuating global commodity prices, automation can reduce costs while maintaining the safety and integrity of mining operations.

Australia is a world leader in developing fully autonomous mining systems, which offer the potential to make operations more predictable and repeatable.

Australia’s automation technology capabilities span the entire coal supply chain from pit to port. This delivers gains in productivity, profitability and safety, as well as reducing environmental impact and offering solutions to address production bottlenecks.

In rail transport, some examples include BMT WBM’s automated and remote-operated machines, such as the robotic wagon vibrators installed at many coal terminals in Queensland. These prevent delays when unloading sticky coal from bottom-dump rail wagons by detecting and dislodging blockages. Previously, operators were required to clear blockages manually, which exposed them to health and safety risks.

Another example is Aurizon, an innovator in the implementation of automated rolling stock inspection and the use of unmanned aerial vehicles (drones) for maintenance activities, enabling the condition of bridges and overhead electrical systems to be inspected and monitored without downtime.
CASE STUDY
MRA DELIVERS EFFICIENCY GAINS SPANNING THE SUPPLY CHAIN

Australian company MRA is a leading provider of automation and plant optimisation technology to the materials handling industries. Established in 1998, it has become known for a range of products and solutions that provide efficiency benefits from pit to port.

MRA’s range of coal supply chain solutions includes automated ship loading, automated stockyard management systems, mobile machine collision avoidance systems, automated train loading systems, automated dump station systems and advanced conveyor optimisation systems. The company’s specialist domain knowledge in mining and ports infrastructure has seen MRA become a preferred supplier to global OEMs and its automated systems have been installed on mobile machines throughout the Asia-Pacific region for the past 18 years.

Ship loader automation is a major optimisation target for export terminals globally. In Newcastle, Australia, MRA has successfully installed the Port Waratah Coal Services Carrington Ship Loaders SL4 & SL5 Boom & Spout Collision Avoidance System, and in Western Australia the Cape Preston Port Corporation Automated Barge Loader.

MRA’s engineers are regularly engaged for specialist services in sites across China and Korea to provide expertise in electrical and automation design and commissioning. Global exports also include ground-breaking technology for automated barge-loading systems and a number of projects in discussion for the supply of materials-handling products and solutions.

MRA also shares its specialist domain knowledge through collaborations with industry and globally recognised research institutes, focusing on innovation in the materials handling industries, in particular the mining and ports infrastructure sectors.

Its technology is providing major gains in productivity, profitability and safety and dramatically reduced environmental impacts, by removing traditional bottlenecks.

mra.com.au
CASE STUDY
4TEL HELPS OPERATORS CONTROL COSTS AND OPTIMISE SAFETY

4Tel is a specialist software and technology company that has been servicing clients in the rail, road and government sectors for over 17 years. 4Tel’s areas of expertise range from design and fitout of transport control centres, to software systems designed to optimise network performance and improve efficiency. 4Tel is represented in Kenya and Chile and has plans to expand further in 2018.

As a complete solution provider, 4Tel offers consulting services as well as proprietary systems that are built in-house and come with tailored support plans. These systems and services include:

› communications-based network control of trains
› software, communications, signalling and data network solutions
› mine-to-port performance reporting, alerting and data collection solutions
› real-time tracking of assets
› rail network management operation solutions
› network design, planning and implementation.

4Tel designed, commissioned and maintains all the electronic control systems used in John Holland’s Country Regional Network Management Centre based in New South Wales, Australia. 4Tel has been able to digitise many of the paper-based activities including electronic tracking graphs, access and billing systems, issuing of movement authorities, and more recently, an app that interlocks work-on-track occupancy authorities into the network control system. Through automation of routine process and maximising the best of the Internet-of-Things technology, 4Tel is continuously innovating new ways to create a digital railway that improves safety and decreases costs while maximising operational efficiency.

Across the coal supply chain, 4Tel’s solutions are used for tracking assets during movements between the pit and port, generating reports on performance and inconsistencies, and alerting receiving entities to arriving deliveries. 4Tel’s systems enable operators to improve safety and reduce costs.

4Tel’s tracking system has customised automated reporting functions that alert coal loaders to approaching trains. This optimises train loading and staff efficiency, and avoids penalties caused by information delays. This real-time tracking information increases the visibility of operations across the network, making assets dispatch and people management easier.

4tel.com.au
Software/optimisation technologies

Australia is a world leader in software that services the resource industry and a significant proportion of the world’s mining computer software is developed in Australia. In addition to capabilities and solutions developed within the sector, software and technologies from other sectors, such as the defence, aerospace or automotive industries, have the potential to help solve mining challenges.

Data analytics has created a step-change in technology, which together with automation can maximise the effectiveness of coal asset utilisation.

Software applications allow coal mine operators to develop economically effective plans to achieve production targets, maximise resource utilisation and optimise value.

In addition to automation technologies, Australia has advanced software capabilities specific to the coal supply chain, which allow operators to devise and deliver improvements in:

› achieving production targets
› engineering design and troubleshooting
› cost reduction
› risk minimisation
› processes and data quality
› data accountability
› haulage optimisation.

One of the Australian companies providing these solutions is E.J. O’Donovan & Associates, a leader in conveyor engineering. Its dynamic analysis program BeltDYN enables accurate analysis of conveyor systems and its discrete element modelling capabilities span design and quantitative evaluation of transfer chutes prior to manufacture and installation.

Another company is Deswick Mining Consultants, which provides software tools that span the coal value chain, from receipt of a geological model through to reporting for costing. Its suite incorporates design and scheduling features across a core platform and associated modules such as design and solids modelling, Gantt chart scheduling, advanced functionality for underground or open-cut coal mines, mining data management, environment, sustainability and mine closure.

Image courtesy of 4Tel
Polymathian, an industrial mathematics and software development company, specialises in maximising value across coal supply chain operations. The company has successfully deployed optimisation software for clients in Australia, South East Asia, South America and Africa.

Polymathian’s coal chain optimisation product, BOLT, is a decision support tool that maximises value from pit to port and into the market. The optimisation scope spans strategic decisions to operational execution. BOLT models in-pit operations, stockpiling, rail scheduling, port operations, vessel nominations, vessel demurrage and marketing strategy for uncommitted coal. BOLT is in use by some of the largest coal mining companies in Australia and around the world including BHP, Rio Tinto, Glencore and Adaro.

BOLT consists of four modules. The long-term module optimises over five or more years, and makes strategic decisions for rail, port and marketing contracts. The mid-term module optimises mining, stockpiling, washing/bypassing, marketing of uncommitted coal, and demurrage over a 12-month period. The short-term rail module determines the optimal rail plan for the subsequent month. The short-term wash module determines the optimal mine/wash plant operations for the subsequent month.

BOLT can also optimise a system of mines with shared resources; for example, determining how multiple mines or pits can cooperate to meet contracted coal demand at shared ports and terminals.

The BOLT toolkit typically delivers an increase in margin of between 10 to 20 per cent depending on the scale. For example, single mines versus a network of cooperating mines connecting by rail to a set of ports.

Polymathian also offers bespoke tools for specific service providers within the supply chain, including mine pit optimisation, rail scheduling and coordination, rail fleet management, port management (berth utilisation and queuing) and shipping scheduling.
CASE STUDY
MICROMINE SOFTWARE SPANS THE SUPPLY CHAIN

Micromine provides solutions that are relevant to every stage of the mining process, from geological exploration and data management to resource estimation, 3D mine design, planning and production control. Micromine solutions are used at more than 2,000 sites in over 90 countries, with more than 18 offices in major mining capitals. International clients include coal mining operators in South Africa, Russia, Mongolia, China, Canada, Uzbekistan, Indonesia, the US and UK.

Micromine’s exploration and 3D mine design solution offers tools for modelling, estimation, design, optimisation and scheduling. It provides users with an in-depth understanding of projects, so prospective regions can be targeted more accurately, increasing the chance of a project’s success. Miners are provided with interactive and easy-to-use modelling, estimation and design tools to simplify day-to-day design and production tasks.

The fleet management and mine control solution, Pitram, provides tools for managing material and mineral handling processing. Pitram assists with material management, which utilises mine design, survey and production data to provide real-time stockpile balances and metals stock throughout the mining operation. Its stockpile management solution is used to assist in managing rolling stock systems. The solution has been widely implemented, including at the Cayeli Bakir Isletmeleri underground copper and zinc mine in Turkey, where it has helped double the amount of mine activities achieving targets. Cayeli reported that of the mine activities monitored, there has been a 10 per cent average increase in productivity.

The databank management software, Geobank, is related to water flow and quality, and is used to process the composting, standardisation and accumulation of coal washability data. Geobank’s logging and management of drill data and Micromine’s blast drilling planning tools, along with environmental data, can be captured and managed using Geobank’s tools.

micromine.com
Simulation modelling

Advanced analytics and simulation technology have proven to be effective tools for optimising system design and operation, production and logistics systems.

Australia offers a broad range of capability in these areas across the entire coal supply chain. An example is Ausenco’s simulation analysis, which played a key role in project planning for the Richards Bay Coal Terminal expansion in Natal, South Africa. It was used to evaluate variations in equipment types, throughputs, storage volumes and berth lengths, providing optimum project definition.
CASEx STUDY
SMS SIMULATIONS MINIMISE RISK FOR COMPLEX SUPPLY CHAINS

Simulation Modelling Services (SMS) provides consulting services, advanced analytics and simulation technologies that predict and measure the performance of mining systems and supply chains, helping clients minimise risk, reduce capital expenditure and operating expenses, and streamline production and logistics processes.

SMS’s clients include several mining conglomerates with operations in Asia, Africa, the Middle East and South America. The company’s solutions are used to test proposed production and logistics systems, optimise the design and operation of existing platforms, identify opportunities to improve processes, and pinpoint bottlenecks and constraints.

Mining and supply chain-related projects that SMS has applied its services and technologies to include:

- **Mines:** Bengalla, Blackwater, Crinium North, Illawarra Coal, Kestrel, Poitrel and Wilpinjong
- **Proposed mines:** Bylong and Mt Pleasant
- **Coal terminals:** Hay Point Coal Terminal, NCIG Coal Terminal, Port Kembla Coal Terminal and Wiggins Island Coal Export Terminal.

Specific examples of value delivered to its clients include quantifying latent supply-chain capacity, confirming equipment utilisation for proposed infrastructure in greenfield and brownfield projects, determining capacity implication of various saleable product strategies and confirming adequacy of stockpiles and varying throughput levels.

SMS develops models and simulates a wide range of scenarios to help clients determine the viability of proposed supply chains, including optimising pit-to-port logistics. In addition, SMS models the impact of proposed maintenance on everyday operations, so clients can implement alternative processes that avoid or minimise risk and interruptions to their business.

Productivity, safety and sustainability

The Australian coal mining sector has achieved significant productivity gains through improvements in exploration, opencast and underground mining techniques, safety procedures and environmental performance, along with innovations in machinery and equipment. Ongoing technological advances made these gains possible, and research, innovation and technological improvements will continue to play an important role in keeping companies at the forefront of international best practice.

Australia has proven capabilities in the engineering and production of specialised solutions to improve performance, productivity, safety and environmental management in coal mining. These solutions are delivered through organisations such as Coal Services, an industry-owned organisation focused on delivering preventative and responsive services and expertise to the NSW coal mining industry.

Working in partnership with customers and stakeholders, Coal Services provides a suite of health, safety, environmental and insurance solutions. A key service is Mines Rescue, an underground incident response and mine safety training program. Coal Services also developed the world’s most advanced mine safety training simulator.
CASE STUDY
NIER FINDS NEW SOLUTIONS TO MINING CHALLENGES

Based at the University of Newcastle, the Newcastle Institute for Energy and Resources (NIER) is one of Australia's premier centres for energy and resources research, supported by strong industry relationships and national and international research collaborations.

NIER's flagship research platforms focus on resources productivity, efficiency and sustainability. These deliver products and services across the coal supply network, including efficiencies in energy and water use in the sector, bulk materials handling and processing, optimisation in transport and shipping, mineral characterisation, low emission and abatement technologies, and mining-related land and water remediation.

One collaboration has resulted in the Reflux Classifier, an award-winning technology used in over 10 countries that has helped solve a processing problem by achieving the sharp separations essential in the recovery of premium, high-grade metallurgical coal. It is an industrial machine that separates fine particles on the basis of either density or size, improving the efficiency of the process with its unique tilted design. The Reflux Classifier can be applied to a relatively broad range of particle sizes and achieve higher recovery of valuable material than other water-based technologies.

Another research platform, the Priority Research Centre for Frontier Energy Technologies & Utilisation, develops and commercialises new technologies to minimise greenhouse gas emissions around the world, with a particular focus on carbon dioxide reduction, in collaboration with industry, government agencies and international organisations.

The Centre is currently working on delivering safe, new methods of managing ventilation air methane generated by underground coal mines. Fugitive methane emissions, a by-product of underground coal mining, account for 64 per cent of all greenhouse gas emissions from the coal mining sector.

newcastle.edu.au/nier
CASE STUDY
CHUTE TECHNOLOGY STREAMLINES MATERIALS HANDLING PROCESSES

Chute Technology applies engineering, design and manufacturing resources to solve materials-handling problems. The business is a partnership between McKajj Design and Management, Dennis Pomfret Engineering and T.W. Woods Construction, one of Australia’s largest heavy engineering and steel fabrication companies.

Drawing on its founders’ engineering, design and manufacturing expertise, Chute Technology designs and manufactures new installations; reworks existing transfers; conducts audits; optimises plants and conveyor systems, develops maintenance plans, access ways and maintenance tooling; and undertakes product development.

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, which would normally be handled in separate stages, taking longer to coordinate 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 was on schedule to deliver first coal from the longwall by mid-year and continues to build workforce numbers.

‘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 timeframe, we also boosted capacity and resolved output issues with old plant not suited to higher volumes,’ says Tom Woods, Chute Technology Partner.

Chute Technology offers a range of products for underground mines, including the Jiffy drive and T.W. Woods’ smooth-flowing, low-height transfer chutes. These feature a Hood and Rotatable Spoon that can be easily converted to suit any belt transfer angle. The transfer can be relocated to other planned conveyor transfer locations with differing belt directions.

chutetechnology.com.au
CASE STUDY

ADVITECH HELPS SAFEGUARD STRUCTURAL ASSETS AND OPERATIONAL INTEGRITY

As part of the Advitech group, a leader in innovative technical solutions, Advitech provides consulting services in engineering design, design certification, 3D CAD drafting, engineering support, project management, risk management and functional safety.

When conveyor and building structures at a major coal-handling facility required assessment to confirm that they would be economically operational for the planned life of the plant, Advitech was called in to advise. Access to all areas of the structure to inspect and assess the structural integrity and material quality, was a challenge, as was the discovery of significant areas of corrosion within critical structures. These required priority design assessment and site rectification to preserve the facility’s short-term life and allow production to continue.

Advitech developed an inspection regime and a prioritised structural assessment plan to systematically evaluate the critical loads and potential failure regions of each structure. Structural design modelling, load assessment and material quality evaluation determined the structural integrity and a design life. Inventor CAD models of the structures were created to allow steelwork modifications to be designed and construction drawings to be prepared.

Throughout this process, Advitech structural engineers provided regular site inspection and assistance with site rectifications. The structural assets were evaluated, design life determined, damaged areas of steelwork rectified, and a regime of ongoing inspections and monitoring of surface treatment was established to protect the asset value and operational integrity.

advitech.com.au
CASE STUDY
ADE HELPS MINES IMPROVE SAFETY AND EFFICIENCY

Australian Diversified Engineering (ADE) works to improve haul road performance by stopping trucks from losing control on watered roads and reducing fugitive dust emissions. The firm has a reputation for innovative design and offering practical solutions to challenges, as well as finding efficiencies, improving safety and removing compromises within operations.

For example, ADE recognised a significant shortcoming resulting in high fugitive dust emission and increased reliance on water trucks that was compromising mining operations. The solution was an innovative spray head design with superior water control that delivered consistent water application at standard haul-road operating speeds.

ADE Spray helps make mine haul roads safer by reducing the risk of truck slides and vehicle rollovers. The Global Haul Road Friction Protocol, developed by Road Safety Training Services, measures the available friction in a haul road and advises a maximum recommended water application rate. This advised rate can be directly entered into the ADE Spray control system, eliminating guesswork and inconsistencies. Mining operators can choose to geo-fence a mine site and let the spray system automatically control water application rates as a water truck navigates a mine site’s road network.

Within a Queensland mining operation, ADE Spray resulted in dramatically improved dust suppression and a reduction of fugitive dust emissions leading to reduced water cart hours. A NSW operation also saw immediate benefits, with water truck reports identifying clear paths for continual improvement.

In addition to its Australian customers, ADE has a number of major customers in America and Africa.
CASE STUDY
HEDWELD HELPS MAKE HEAVY EQUIPMENT MAINTENANCE FASTER AND SAFER

Hedweld has over 37 years of experience in designing and manufacturing innovations that improve equipment availability, productivity and safety on mine sites globally. The company's Trilift® range of workshop component handling equipment and Safe-Away® range of ladder and stair access systems are well known in the industry.

Trilift products are specifically designed to make the removal, installation and handling of components such as tyres, suspensions, wheel motors and transmissions safer and more efficient. Most are universal in design, allowing for usage across a range of makes and models.

Using Trilift products allows mine sites to reduce the number of hours spent performing maintenance, decreasing labour and downtime costs and maximising equipment availability.

Hedweld has contributed to the streamlining of the Australian coal supply chain by supplying maintenance tooling for tasks such as transmission handling and tyre handling, enabling large mining equipment to spend less time in the workshop and more time in use. One example is the Trilift Cat 797 Transmission Hoist, which allows the Cat 797 transmission to be removed and installed without removing the dump truck tray. This means a transmission change can be completed in eight hours, compared with 24 hours and three shifts using the traditional procedure. This delivers an 80 per cent workshop productivity saving and a 73 per cent labour cost saving, meaning mines can see a capital return on investment after the first transmission change-out.

Hedweld products are exported to Africa, North and South America, Central Asia, and the Asia-Pacific region. Hedweld commenced exporting in the 1990s and currently exports to 32 countries.

hedweld.com.au
CASE STUDY

ALFABS DELIVERS ENGINEERING SUPPORT AND EQUIPMENT TO MINING OPERATIONS

Alfabs Mining Equipment is a heavy engineering company with a wide array of experience in engineering fabrication. It also provides protective coatings, equipment hire, and mining, transport, rail and onsite services.

The company’s engineering expertise includes structural steel, detailed duct and pipework, coal conveyor and storage projects, and scheduled onsite maintenance projects.

With three locations in the mining areas of the Hunter Valley and Wollongong in NSW and Mackay in Queensland, Alfabs has the storage and pre-assembly capacity to handle large-scale projects. Combined with its protective coatings and transport business units, the company can offer a ‘one-stop-shop’ solution for mining customers.

Alfabs Mining Equipment has recently overhauled and modified a Multi Bolter for the Mastermyne Group and this unit was successfully introduced to a NSW coal mine. The project was carried out on budget and delivered in the specified project timeline.

The LS191 LHD machine has also been repowered with a T.E. ExDES Hino engine package, which produces 100 per cent capture of DPM’s. It has a 40-hour filter life and 90 per cent carbon monoxide reduction. The BMA Broadmeadow mine has monitored the operational performance of two LHD’s on site in Queensland, and following successful trials, is now re-powering their whole fleet. Specialising in the design and manufacture of QDS, secondary support, longwall move and materials handling equipment, all of its products are available for both sale and hire and can be designed and custom-built to suit each client’s specific requirements.

All Alfabs equipment is supplied with a complete Plant Safety File and approvals to meet the requirements of each specific client. Both electronic and hard copies are supplied and generally include items such as GA drawings, engineering certificate, NDT report, design risk assessment, physical stability test, training package, spare parts manual, maintenance/servicing schedule(s) and MDG audits.

alfabs.com.au
The following are some of the organisations involved in the Australian coal supply chain. Contact your local Austrade representative about connecting and partnering with the Australian resources and energy sector.

**Department of Industry, Innovation & Science**

The Australian Government is committed to creating a policy framework to expand Australia’s resource base, increase the international competitiveness of our resources sector and improve the regulatory regime, consistent with the principles of environmental responsibility and sustainable development.

› industry.gov.au/resource

**METS Ignited**

METS Ignited is an industry-led, government-funded, Growth Centre for the METS sector. METS Ignited works with Australian suppliers to the mining industry, global miners, research organisations and capital providers to improve the competitiveness and productivity of the Australian METS sector.

› metsignited.org

**Resources & Energy NSW**

As part of the NSW Department of Planning and Environment, Resources and Energy plays a key role in delivering the NSW Government’s priorities for economic growth by working to develop thriving resources and energy sectors in NSW.

› resourcesandenergy.nsw.gov.au

**Department of Natural Resources and Mines, Queensland**

As part of the Queensland Government, the Department of Natural Resources and Mines works to ensure the responsible and sustainable use of the state’s natural resources – water, land, minerals and energy – for the benefit of current and future generations of Queenslanders, and to deliver policies, programs and services that support industry while reflecting the needs of the broader community.

› dnrm.qld.gov.au

**NSW Trade & Investment**

As part of the NSW Department of Industry, NSW Trade & Investment works to grow the economy and create jobs across NSW by supporting businesses to export their products and services, attracting international investment, and increasing global competitiveness.

› industry.nsw.gov.au/contact-us/nsw-trade-and-investment

**Trade & Investment Queensland**

Trade & Investment Queensland is the Queensland Government’s global business agency, helping Queensland exporters take their products to world markets and promoting Queensland as the perfect place for investment.

› tiq.qld.gov.au
HunterNet

Incorporated in 1992, HunterNet is a network of manufacturing, engineering and specialist services companies located in the Hunter and Central Coast regions of NSW. Formed as a non-trading, not-for-profit cooperative, it involves over 200 companies active in national and international infrastructure and asset management, energy and resources, defence and advanced manufacturing supply chains.

› hunternet.com.au

Austmine

Austmine is the leading industry body in Australia for the METS sector. It aims to develop the METS sector and provide growth opportunities and value to members to achieve greater success. Austmine represents members covering the entire spectrum of METS companies, from major OEMs, contractors and EPCMs, through to SME software, equipment manufacturers, consultancies, and technology and support services.

› austmine.com.au

Ai Group

The Australian Industry Group (Ai Group) is Australia’s peak industry association. Acting on behalf of business for more than 140 years, Ai Group represents the interests of more than 60,000 businesses employing more than 1 million staff. It has a longstanding involvement with diverse industry sectors, including manufacturing, construction, transport, labour hire, mining services, defence, airlines and ICT.

› aigroup.com.au

Industry Capability Network

Industry Capability Network is a business network that introduces Australian and New Zealand companies to projects large and small.

› icn.org.au

Minerals Council of Australia

The Minerals Council of Australia represents Australia’s exploration, mining and minerals processing industry, nationally and internationally, in its contribution to sustainable development and society.

› minerals.org.au

National Energy Resources Australia

National Energy Resources Australia (NERA) is one of six Growth Centres established by the Australian Government under the Industry Growth Centres Initiative. NERA was established to maximise the value to the Australian economy by having an energy resources industry that is globally competitive, sustainable, innovative and diverse.

› nera.org.au

Resource Industry Network

Resource Industry Network is a peak industry association representing companies actively engaged in the resource sector and those who are allied to the sector. It connects, develops and promotes members to commercial decision makers, peak bodies and government representatives.

› resourceindustry network.org.au

Additional resources

To accompany this report, Austrade has produced

› a Coal Supply Chain Company Directory, and

› sample visit programs for two key mining regions in Australia.

austrade.gov.au/mets
ABOUT AUSTRADE

The Australian Trade and Investment Commission – Austrade – contributes to Australia’s economic prosperity by helping Australian businesses, education institutions, tourism operators, governments and citizens as they:

› develop international markets
› win productive foreign direct investment
› promote international education
› strengthen Australia’s tourism industry
› seek consular and passport services.

Austrade helps companies around the world to identify and take up investment opportunities in Australia as well as to source Australian goods and services. Our assistance includes:

› providing insight on Australian capabilities
› identifying potential investment projects and strategic alliance partners
› helping you identify and contact Australian suppliers.

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REFERENCES

3. Ibid.
8. Ibid.