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Poland to delay phaseout and open more mines amid energy crisis

The current energy crisis means that Poland will not only delay its plans to shut down existing coal mines but will also expand production and even open new facilities, two government ministers have revealed.

Poland uses coal to generate 70% of electricity, by far the highest figure in the EU. The government's current energy plan foresees that falling to between 11% and 28% by 2040. Additionally, one third of Polish households are heated by burning coal, a figure the authorities have also sought to reduce.

Most of the coal burned in Poland is mined domestically. However, under an agreement with unions, the government announced plans in 2020 to close all Polish coal mines by 2049.

However, in an interview with TV Republika, climate minister Anna Moskwa noted that there was growing "demand for coal even before the outbreak of war" in Ukraine. As a result, "we are planning to increase production wherever possible and are also planning new locations".

Moskwa also noted that, although "nuclear energy is

the future for Poland" – with the government currently finalising plans to construct the country's first three nuclear power plants – "until we are sure of this atom[ic] energy we will not shut down any coal-fired power plant".

Separately, in an interview with the Sieci weekly, state assets minister Jacek Sasin confirmed that, while the government still intends to close down all mines by 2049, it now needs to "revise the schedule" for when each one will close.

That will involve "postponing mine closures" and "perhaps drilling new shafts". He mentioned the existing Bogdanka mine in eastern Poland as a location where production could be increased. "If we want coal, we have to invest."

This would help to avoid "greater dependence on imported coal, which is much more expensive than ours", explained Sasin. Following an embargo on imports of Russian coal – which was mainly used for heating homes – the government has been rushing to import coal from elsewhere.

It has also provided households with special allowances to buy coal for

heating this winter and has temporarily suspended quality standards for the burning of coal.

Sasin, like Moskwa, also noted that Russia's war in Ukraine has emphasised that gas is not a reliable energy source to use during the transition to nuclear. "Therefore we have to stay with coal longer and invest in renewable energy, which unfortunately is erratic."

Polish government picked US firm Westinghouse to construct the country's first nuclear power station. Shortly after, it named South Korea as the partner in developing a separate nuclear plant to be overseen by private and state firms. It also intends to build one further plant.

Over the last year, the state treasury has also been buying coal assets from state-owned energy firms as part of an effort to restructure the Polish energy sector by helping state firms more easily find financing for low- and zero-emission investments.

The government has also been seeking to expand renewable sources of energy, which last year made up 17% of Poland's energy mix, an increase from 7% in 2010.



Bowen Coking Coal raises A\$85m

Coal miner Bowen Coking Coal has completed an A\$85-million capital raise to fund infrastructure guarantees and prepayments.

The company announced that it would issue more than 283.3-million shares, at a price of 30c each, in two tranches.

The first tranche will consist of more than 253.5-million shares, raising an initial A\$76-million under the company's existing placement capacity, while the second tranche of more than 29.7-million shares, raising a further A\$9-million, will be subject to shareholder approval at the company's annual general meeting, scheduled for November.

"We are delighted with the support for the placement and welcome a number of new investors to the register. The strong coal price environment has increased the near-term potential for our assets but has also increased competition for access to infrastructure," said MD Gerhard Redelinghuys.

"The placement will provide the required capital to support guarantees and prepayments to secure this access alongside working capital to manage our ongoing ramp-up. We are excited by the potential of our asset portfolio and look forward to continued growth and we aim to produce five-million tonnes run-of-mine by 2024."

Peabody approves \$140m redevelopment capital for Australia mine

US-based coal miner Peabody Energy has begun initial steps to redevelop its North Goonyella mine – a hard-coking coal longwall operation in Australia with more than 70-million tons of reserves.

The company announced an initial \$140-million of redevelopment capital budget for further ventilation, equipment, conveyors and infrastructure updates in anticipation of reaching development coal – subject to regulatory approvals – in the first quarter of 2024.

Development costs beyond the current board-approved amount are estimated to be \$240-million, allowing longwall operations to start in 2026.

Peabody said project returns were estimated at about 25%, solely for 20-million tons of longwall production over five years, with further options to develop the remaining reserves.

The project would benefit from substantial infrastructure and equipment in place at the mine including a new 300 m longwall system, a proven coal handling preparation plant, a dedicated rail loop for transport to the Dalrymple Bay Coal Terminal, and an accommodation village with housing and service amenities for more than 400 workers.

North Goonyella is expected to reweight Peabody's long-term production and revenue



toward metallurgical coal and to generate attractive returns at historical long-term metallurgical prices.

"We are pleased to be moving forward with redevelopment of the North Goonyella southern reserves to unlock the value of this strategic asset as we continue to strengthen our balance sheet," said president and CEO Jim Grech in a statement announcing its third-quarter results.

Meanwhile, Peabody reported net income attributable to common stockholders of \$375.1-million, or \$2.33 a diluted share, for the third quarter of 2022, compared

with a net loss attributable to common stockholders of \$44.2-million, or \$0.38 a diluted share, in the prior year quarter.

"All of our business segments continued to build on first-half momentum and reported strong performance results, delivering free cash flow of over \$460-million and adjusted Ebitda of \$439-million while recovering from significant weather events in the early part of the third quarter, setting the stage to finish the year even stronger," said Grech.

He added that coal prices remained at levels that result in a favourable outlook for each of its operating segments.

Russian exports hit 6-month low

Russian thermal coal exports declined 11% on the year in October to just under 11m tonnes – the lowest since April – as an EU-wide embargo on imports dented loadings.

The country exported 1.3m tonnes less than in the same month last year, while year-to-date shipments were down 4m tonnes at 120m tonnes, the estimates from the dry

bulk data provider showed.

Of the October total, just 0.6% was exported to west European countries – likely coal from Kazakhstan, which is still permitted to be loaded at Russian ports and shipped to EU destinations – compared with over 10% in the same month of 2021.

"This is mainly because of the ban issue," said a head coal trader with a Swiss

trading house.

The EU forbade the import of Russian coal from 10 August in response to the country's invasion of Ukraine, with European buyers instead sourcing incremental volumes from alternative origins, such as South Africa, Colombia and even Australia.

Russia had previously supplied Europe with 60-70% of its thermal coal needs.

Rising exports?

DBX, however, provisionally saw total Russian exports rising to nearly 12m tonnes in November, which one coal analyst with another Swiss trading firm attributed to several factors.

"Freight rates have come down and also the EU said shippers can go to pick up Russian coal to deliver to

non-EU countries," he said, regarding the European Commission's decision in mid-September to allow EU operators to transport and finance Russian coal earmarked for non-EU member countries.

This was to avoid any impact from EU sanctions on energy security for less developed countries.

Regarding freight rates, the Baltic Dry Index – a barometer for global dry shipping trade – was assessed last at 1,377 points, down more than 20% on the month.

"Also, non-Russian coal can be picked up in Russian ports for export to the EU," said the analyst, with regards to the aforementioned shipments of Kazakh coal.



Epiroc grabs majority slice of Radlink

Epiroc has completed the acquisition of a majority stake (53%) of Radlink, an Australian company that provides mines with wireless connectivity solutions.

Radlink, headquartered in Perth, Australia, designs, delivers, and integrates wireless data and voice communication networks and supporting infrastructure to surface and underground mines throughout Australia.

Robust wireless networks are vital to support mining automation, including

autonomous and teleremote solutions, which in turn strengthen safety and productivity.

The company has approximately 330 employees and had revenues in the fiscal year ending 30 June 2022, of about \$145 million.

The move follows Epiroc's recent acquisition of another Perth-based company, mining automation specialist Remote Control Technologies.

Radlink becomes part of Epiroc's Parts and Services division.



A Radlink-built communication network site.

Coal India production increases 17% in April-October

State-owned CIL said its coal production increased by 17.4% to 351.9 million tonnes (MT) in the April-October period of the ongoing fiscal.

The company's coal output in the corresponding period of last fiscal was 299.6 MT, Coal India Ltd (CIL) said in a recent report.



Alliance Resource Partners reports record sales prices and revenues

Alliance Resource Partners, L.P. has reported substantial increases to financial and operating results for the quarter ended 30 September 2022 compared to the quarter ended 30 September 2021.

Total revenues in the 2022 quarter increased 51.3% to a record US\$628.4 million, compared to US\$415.4 million for the 2021 quarter, as a result of significantly higher coal sales revenues, which rose US\$188.3 million to US\$550.6 million, and oil & gas royalties revenues, which jumped 75.6% to US\$35.3 million.

Coal sales revenues increased on the strength of record coal sales prices, which rose 40.5% in the 2022 quarter to US\$59.94/t sold, and increased coal sales volumes, which were 8.1% higher compared to the 2021 quarter.

Oil & gas royalties revenue in the 2022 quarter benefited from significantly higher volumes and sales price realisations per BOE, which increased 33.1% and 31.6%, respectively, compared to the 2021 quarter.

Total operating expenses increased to US\$450.3 million in the 2022 quarter, compared to US\$348.7 million in the 2021 quarter, due primarily to increased coal sales volumes and ongoing inflationary cost pressures.

Net income for the 2022 quarter increased 186.0% to US\$164.6 million, or US\$1.25 per basic and diluted limited partner unit, compared to US\$57.5 million, or US\$0.44 per basic and diluted limited

partner unit, for the 2021 quarter. EBITDA also increased 84.0% in the 2022 quarter to US\$250.2 million compared to US\$135.9 million in the 2021 quarter.

Performance in the 2022 quarter also improved compared to the quarter ended 30 June 2022 as modest increases to coal sales volumes and pricing pushed both coal sales and total revenues higher by 3.5% and 1.9%, respectively. Increased revenues, partially offset by higher total operating expenses in the 2022 quarter, led net income and EBITDA higher by 1.9% and 2.6%, respectively, both as compared to the sequential quarter.

Total revenues increased 55.6% to US\$1.71 billion for the nine months ended 30 September 2022, compared to US\$1.10 billion for the nine months ended 30 September 2021, primarily due to substantial increases in prices and volumes from both coal and oil & gas royalties. Higher revenues, partially offset by increased total operating and income tax expenses, led to significantly higher net income, which rose 187.1% to US\$362.7 million for the 2022 period, or US\$2.76 per basic and diluted limited partner unit, compared to US\$126.3 million, or US\$0.97 per basic and diluted limited partner unit, for the 2021 Period. EBITDA increased 85.3% in the 2022 Period to US\$646.3 million compared to US\$348.9 million in the 2021 Period.

The Board of Directors of ARLP's general partner

increased the cash distribution to unit holders for the 2022 quarter to US\$0.50 per unit (an annualised rate of US\$2.00 per unit), payable on 14 November 2022, to all unitholders of record as of the close of trading on 7 November 2022. The announced distribution represents a 150.0% increase over the cash distribution of US\$0.20 per unit for the 2021 quarter and a 25.0% increase over the cash distribution of US\$0.40 per unit for the Sequential quarter.

Joseph W. Craft III, Chairman, President and Chief Executive Officer, comments:

"With energy market fundamentals remaining favourable during the 2022 quarter, ARLP again delivered strong financial and operating performance, as we posted record

quarterly total revenues and income from operations as well as significant increases to net income and EBITDA compared to the 2021 quarter.

"Higher coal sales and production volumes combined with record per ton price realizations drove our total Coal Segment Adjusted EBITDA up 77.8% to US\$224.6 million as margins per tonne sold jumped US\$9.58 compared to the 2021 quarter. Strong energy markets also continued to benefit our royalty businesses as increased volumes and commodity price realisations led to increased total royalty

revenue and record Segment Adjusted EBITDA during the 2022 quarter.

"ARLP was also able to execute new coal sales commitments for delivery of 5.6 million t through 2025 at prices supporting higher margins in the future. With ARLP sold out for this year and solid contracted coal sales volumes in 2023 and 2024, we have good visibility into our

ability to generate cash flow growth over the next several years. Reflecting our strong year-to-date performance and future expectations, ARLP's Board elected to accelerate our previously planned increases to cash distributions to unitholders by declaring a US\$0.50 per unit distribution for the 2022 quarter, as communicated recently."





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Epiroc snaps up mining automation specialists

Leading mining equipment manufacturer Epiroc is set to acquire another Australian business: Remote Control Technologies, a company that provides automation and remote-control solutions for mining customers around the world.

With this acquisition, Epiroc will be the world-leading automation solutions provider not only for surface and underground rock drilling but also for underground loading and haulage.

Remote Control Technologies, known as RCT, is headquartered in Perth, with customers in more than 70 countries. The company provides automation and remote-control solutions applicable for either a single machine or an entire mixed fleet of machines regardless of manufacturer or type of equipment. RCT

also provides data and information systems, fleet and machine management systems, and machine protection systems.

RCT has about 225 employees and had revenues in the fiscal year ending June 30, 2022, of approximately \$85 million.

Epiroc president Helena Hedblom said automation was increasingly important for the mining industry

to strengthen safety and productivity, and RCT's advanced solutions complemented Epiroc's existing automation offering well.

"Together we will provide complete automation and remote-control solutions to support our customers on their journey towards optimal operations," she said.

"We are especially pleased that Bob Muirhead,

RCT's founder and a true pioneer within mining automation, will continue in an active management role. We look forward to welcoming the strong RCT team to Epiroc."

The acquisition is expected to be completed in the fourth quarter 2022.

RCT will belong to Epiroc's Parts and Services division once the acquisition is completed.



Miners hope for foreign labour help as skills shortage continues

As the skills shortage continues, large mining companies are hoping that foreign workers can help solve the problem.

Mining giants BHP and Whitehaven Coal have reported lower coal outputs over the past three months, while shipments through the Port of Newcastle were over 12% lower in the past nine months.

Both miners have cited labour shortages,

absenteeism, wet weather and planned maintenance for the disruption.

Whitehaven managing director Paul Flynn said there was no indication that labour availability was improving.

"It is not turning around in the way we would like it to," he told investors this month.

"Trades are hard to find there is no doubt about that, so we are looking at different roster patterns

and including fly-in fly-out arrangements.

"Even though we know the doors are open from our borders' perspective, there is not the inflow of people we would expect from an expat perspective into the country.

"On that topic we are very much focusing on the higher skills areas in particular, offshore people coming in to fill many of the roles at a more senior, technical level

across our mines."

BHP's chief operating officer Edgar Basto echoed this statement, saying that "expediting skilled migration" was one of the things needed to cure Australia's labour shortage.

While a wetter than average season has also tampered production, Whitehaven said in August that it would moonlight as a property developer in the New South Wales Gunnedah basin to ease a housing shortage that was deterring prospective recruits.

The company also said it was preparing to transport workers to mine sites by helicopter if the flooding that has beset the region on multiple occasions over the past two years were to recur.



Allegiance hoping for a change at New Elk

Coal miner Allegiance Coal is continuing to face difficulties at its New Elk operation, in British Columbia, but is hopeful that it will be able to address issues around sustaining the workforce and investing in equipment to minimise downtime at the mine.

The ASX-listed miner said a continuous miner at the New Elk mine, which had been sent for maintenance and had subsequently sprung an oil leak that required additional maintenance work, will be deployed underground.

Miner reliability has been a continuous issue for the New Elk operation, along with labour issues. However, Allegiance is hopeful that production at New Elk will improve with the return of the continuous miner along with the first of the newly sourced overhaul articulating head roof bolters, which are now operating underground.

In addition to the mechanical issues at the mine, New Elk's general manager and the mine superintendent have both left, by mutual agreement with the company. The

mine's chief mining engineer, along with CEO Jon Romcke, have taken over operations until a recruitment process has been finalised.

Allegiance told shareholders that the change in personnel provided the company with the opportunity to re-evaluate the approach to staffing and operations at the mine.

Meanwhile, two coal mines in neighbouring New Mexico and Utah have closed, providing Allegiance with an opportunity to recruit

available mineworkers. The company has also entered into supply arrangements with labour hire companies to recruit workers.

"We have set up a shift roster with a view to engaging workers on a seven-day on and seven-day off cycle to allow them to work at the mine but also to remain living at home, a roster structure preferred by many," the company said.

At the Black Warrior mine, production performance is trending positively and in line with mine planning, Allegiance said.

GroundProbe launches BlastVision® a world-first in blast analytics

GroundProbe has launched BlastVision®, a world-first solution that delivers actionable blast performance insights for optimal safety and productivity.

The crucial data aids in the detection of potential misfires and out-of-sequence firing and in identifying and tracking flyrock. Intra-blast monitoring also adds valuable wall control insights, such as monitoring and mapping instantaneous blast damage to slopes and identifying movement on significant structures.

GroundProbe is a member of the Orica Group, the world's leading mining and blasting solutions provider, while GroundProbe specialises in geotechnical monitoring.

GroundProbe's Chief Executive Officer, David Noon, said that GroundProbe leveraged this partnership to gain information around current blast monitoring methods through interviews with engineers.

"Through talking to mine site engineers responsible for blasting on the ground,

we identified that many sites were still using quite simple and sometimes unsafe methods for blast analysis.

"Techniques included recording blasts with ground-based camera systems and conducting visual inspections of this footage to determine areas of concern.

"From this, the idea of using drone footage and automated algorithms to quickly identify key areas of interest was born."

BlastVision® takes custom high-speed drone footage of a blast as it happens. Using world-first advanced proprietary algorithms and modern AI frameworks,

BlastVision® converts the footage into analytics data. Data is remotely analysed in our custom software platform, with insights swiftly reported back to the site. From these insights, mine site personnel can optimise blasting and monitor the impacts of blasting, improving both safety and productivity.

GroundProbe's VP – Technology, Fernanda Carrea, said that no other solution provides the range of insights from the whole blast area that BlastVision® provides, from start to finish.

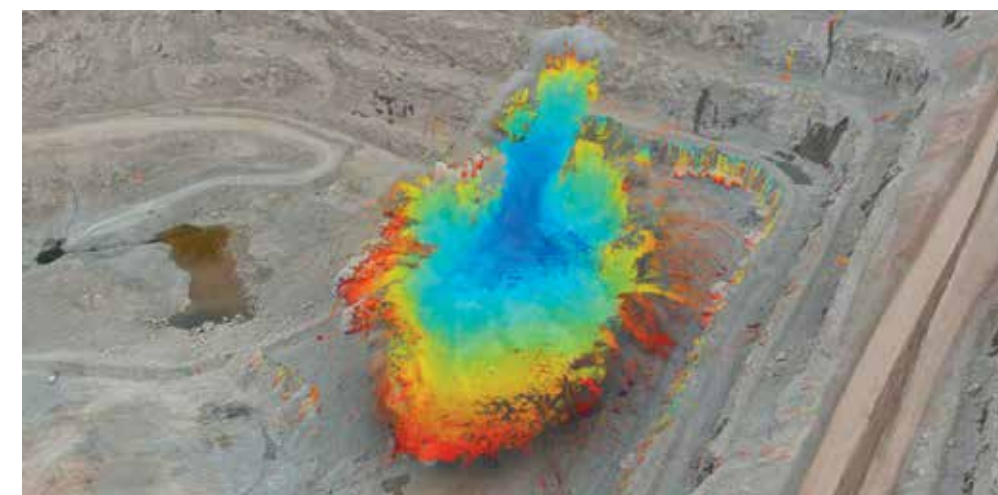
"BlastVision® provides an increased level of

safety, efficiency, accuracy and productivity through our software algorithm automatically identifying key areas and issues.

"Data is also able to be captured before, during and after a blast, and covers the blast area in its entirety.

"We can proudly say that this patent-pending technology is a world first."

BlastVision® has been tested, trialled or demonstrated across over 60 mine sites around the globe. As a result, BlastVision® has positively impacted hundreds of drill and blast team members across these mine sites.



Rio Tinto to develop autonomous haulage solutions

Rio Tinto will partner with Scania to develop autonomous haulage solutions to support a pathway to lower emissions mining.

The two companies have established a long-term research and development collaboration agreement for the continuous advancement

of this autonomous technology.

Rio's Channar iron ore mine, located in the Pilbara region of Western Australia, will be the first active partner site for the two companies.

The partnership will also include options for the future transition to electric-powered vehicles.

"Rio Tinto is excited to partner with Scania to develop a mining solution which will create optionality across our diverse portfolio," Rio Tinto group technical managing director Santi Pal said.

"Collaboration and partnership is key to reimagining mining in the future."

The partnership will utilise Scania's autonomous mining trucks which boast better emissions and productivity.

"Our climate action plan includes phasing out the purchase of new diesel haul trucks by 2030, and partnering with industry leaders, such as Scania, across a range of fields, is an important step towards achieving that," Pal said.

"As well as the potential decarbonisation benefits, this partnership provides a path to potential productivity improvements."

The announcement comes after Rio announced its move to a haul truck mosquito fleet recently.

"With its dedication to achieving cleaner, more energy-efficient operations, Rio Tinto is the ideal partner and first customer for Scania as we seek to put mining on a pathway to net zero emissions," Scania vice president and head of autonomous solutions Peter Hafmar said.

"This is a major step towards the goals of a sustainable autonomous mining solution, and builds on our already fruitful long-term collaboration."



Innovation protects underground workers from falling hazards

The Australian-made SafetySpear won the prestigious Innovative Mining Solution category at the Australian Mining Prospect Awards just 18 months after it was introduced to the market.

From over 20 nominations, the Safety Spear was the only physical, real-world product among the three finalists, the others being data-based.

Designed and manufactured by Rattlejack, the SafetySpear works to protect underground mining personnel and equipment from free falling overhead hazards by plugging drill holes quickly and inexpensively with a lightweight, high-impact absorbing polymer system.

First introduced in May 2021, the spear's market potential is being expanded by Murray Engineering, a Perth-based company with an international footprint.

The innovation addresses shortcomings of other

practices in widespread global use, including corrosion-prone steel systems and traditional grouting and plating over where weaknesses can result in serious mine site injury and death.

It has been purpose-built to activate on impact with any downward force: its unique two-stage design decelerates the impact by blocking the hole with its flexible upper section, conforming to the shape and size of the available space.

This effectively stops the falling hazard with minimal backward movement, a method never seen in underground mining prior.

Installation is achieved with standard production drilling equipment enabling the hazard to be minimised without delay. With its lightweight design, the

SafetySpear also has minimal risk of manual handling injuries, and includes easy-to-follow pictorial instructions for a simple installation process for operators of all experience levels.

In collaboration with Fosterville gold mine in Victoria and Byrnecut Mining Australia, the SafetySpear has been tested in real world conditions across various underground operations across Australia.

With accident occurrences involving severe weights, speeds and forces of height drop acceleration, the

SafetySpear has proven results, able to safely handle weights immense weights in simulated worst-case scenarios typical at most mine sites.

Initial financial benefits across the two mine sites also show great promise, with Byrnecut estimating in excess of a \$500,000 differential per year, compared to previous methods.

Fosterville has not completed a full 12-month cycle, and with much more challenging ground conditions place the differential at \$250,000+ per year.



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Over 40 years ago, we innovated the Mineral Sizer™ to help underground coal mines break coal more efficiently and effectively whilst also increasing productivity.

The Mineral Sizer has since developed into a unique range of dependable solutions and systems that are tailored to each application. The Sizer has been successfully installed in many applications from high capacity primary machines that reduce ROM material to a conveyable size, to secondary or tertiary machines designed to deliver a specific product size in the coal preparation plant.

To cater for today's variety of modern mining methods, MMD has also deployed leading modular Sizing stations and systems worldwide to take advantage of cost effective long haul by conveyor. High throughputs and short relocation times enable mines to achieve their efficiency and productivity goals.

Discover how we can deliver the complete sizing solution for your specific needs.



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Identifying and addressing conveyor idler issues



In any belt conveyor system that moves bulk materials, the belt must run straight and true to maximise its life, minimise fugitive material and safety hazards, and achieve high system efficiency. There can be many consequences of a mistracking belt, but all result in higher costs and increased maintenance. Even a slight belt misalignment can lead to a variety of

issues, from small annoyances to full-blown catastrophes.

The most obvious effects include spillage and dust that require personnel to do cleanup, which is unproductive work that introduces risks from activities in close proximity to the moving conveyor. Spillage from non-centered cargo often gets into idlers and pulleys, reducing bearing life and causing them to seize, leading to friction damage on the belt and potentially starting a fire.

A misaligned belt can also come in contact with the stringer, causing fraying, shredding or splice damage. Great lengths of valuable belting can be destroyed with surprising speed, and even the support structure itself can be damaged. A compromised bracket or support can cause a catastrophic idler failure, which could damage other components of the system and require extensive downtime to repair. Further, there is potential for injury from a damaged belt or loose idler not to mention the increased exposure to injury from too frequent a need to clean.

"I've been working around conveyors for 20 years, and I've seen thousands of belts," observed Martin Engineering Process Engineer Dan Marshall. "I've seen just about every problem that can be caused by a mistracking belt, but one thing I've never seen is a belt that runs true right out of the box. All conveyors, no matter how well designed and built, have some belt wander."

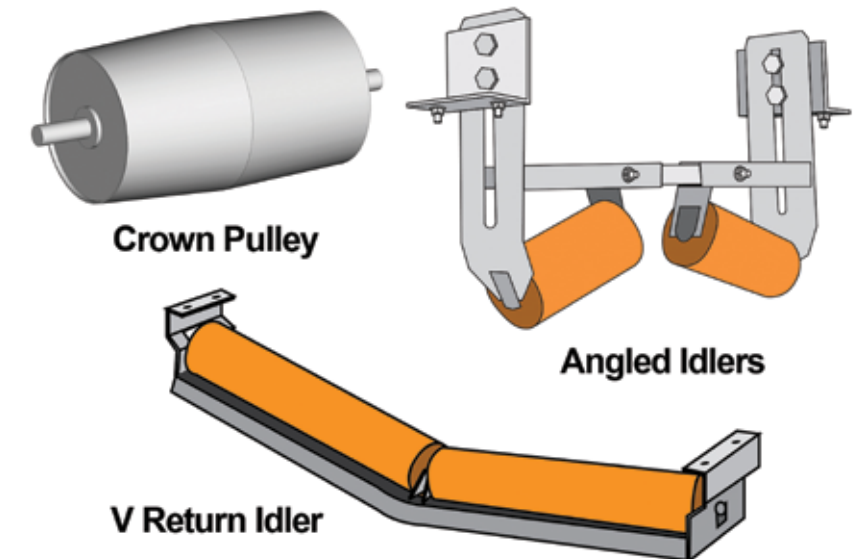
A wide variety of circumstances can lead to mistracking, and operators have tried many things to correct the alignment. Some have elected to place an obstacle such as a block of wood in the belt path, so it won't travel too far out of line. This occasionally improves the situation, but more often it's just temporary and the belt will eventually slice through the obstacle.

Many operators have realised that pivoting an idler is a quicker and more effective way to steer a belt. This common approach is called "knocking an idler," striking it with a hammer to move it slightly and realign the belt.

Equipment manufacturers have also designed components to help align a belt, and these solutions can be successful in specific applications. They include specially-shaped rollers, angled idlers and devices that apply pressure to the belt edge to push it back in line.

"While these mechanisms can improve a belt that's consistently off-center in one direction, they do not react to dynamic belt movement, meaning that they don't correct intermittent belt wander," Marshall continued. "To combat such changing conditions, engineers designed the tracking idler. Unlike the edge correction approach, the device senses belt movement in either direction, and pivots the idler slightly to steer the belt back into position. It doesn't apply a great deal of force to the edges, which can damage a belt and splices. When the belt is running true, it remains centered, and

Specially Shaped Rollers



when it senses a misaligned condition, it gently corrects the belt."

Unfortunately, to accommodate limited space availability, tracking idlers typically have short sensing arms. This requires a fairly large belt displacement to create a small movement of the idler. While these designs do tend to improve tracking, there are limits to how much correction they can deliver, and short sensing arms can actually pinch a belt if the idler pivots too far. To combat this, some operators choose to "tie off" a tracking idler to limit its movement. While the practice can help preserve the belt, it doesn't address significant mistracking.

To overcome the limitations of existing belt alignment devices, Martin Engineering has invented and patented a Multi-Pivot Belt Tracker, which employs sensors, pivoting idlers and geometry to align a wandering belt. The sensors avoid pinching the belt, and the engineered geometry amplifies any detected misalignment to create a greater pivot.





Multi-Pivot Belt Trainers use longer arms than other designs, positioning the guide rolls further from the pivot roller, as well as closer to the belt edge. The closer proximity allows guide rolls to sense very slight misalignments and make immediate corrections. Rather than waiting for a powerful mistracking force, the longer arms require considerably less pressure to move the pivot roller. The result is better correction with no pinch points and less wear on conveyor and tracking equipment, for longer and more efficient service life. Specific designs are available for both the load-carrying belt path and the return run.

"Installing trackers is the economical solution, but operators should do a full analysis and consider also addressing other causal issues," Marshall added. "By focusing solely on belt

alignment, plant personnel may miss other opportunities to increase production and relieve some of the burdens on their system."

Keeping the belt centered and moving quickly is the key to high production, controlled operating cost and a safer workplace. "Misalignment causes downtime and costs money," Marshall concluded. "But nothing causes more downtime and expense than a destructive belt fire or other catastrophe as a result of inattention to mistracking problems."

AUTHOR

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Achieving pneumatic cylinder longevity in harsh environments

Pneumatic cylinders are an efficient, reliable and clean solution for moving loads in a linear direction (back and forth or up and down), with good levels of force and speed.

Pneumatic cylinders use compressed air as the input source to move a load. There are various pneumatic cylinder types, including single-acting, double-acting and rodless. Most contain a piston inside the cylinder, and the compressed air is pushed in at one end of the cylinder and acts upon the piston within the contained environment to translate the energy into movement, using a rod to move the external load. In the case of rodless cylinders, these are engineered to perform as a self-contained linear actuator with the piston moving within a cylinder bore, for improved flexibility.

Unlike a hydraulic cylinder which uses fluid and therefore comes with a risk of leakage or cross-contamination, a pneumatic cylinder relies solely on air, making them suitable for use in a vast array of mechanical applications (although generally in fixed installations as moving large air compressors around is not ideal or easy!).

AT THE HEART OF A LINEAR MOTION SYSTEM

Cylinders are often the most important component of a linear motion system. If the cylinder fails, the linear motion

system is unable to function and, in most instances, the machine it is part of and even the entire production line is out of action until the cylinder can be replaced.

This downtime is undesirable in any setting, but in a harsh environment where contaminants are heavily present, standard cylinders are going to fail all the more frequently, resulting in greater downtime. Cylinders can be contaminated internally from the air supply or externally from the operating environment. In the case of the latter, seals become damaged from particles and corrosive elements in the immediate atmosphere, which are then able to enter the main workings of the cylinder, reducing the effectiveness and life of that cylinder.

WHAT ENVIRONMENTAL FACTORS IMPACT CYLINDERS' LONGEVITY?

Airborne particles in the form of dust and grit are the most obvious threat to cylinders. If this penetrates a nose seal, it builds up and sits in seals and bearings with a similar effect to sandpaper. In a normal environment, with regular preventative maintenance, standard cylinders can cope well with basic levels of dust, but where these contaminants are prevalent, such as mines and quarries, a more robust cylinder must be considered.

Water may not be deemed a contaminant in the usual sense, but when it comes to pneumatic cylinders it is

very much a problem as where there is compressed air, there is water vapour. Furthermore, where washdowns are conducted regularly and thoroughly, the water collects within system components where it can block the flow of air through orifices, dilute or adulterate lubricants, corrode the barrel or rod finish and, of course, freeze in cold weather.

Contamination from synthetic oils used to lubricate the air compressor can have a similar impact on cylinders to water, in that it can block orifices, as well as causing seals to swell. In harsh environments, greater quantities of lubricant are often used, which makes the contamination situation worst.

In applications where extreme heat is used, and/or where chemicals, paint or weld splatter are present, the piston rod and rod-seal are prone to damage.

So, these are the problems, but what are the solutions?

SELECTING A CYLINDER FOR HARSH APPLICATIONS

First and foremost, invest in cylinders that are manufactured and sealed to a high quality from a well-established, recognised manufacturer. You really do get what you pay for!

However, for really harsh environments you will need to look to a more customised cylinder. The good news is, most of these customisations are relatively straightforward and represent a good ROI.

Let's start with the cylinder seals, these being one of the most important means of preventing the ingress of dirt and water. Standard seals can be replaced with specialist versions to meet the needs of your specific application. Viton™ - a fluoropolymer elastomer and synthetic rubber compound - seals, for example, have been designed for use in some of the harshest environments, where temperature extremes and chemical interactions are common. These can readily be used in Matara's standard rod type pneumatic cylinders and rodless pneumatic cylinders.

Moving further into the cylinder construction, with rod type pneumatic cylinders a rod seal/wiper can be incorporated to both stop contaminants from entering the inner body of the cylinder, with the wiper removing larger particulates from the rod. For added protection the rod can be fitted with a rod bellow/gaiter which keeps contaminants away from piston rods.

When it comes to corrosion prevention, then you may need to consider going further than just swapping out seals for more tougher versions. For corrosive environments, including those where regular washdowns are conducted, the choice of rod material may need to be reconsidered. Standard rods are mostly manufactured from chrome, but swapping to stainless-exercised steel rods and fasteners, or even a stainless-steel rod, will provide extra protection against corrosion. This will impact the cost, usually by an additional 10% of the overall cost of the cylinder. For complete corrosive protection, Matara offers a range of 100% stainless steel pneumatic cylinders.



The other option is to stick with existing materials but use specialist coatings or epoxy paints. There are a good range of options here, including Armoloy TDC® coating, which we use on our linear rail and ballscrews for maximum longevity in demanding applications and locations. Armoloy TDC® is a hard (78Rc), thin, dense chromium coating with a micro-nodular surface texture which provides corrosion protection equal to 440 series stainless steel.

MAINTENANCE MATTERS

Having selected the right cylinder type for your environment, it's important to conduct basic preventative maintenance to a regular schedule. This should include the regular cleaning of external parts of the system so that visual inspection of seals and other parts is straightforward; inspection for wear and tear; draining of air line filters and checking that the water traps are operating as they should; lubrication of the cylinder, rod seal, piston seals and surfaces; checking for air leaks and resealing where required; and last, but not least, replacement of air filters.

Harsh environments make for difficult operating conditions, but by selecting quality pneumatic cylinders customised to your specific site, you can cost-effectively prolong the service life of a cylinder and reduce costly downtime.

Japh Humphries

UK Sales & Commercial Manager, Matara UK Ltd.

The current state of play

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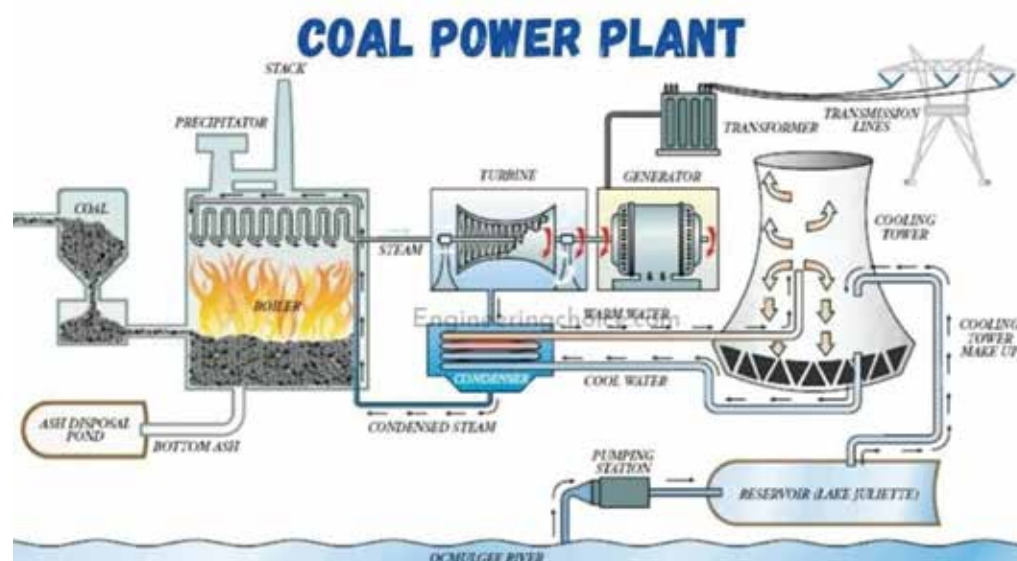
Coal International takes a detailed look at where we are now in relation to Coal fired plant, the largest operators, and emissions targets.

A coal-fired power station or coal power plant is a thermal power station that burns coal to generate electricity. A coal-fired power station is a type of fossil fuel power station. The coal is usually pulverised and then burned in a coal-fired boiler.

The furnace heat converts boiler water to steam, which is then used to spin turbines that turn generators. Thus, the chemical energy stored in coal is converted successively into thermal energy, mechanical energy, and, finally, electrical energy.

Coal that has been ground into a fine powder by pulverizing is blown into a furnace-like device, called a boiler, and burned. The heat produced converts water, which runs through a series of pipes in the boiler, to steam. The high-pressure steam turns the blades of a turbine, which is connected by a shaft to a generator. The generator spins and produces electricity.

Coal-fired plants produce electricity by burning coal in a boiler to produce steam. The steam produced, under tremendous pressure, flows into a turbine, which spins a generator to create electricity. The steam is then cooled, condensed back into the water, and returned to the boiler to start the process over.



Example: The Kingston Fossil Plant near Knoxville, Tennessee, burns coal to heat its boilers to about 1,000 degrees Fahrenheit to create high-pressure steam. The steam is piped to the turbines at pressures of more than 1,800 pounds per square inch.

The turbines are connected to the generators and spin them at 3,600 revolutions per minute to make alternating current (AC) electricity at 20,000 volts. River water is pumped through tubes in a condenser to cool and condense the steam coming out of the turbines.

The Kingston plant generates about ten billion kilowatt-hours a year, or enough electricity to supply 700,000 homes. To meet this demand, Kingston burns about 14,000 tons of coal a day, an amount that would fill 140 railroad cars.

In 2020 the total number of plants started falling as they are being retired in Europe and America although still being built in Asia, almost all in China. Some remain profitable because costs to other people due to the health and environmental impact of the coal industry are not priced into the cost of generation, but there is a risk newer plants may become stranded assets.

The UN Secretary-General has said that OECD countries should stop generating electricity from coal by 2030, and the rest of the world by 2040.

Today, advances in technology have allowed coal to improve living conditions with its current role in meeting man's fuel needs. Coal has been used extensively in power generation where better technology is employed to ensure that there is a balance between ecology and economics in producing sustainable and affordable energy. Some of its advantages include reliability, affordability, abundance, known technologies, safety, and efficiency.

- **Reliability:** One of the greatest advantages of coal fired plants is reliability. Coal's ability to supply power during peak power demand either as base power or as off-peak power is greatly valued as a power plant fuel. It is with this fact that advanced pulverised coal fired power plants are designed to support the grid system in avoiding blackouts.
- **Affordability:** Energy produced from coal fired plants is cheaper and more affordable than other energy sources. Since coal is abundant, it is definitely cheap to produce power using this fuel. Moreover, it is not expensive to extract and mine from coal deposits. Consequently, its price remains low compared to other fuel and energy sources.
- **Abundance:** There are approximately over three hundred years of economic coal deposits still accessible. With this great amount of coal available for use, coal fired plants can be continuously fuelled in many years to come.

- **Known technologies:** The production and use of coal as a fuel are well understood, and the technology required in producing it is constantly advancing. Moreover, coal-mining techniques are continuously enhanced to ensure that there is a constant supply of coal for the production of power and energy.

On the other hand, there are also some significant disadvantages of coal-fired plants including Greenhouse Gas (GHG) Emissions, mining destruction, generation of millions of tons of waste, and emission of harmful substances.

- **Greenhouse gas emissions:** It cannot be denied that coal leaves behind harmful by-products upon combustion. These by-products cause a lot of pollution and contribute to global warming. The increased carbon emissions brought about by coal fired plants has led to further global warming which results in climate changes.
- **Mining destruction:** Mining of coal not only results in the destruction of habitat and scenery, but it also displaces humans as well. In many countries where coal is actively mined, many people are displaced in vast numbers due to the pitting of the earth brought about by underground mining. Some places near coal mines are unsafe for human habitation as the land could subside at any time.
- **Generation of millions of tons of waste:** Waste products which can no longer be reused are generated from coal fired plants, and also contribute to the waste disposal problems, in some cases containing harmful substances.
- **Emission of harmful substances:** Thermal plants like coal fired plants emit harmful substances to the environment. These include mercury, sulphur dioxide, carbon monoxide, mercury, selenium, and arsenic. These harmful substances not only cause acid rain but are harmful to humans.

HOW MANY COAL-FIRED POWER PLANTS ARE BEING BUILT IN THE WORLD TODAY?

A recent study by the World Resources Institute found that 1,600 new coal-fired power plants are being built around

the world, with most of them in China and India.

Cecil E. Roberts stated that coal-fired power plants are being built all over the world. At the National Press Club in Washington, he made a reference to 1,600 people. PolitiFact discovered that 458 units are currently under construction, which is significantly lower than Roberts' estimate. According to Roberts' campaign, there are currently 1,600 coal-fired power plants being built around the world. If you include those who are in the pre-permitting or permit phases, there are only 1,160 total. According to the *International Energy Agency*, final investment decisions for new coal-fired power plants have been slowed.

The Trump administration announced in 2019 that it would withdraw from the Obama-era Clean Power Plan, which would have phased out coal-fired plants. The Trump administration's rationale for ending the Clean Power Plan is that electricity prices will rise as a result. There are still over 2,400 coal-fired power plants operating in seventy-nine countries, with a total capacity of nearly 2,100 gigawatts.

HOW MANY COUNTRIES USE COAL POWER PLANTS?

There are approximately 4,000 coal-fired power plants worldwide, with a total capacity of about 2,000 GW. These plants provide about 40% of the world's electricity.

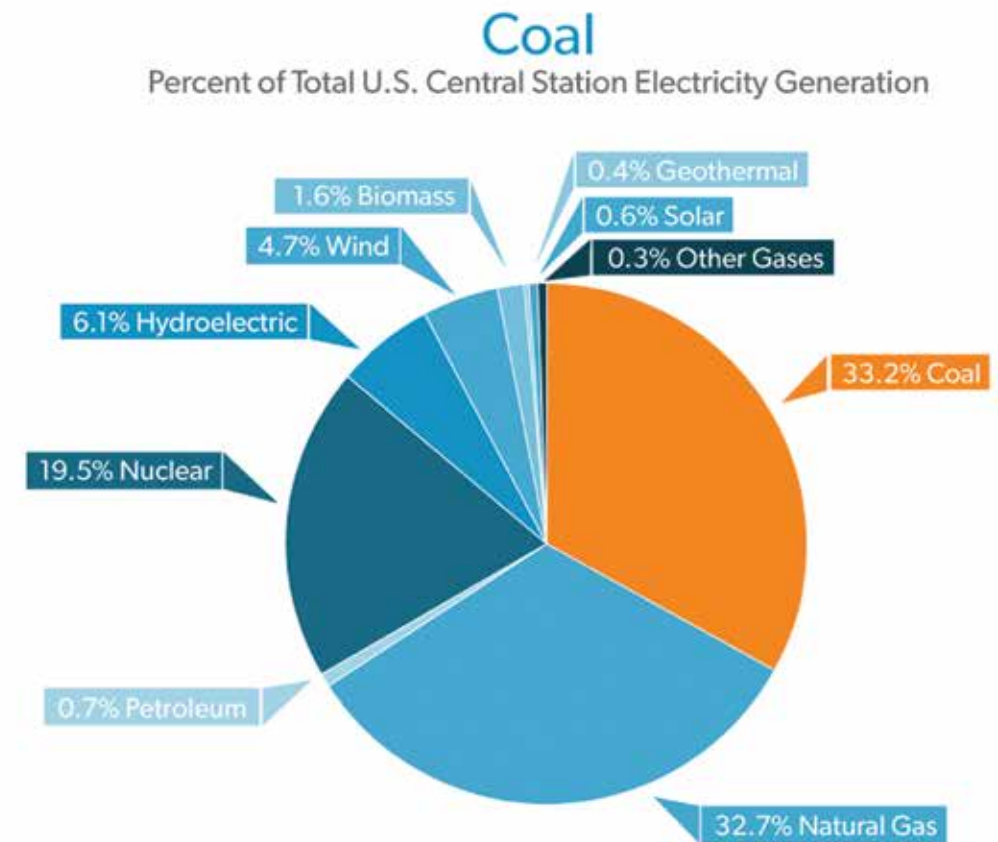
HOW MANY POWER PLANTS ARE IN THE WORLD 2021?

At the start of 2021, there were about 8,600 nuclear reactors operable in the world. These reactors supplied about 10% of the world's electricity.

Renewable energy sources such as solar and wind are rapidly expanding, but they are not meeting the world's energy needs. Fossil fuels continue to provide about one-third of the world's electricity, primarily coal, oil, and natural gas.

President Trump's administration has proposed a 35% and 50% reduction in the country's renewable and non-renewable energy capacity, respectively. Renewable energy is expected to be able to meet the world's energy needs in the near future, thanks to rapid growth.

There are many components and different varieties of instrumentation within today's coal-fired power generation plants. In order for these components to continue to operate with maximum efficiency, one must do everything possible to minimise the risk of failure. One element of critical preventative maintenance is keeping everything at a temperature that will not cause instrumentation to freeze. If an operator's instrumentation fails, the consequences can be disastrous. Without certain instrumentation fully functioning, the operator loses his or her "eyes and ears" of the plant. There is certain equipment that is absolutely critical to a



Source: EIA, MER, March 2016
Credit: Institute for Energy Research

power generating plant performing at an optimal level. This heating requirement can be a tricky practice, however, as heating systems need to be designed in such a way that they provide the necessary heat while considering any possible safety hazards. Generally, a plant has an ample amount of combustible materials present. If heating is not done in a responsible, monitored manner, there is a possibility of causing costly fires or in some extreme cases, explosions. Most power generating plants' top priority is always going to be its workers' safety.

When installing a heat trace system to a plant's instrumentation, it does have to be sized appropriately, with a good amount of thought guiding where its power point is located. When a heat trace system is configured for a specific plant, there is going to be a home run or grid power connection point voltage drop somewhere. This location has to be well designed so that it is in a logical place. By paying close attention to this, engineers can be assured there are not more circuits present than necessary, reducing the amount of overall amp draw. A well-planned system will also reduce the amount of installation time required as well, ultimately saving on cost.

PROPER MAINTENANCE

Just as critical as proper installation and setup of a heat trace system inside of the power plant is the maintenance of it. Unfortunately, heat trace does, in fact, degrade over time. Generally, one will observe noticeable deterioration on the heat trace system between and five and ten years into its lifespan. These observations should not be taken

lightly. Power plant personnel should make a coordinated effort to check the health of the heat trace system on a regular basis, especially when nearing this period. Allowing preventative maintenance experts to gauge the relative health of the heat trace system that is in place will provide the plant with an opportunity to perform upgrades and repairs during scheduled outages. By taking advantage of scheduled outages for required maintenance on the heat trace system, the plant will maximise its ability to avoid unplanned outages due to deterioration.

APPLICATIONS

A growing trend in the industry is the use of wireless controls for their heat trace system. By utilizing wireless transmitters, operators are able to completely integrate their heat trace system into the vast amounts of data that is being monitored and analysed. This benefit is left on the table far too often. This practice comes with special considerations that must be accounted for. For example, sometimes when these systems are set up, there is an output with the heat trace that is simply going nowhere. An operator must understand what kind of integration or communication is associated with their particular heat trace system. If the heat trace is not communicating properly, the operator will have no real idea of what is happening. Most heat trace systems have an alarm functionality built into it. This allows a signal to be sent to the operator if a certain line is not functioning properly. There are many instances within power plants where an alarm is "sounding," but that information is not going anywhere, there is no way for the operator to know about it and address the situation. If

everything is working, an operator should not have to think about it, but it is not, he or she needs to know.

Another growing application of heat trace solutions inside of coal-fired power plants has to do with keeping the chute clean. Many power plants will spray down coal with a water-based chemical solution in order to cut down on dust. However, during colder winter months, this solution can often freeze in the chute. Power plant employees are then forced to dedicate valuable time to cleaning the chute, sometimes taking all day. This can be a costly, potentially dangerous job if not taken very seriously. As a solution to this widespread problem, a heat trace system can be carefully designed and installed to prevent the coal from freezing. This heat trace solution, if properly done, is a low maintenance solution to this issue as it only requires a cold-weather start-up once a year before the temperature begins to drop. This start-up can be incorporated into a plant's regular maintenance, and if done properly, will ensure the heat trace system works correctly in future seasons.

Heat trace technology is continually growing, and more applications are being discovered. Each application presents a unique set of challenges that must be overcome. However, the end result is a more efficient coal-fired power plant that communicates effectively with its operator.

In 2021 CO₂ emissions from coal-fired power plants rose to a record 9.7 Gt, representing an increase of nearly 6.6% from the previous year and more than 100 Mt above their previous peak in 2018. Without the supply constraints and soaring prices that affected China and India during certain periods of the year, global coal use for electricity generation in 2021 would have been even higher.

Given that no new coal plants have been fitted with carbon capture, utilisation, and storage (CCUS), the only emission

reductions are from efficiency gains. Some efficiency gains have been reported in China, though the increase is limited to around 0.2%.

To get on track with the Net Zero by 2050 Scenario, an annual average reduction of emissions from coal-fired power plants of around 8% is needed through to 2030.

In 2021 coal-fired power generation reached an all-time high, increasing by 8% and reversing the declining trend over the past two years. Coal served more than half of the additional power demand in 2021, growing in absolute terms faster than renewable energy for the first time since 2013.

The recourse to coal-fired electricity generation in 2021 was compounded by record high natural gas prices. The costs of operating existing coal plants across US and many European power systems were considerably cheaper than the operating costs of gas-fired power plants for the majority of 2021. Compared with 2020, coal-fired power plant emissions increased by around 16% in the United States and by 20% in the European Union. In India, coal-fired generation reached an all-time high, increasing by 13% above 2020 levels. This was in part due to strong demand growth and because the growth in renewables slowed to one-third of its average rate of the previous five years.

As a result, coal's share of total global generation rebounded above 36%. This is not on track with the Net Zero by 2050 Scenario, which calls for immediate reductions and a decline in unabated coal-fired generation of about 55% by 2030.

Russia's invasion of Ukraine and the ongoing energy crisis have forced the European Union and individual countries to take measures to reduce import dependency on Russia. Coal-fired production limits have been relaxed in France

and the Netherlands. Phase-out delays and the temporary reopening of idle plants are being discussed and/or have been approved in Greece, Italy, the United Kingdom, Germany and Austria.

Since the Paris Agreement entered into force in 2016, 21 countries have set phase-out dates before 2040 for unabated coal-fired electricity generation. As of the end of 2021, four countries had already completed their phase-outs: Belgium (2016), Austria (2020), Sweden (2020) and Portugal (2021). Of the seventeen remaining countries, twelve are from the European Union and the others are Canada, Chile, Israel, the United Kingdom, and New Zealand. These countries accounted for only 3% of global coal power generation in 2021, and almost half of that came from Germany. However, recent energy security concerns brought on by Russia's invasion of Ukraine have caused some European countries (Austria, France, the United Kingdom, and Germany) to temporarily turn to coal-fired power.

In the European Union, the Just Transition Mechanism comprises over USD 20 billion for a fair transition towards a climate-neutral economy, to support economic diversification and assist affected areas and workers. Germany designed a similar regional support programme offering compensation for losses faced by workers and companies, and also has a mechanism that offers tenders compensating plant owners in exchange for retiring coal capacity. In the United States, regulators have allowed accelerated depreciation schedules, backed by ratepayers, to support faster cost recovery for some coal assets.

At the UN Climate Change Conference COP26 in November 2021, a coalition of 45 countries plus the European Union, 5 subnational governments and 26 organisations signed a Global Coal to Clean Power Transition Statement, acknowledging coal power generation as the single biggest contributor to climate change.

The statement includes four commitments, one of which is to scale up technologies and policies to transition away from unabated coal-fired power generation in the 2030s in major economies (or as soon as possible thereafter) and in the 2040s globally (or as soon as possible thereafter). The signatories include twenty-three countries without any pre-existing phase-out commitment, among them major coal users such as the Philippines, Poland, South Korea, and Viet Nam. In total, the signing parties accounted for 12% of global coal-fired electricity in 2021.

A group of 25 countries and public finance institutions signed a UK-led statement committing to ending international public support for the unabated fossil fuel energy sector by the end of 2022. According to the UNFCCC, this could collectively shift an estimated USD 17.8 billion a year in public support away from unabated fossil energy. Additionally, several banks and financial institutions made commitments at COP26 to end the financing of unabated coal.

This announcement came shortly after similar pledges by China, Japan, Korea and the G20 to end the provision of international public finance for new unabated coal power generation abroad by the end of 2021.

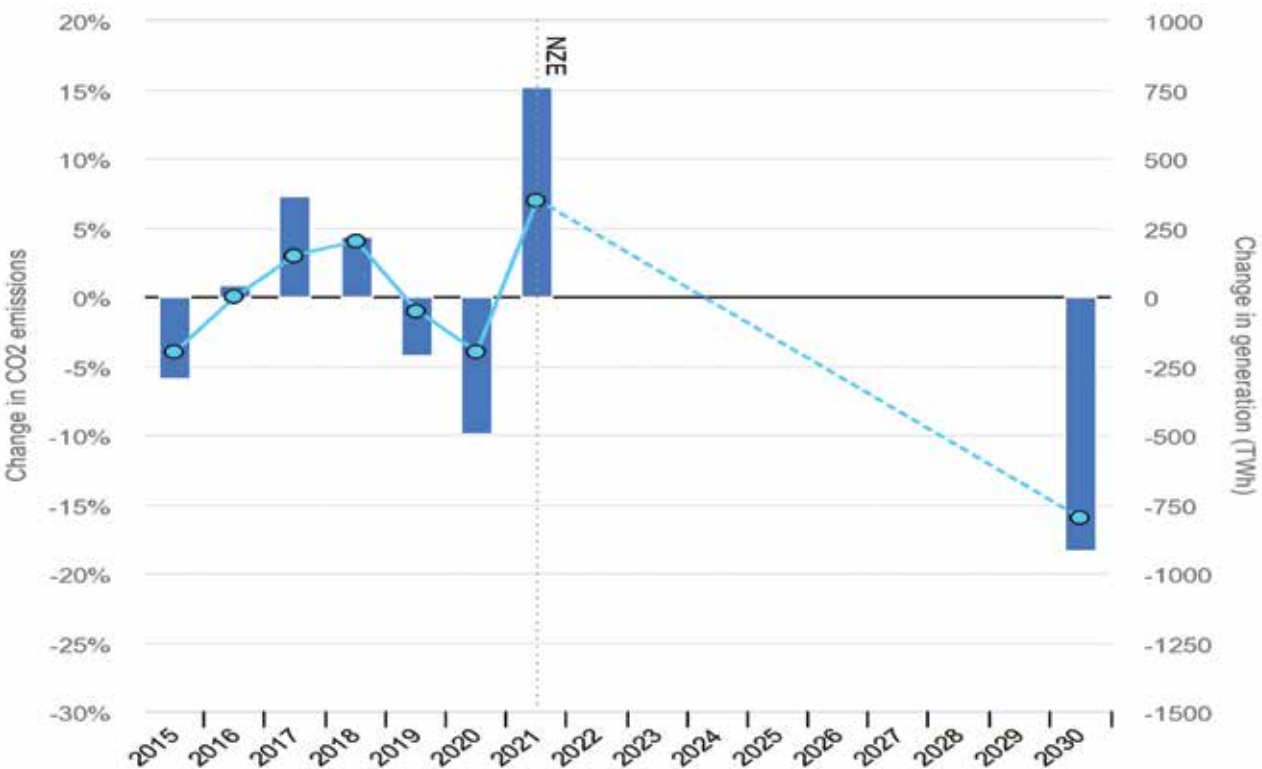
To help finance some of these efforts, the governments of South Africa, France, Germany, the United Kingdom and United States, along with the European Union, announced the Just Energy Transition Partnership (JETP) to support the decarbonisation of South Africa's coal-intensive economy. The JETP will mobilise an initial commitment of USD 8.5 billion, primarily focused on decarbonising the electricity sector.

Efforts to address emissions from the existing coal-fired power plant fleet, including those from the large, young fleet in emerging market and developing economies, are essential for reaching net zero goals. Governments and industry should consider a three-pronged approach in order to stay on track with the phase-out of unabated coal plants by 2040:

- **Retrofit** coal-fired power plants with CCUS.
- **Repurpose** coal plants to co-fire with low-carbon fuels.
- **Retire** less-efficient coal plants.

Phasing down and ultimately replacing coal in electricity systems in a secure and affordable manner requires a number of regulatory and operational changes, including actions to tap a wider set of smaller and more distributed sources for grid services.

Governments can accelerate CCUS deployment at coal-fired power plants through targeted policies such as a carbon price, grant funding for CCUS projects and tax incentives. In addition, increased funding for large-scale demonstration projects can help drive down costs and increase capture rates. Simultaneous support for CO₂ transport and storage infrastructure is also vital, and governments can play a key role in identifying and funding strategic CO₂ transport networks and storage sites.



Policy	Country	Year	Status	Jurisdiction
Social Contract for the Mining Industry	Poland	2022	Planned	National
Just Energy Transition Programme	Brazil	2022	In Force	National
Act to Reduce and End Coal-Fired Power Generation	Germany	2021	In Force	National
Special refinancing loan to support the clean and efficient use of coal to promote green and low-carbon development	People's Republic of China	2021	In Force	National
Bill on the prohibition of coal-fired thermoelectric 2020plants	Chile	2021	In Force	National
Guiding opinions on Promoting the Development of the West and Forming a New Pattern	People's Republic of China	2020	In Force	National

Given the dependence of a number of countries and regions on coal, the closure of power plants could have significant economic and social consequences. Coal-dependent regions are often highly specialised “mono-industry” areas, where the economy and the local identity are closely tied to the coal value chain.

Governments should manage closures appropriately and successfully by planning for the impacts on affected workers and communities by facilitating early dialogue with affected stakeholders and establishing the right financial mechanisms to ensure a just transition.

Ammonia, which does not emit CO₂ when burned, is an alternative fuel to reduce emissions from coal-fired power plants. In order to get on track with the Net Zero Scenario, the private sector should begin evaluating co-firing opportunities and conducting small-scale ammonia co-firing tests, with an eye towards commercial plant application in the coming years.

Meanwhile, co-firing sustainable bioenergy can allow coal-fired power facilities to continue contributing to flexibility and capacity adequacy while reducing CO₂ emissions. However, the biomass feedstocks used must be considered sustainable to ensure a net CO₂ emissions reduction from co-firing.

Andrew Minchener

International Centre for Sustainable Carbon, Reviewer

THE LARGEST COAL-FIRED POWER PLANTS IN THE WORLD



The list of the largest and most powerful coal-fired power plants in the world helps to imagine how important the role of thermal energy in the economy remains.

Although coal combustion is one of the most polluting ways to generate electricity, this type of power plant is still responsible for generating a significant share of electricity globally. The largest coal-fired power plants in the world are complex facilities that require billions of dollars of investment and maintain the energy balance of entire regions.

TUOKETUO POWER STATION (CHINA)

Tuoketuo Power Station is the largest coal-fired power plant in the world. It is located in Tuoketuo County, Inner Mongolia Autonomous Region, China. This huge power plant was commissioned in November 1995 by Tuoketuo Power Company. The company consists of several major shareholders such as Datang Power, Beijing Power and Huaneng Thermal Power. On February 25, 2017, after 168 hours of trial operation, the two 660 MW ultra-supercritical

units of the fifth phase were officially put into operation, bringing the installed capacity to 5,824 MW, and making it the largest coal-fired power plant in the world. At present, the installed capacity of Tuoketuo Power Station reaches 6,720 MW.

TAEAN THERMAL POWER STATION (SOUTH KOREA)

Taeon Thermal Power Station is a coal-fired power plant in Taeon County, Chungcheongnam-do Province, located on the shores of the Yellow Sea. Started in 1995 and expanding to date, this power plant is owned by the Korea Electric Power Corporation (KEPCO) but operated by a subsidiary of the Korea Western Power Company (KOWEPO). With an installed capacity of about 6.1 GW, Taeon was the largest coal-fired power plant in South Korea and one of the largest in the world at the end of 2021. It is generating tens of billions of kilowatt-hours of energy annually. With 31.4 million tons of CO₂ emissions in 2018, Taeon Thermal Power Station has become the fourth highest carbon emitting power plant on the planet. A coal gasification plant was built at the site of the power plant, which feeds a 300 MW combined-cycle power plant (CCGT), which was commissioned in August 2016. The total cost of the coal gasification plant and associated combined cycle power plant is estimated at \$1.14 billion.

DANGJIN POWER STATION (SOUTH KOREA)

Dangjin Power Station is a large coal-fired power plant, located on the coast of the Yellow Sea about 15 km northwest of the city of Dangjin. The Korea Electric Power Corporation (KEPCO) own the power plant. Construction work began in the late 1990s, but the station continues to expand. With a current installed capacity of 6,000 MW (after the completion of two large 1,000 MW power units in 2015-2016), it has become one of the most powerful in South Korea. The annual output of the power plant in 2013 exceeded 33 billion kWh. This facility uses modern technology to improve the efficiency of electricity generation. Units 5-8 use supercritical technology with steam temperatures up to 569°C. Units 9 and 10 already use ultra-supercritical technology with a steam temperature of 600°C, with an efficiency of about 45%.

TAICHUNG POWER PLANT (TAIWAN)

Taichung Power Plant is a coal-fired power plant located in the Longjing District of Taichung City on the west coast of central Taiwan. With a capacity of 5,500 MW, it was ranked as the world's most powerful coal-fired power plant in 2017. The operator is the state-owned Taiwan Power Company, which owns four other coal-fired power plants in addition to the Taichung power plant. The power plant consists of ten coal-fired power units, supplemented by four small gas turbine power units of 70 MW each. The first four power units with a capacity of 550 MW each were built in 1991 and 1992. Four additional units were added in 1996 and 1997 with a total capacity of 2200 MW. Units 9 and 10 (1100 MW each) were added in 2005 and 2006. The power plant emits more than forty million tons of CO₂ every year, which is comparable to the total CO₂ emissions of some European countries such as Switzerland. In 2016, Taichung Power Plant provided about 19% of all electricity consumed in Taiwan.

BEŁCHATÓW POWER STATION (POLAND)

Bełchatów Power Station is the largest coal-fired power plant in Europe that generates cheap electricity from lignite. The power plant with installed capacity 5,100 MW produces 20% of Poland's electricity. The facility is located in Rogowice, Łódź Voivodeship. The power plant emits the most greenhouse gases of any thermal power plant in the world, being highly inefficient in terms of CO₂ emissions per unit of electricity generated. In 2018, Bełchatów Power Station emitted 37.6 million tonnes of CO₂, more than New Zealand's total emissions. Bełchatów Power Station operates twelve power units, including eleven obsolete units with a capacity of 370-390 MW each, commissioned in 1981-1988. The station also has one more powerful and efficient power unit with a capacity of 858 MW, commissioned in 2011. In the second half of 2019, the oldest unit of the power plant, Unit 1, was decommissioned. In 2021, the authorities refused to build a lignite open pit at a nearby field, Złoczev. The lignite is currently mined from the nearby Bełchatów coal mine and transported to the power plant by conveyor belts. The predicted depletion of coal seams at previously developed deposits and the lack of agreement to develop another deposit make it necessary to close the thermal power plant in the 2030s.

YONGHUNGDO POWER PLANT (SOUTH KOREA)

Yonghungdo Power Plant is a thermal power plant in Incheon Province in South Korea, which is operated by the local company South-East Power Co. The facility uses coal and anthracite as fuel. Currently, the installed capacity of the power plant exceeds 5080 MW. The power plant is distinguished from similar facilities by its highly efficient and environmentally friendly equipment, aimed at minimizing carbon emissions. The facility provides about 23% of the electricity consumed in the region and plays a key role in the stable supply of electricity. Recently, the plant equipment has been enhanced by smart technologies and renewable energy sources, including a solar photovoltaic installation, a small hydropower plant, a range of wind generators and modern energy storage systems. This contributes to a more sustainable supply of energy to consumers and helps to reduce the environmental footprint.



Dangjin Power Station (South Korea).



Taichung Power Plant (Taiwan).



Bełchatów Power Station (Poland).

Applied fiber main dragline pendants surpass life of steel

Marion 8200 Super – During Applied Fiber Main Pendant Inspection 7th year in operation.

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ow entering their 7th year of service on a Marion 8200, as expected, Applied Fiber's Synthetic Fiber Pendants have surpassed the life of steel. The pendants are proving beneficial to both production and maintenance on the largest earth moving machines in the world.

Just recently, the first Dragline Main Fiber pendants installed in 2016 in Wyoming USA had their annual inspection and Applied Fiber was there to witness this milestone event. The pendants are performing even better than anticipated. Where some steel pendants are changed out as soon as every 5 or 6 years, the pendants on this Marion 8200 at NavTec energy appear "just broken in" and that they will far exceed double the life of the steel with numerous additional benefits.

"It's amazing, aside from some dust on the fibers and some grease on the fittings, the pendants almost look new," said the inspector of the pendants.

The first-installed set of cables have seen over 1350 peak load cycles daily which equates to over 5.6 million fatigue cycles in this time and they look amazing. The pendants

provide the machine, operator, and production a number of benefits, too.

MAINTENANCE AT CLOUD PEAK ENERGY NOW NAVTEC STATES:

The Applied Fiber pendants are a true step change in dragline technology. We converted the Marion 8229 in 2016, and 8233 in 2017, and a BE1570 lot 12 in 2018 – all of which have really smoothed out the machine operation.

On the first 8200, key 29, we effectively increased bucket capacity 2 cu yards (due to increase in soil density) and have had only limited issues operating for six years, a noteworthy change from prior years with steel pendants. The pendants make a huge difference the machine swings well and has noticeably less bouncing and vibration.

The second 8200 we installed the pendant on was getting beat up and we replaced the steel two years early and increased the payload by 5 cu yds (from 82 to 87 cu yds). Since installing the pendants on this machine four years ago the machine now operates much smoother due to the lack of pendant bouncing and overall system damping.

On the 1570, the machine is running much smoother with significantly less fatigue. We would typically see regular cracks in boom nodules #8, #10, and #14... creating



A Bucyrus 1570 Dragline Equipped with Applied Fiber Synthetic Main Boom Support Pendants.

1-2 weeks downtime a year. Since installing fiber pendants three years ago – we have had only minor cracking in this region. We estimate that we have already gained several weeks of production in the three years of operation with the fiber pendants.

Visitors can see the difference from a distance and our operators appreciate how much it quiets the machine movement down. One of our operators went from having numb hands at the end of a shift to having no issues – the difference both in the cab and outside the machine is very noticeable. Putting a low-mass dampener into the boom makes all the difference.

More production, less wear & tear, less downtime, and much smoother operation – NavTec is pleased with what these pendants have done for our draglines. We forecasted just under a two-year ROI and actual performance has met and in many cases exceeded our predictions."

Since the first install, several draglines in the US and in Australia have been upgraded to fiber pendants. All of these pendants are expected to surpass the life of steel and gain the additional benefits that Navtec achieved.



Looking down from the Boom Tip- Applied Fiber Pendants on Marion 8200 Dragline.



Installed Pendants at Boom Tip of Dragline in Australia.

TerrAffix helps UK reclaim landscape eroded and polluted by its mining past

TerrAffix Soil Solutions and the Coal Authority have successfully developed a new restoration treatment to dramatically address the soil erosion and pollution stemming from the UK's legacy of metal mining dating back to the Victorian era.

The company has been recently acquired by the RSK group, comprising 175 environmental, engineering and technical services businesses committed to the UN's Sustainable Development Goals.

TerrAffix has been working at the re-profiled Garrigill Burn spoil tip in Cumbria, within the North Pennines Area of Outstanding Natural Beauty and a UNESCO Global Geopark, at a height of 440 m above sea level (pictured left).

Technical Director Siôn Brackenbury said: "In the UK, there is a legacy of metal mining stemming from the earliest Bronze Age workings to extensive mining during the Victorian and Edwardian periods driven by industrialisation. By the early 1900s, most workings had closed, leaving a legacy of polluted spoil with significant metal deposits. These spoil heaps remain within the landscape as dune-like areas, progressively eroding and polluting the wider environment."

He added that, working with the Water and Abandoned Metal Mines programme (a partnership between the Coal Authority, the Environment Agency and Defra together with Nottingham and Swansea universities) the TerrAffix team was delivering a programme of research and development to institute techniques for the establishment of vegetation on spoil. This work built upon PhD and MSc projects

sponsored by the company and TerrAffix was able to call on the assistance of RSK group company Salix, which provided the biodegradable erosion control blankets for the trials.

Siôn said: "Only a year into the project, the vegetation is well-established on several plots, with roots achieving a depth penetrating into the spoil to bind the upper surfaces that were previously unvegetated, preventing erosion and providing new areas of habitat for invertebrates."

Dr Hugh Potter, Water and Abandoned Metal Mines Programme Manager at the Environment Agency, said: "Our monitoring showed that each year, about three tonnes of lead, cadmium and zinc was being washed into the River South Tyne at Garrigill, which causes serious pollution. The first stage of solving this problem was to re-profile the spoil heaps but that still left the highly contaminated wastes susceptible to erosion by rain. Working with TerrAffix, we have created biologically active soil to encourage the growth of plants that are native to the local area (pictured in the image, right)."

"The results so far on some of the trial plots are very encouraging. Hopefully, the techniques used



at Garrigill will help us to sustainably decrease pollution from other abandoned mines across England, while also promoting biodiversity and capturing carbon dioxide."

Different land restoration treatment formulations have been applied either by hydroseeding or manually. TerrAffix designed the solution using widely available plant biomasses, such as bracken plus amended biochars manufactured from forestry waste materials.

Siôn said: "These mine sites are very unfavourable to plant growth, since the soils have toxic levels of metals, are free-draining, often highly acidic and low in

organic matter. The TerrAffix treatments are creating soils that encourage the distinctive "Calaminarian" (metal tolerant) plants to grow – these are priority habitats for biodiversity."

He added: "These landscapes botanically have much in common with coastal grassland, supporting species such as sea thrift and sea campion, as well as some typical acid grassland species. Work being undertaken within Wales is looking at the genetic profile of plants adapted to metal mine conditions to see if they differ from their counterparts growing in non-contaminated areas."



China's strategy to produce hydrogen from coal does not support long-term decarbonisation goal, experts say

- Two-thirds of the 33 million tonnes of hydrogen produced in China in 2020 was produced from coal, emitting 360 million tonnes of carbon dioxide
- o A shift to low-emission production of hydrogen is crucial to China achieving its goal of becoming carbon neutral by 2060, report says

China's approach to produce hydrogen from coal and deploying carbon capture technology will help to enlarge supplies of the clean fuel and reduce emissions, but it is detrimental to the country's long-term goal of transitioning to net-zero, climate experts say.

As China aims to raise the share of hydrogen in its energy mix to achieve carbon neutrality by 2060, a shift to low-emission production of hydrogen is crucial, according to a report jointly published by the International Energy Agency (IEA) and the Administrative Centre for China's Agenda 21.

"Equipping existing hydrogen production facilities with CCUS [carbon capture, utilisation and storage] is a key strategy to reduce emissions and enlarge the country's low-emission hydrogen supply," the report noted, referring to the suite of technologies which can capture and make effective use of the high concentrations of carbon dioxide emitted by industrial activities.

Since many of the existing coal-based hydrogen plants in China were built recently, they could be in operation for decades to come. Deploying CCUS in existing fossil fuel-based hydrogen plants,

especially in regions with abundant coal, access to carbon storage and limited renewable energy availability can help produce hydrogen with low emissions and at low cost, the report said.

In addition to coal, which accounted for two-thirds of China's hydrogen production, natural gas-generated hydrogen or "blue hydrogen" accounted for 19%, while "green hydrogen", the cleanest way of producing hydrogen by splitting water through electrolysis powered by renewable energy, accounted for only 1% in 2020 due to high costs and nascent technologies, according to the China National Coal Association.

China is the only country producing hydrogen from coal at significant scale. At the end of 2021, almost 47% of the global hydrogen production is from natural gas, 27% from coal, 22% from oil and only around 4% comes from electrolysis, according to the International Renewable Energy Agency.

The cost of coal-based hydrogen is also cheaper than green hydrogen. The average cost of producing hydrogen from coal with CCUS is currently between US\$1.4 to US\$3.1 per

kilogram, while the cost of blue hydrogen ranged from US\$3.1 to US\$9.7 per kg, depending on the origin and availability of the electricity, according to the IEA.

Deploying hydrogen production and CCUS together can be mutually beneficial and reinforcing, according to the report. CCUS-equipped hydrogen production is likely to be a cost-effective way for China to acquire low-emission hydrogen. Similarly, applying CCUS to hydrogen production can support early CCUS scale-up, the report added.

"Using CCUS to assist fossil fuel-based hydrogen production to significantly reduce carbon emissions may be an opportunity in the short term, but relying too much on it is dangerous," said Shen Xinyi, a researcher at Helsinki-based think tank the Centre for Research on Energy and Clean Air (CREA).

Investing in the wrong infrastructure will lead to "carbon lock-in", a situation that can seriously imperil climate action when fossil fuel-intensive systems perpetuate, delay or prevent the transition to low-carbon alternatives, she said.

Other experts said that

China must use CCUS to assist hydrogen production as a transition strategy from the current fossil fuel-reliant hydrogen industry towards a renewable-based one.

"Eventually, the hydrogen production route has to be closely bundled with renewable energy," said Lin Boqiang, director of the China Centre for Energy Economics Research at Xiamen University.

Electrolysis is likely to predominate hydrogen production from the 2030s, eventually accounting for as much as 80% of China's hydrogen supply by 2060 because of declining costs of electrolyzers and renewable energy, according to the IEA. In the long term, renewable-based hydrogen is expected to fall to around US\$1.5 per kg.

Still, to accelerate the development of China's hydrogen industry, more policy guidance is needed to consider renewable-based hydrogen as the main method rather than supplementing fossil fuel-based production, according to Shen from CREA.

"China needs hydrogen energy to achieve its dual-carbon goal, and only green hydrogen can achieve this," said Shen.



Predicting coal and gas outbursts with early warning systems



Scientists from China have collaborated on a new paper to identify better gas outburst detection methods to significantly improve safety in mining. The authors have presented a novel deep-learning-based system for early warning and prediction of mining disasters.



OUTBURSTS IN MINING

Safety is a primary concern for mine operators and companies. Mining disasters have historically claimed the lives of many mine workers, and while safety has substantially improved in the past few decades, disasters still occur and cost the global industry millions of dollars each year.

Gas outbursts are a particular problem in mineral extraction such as coal mining. Much research has been carried out to help develop strategies to reduce the instance of these disasters over the past decades, with no major gas-related accidents being reported in 2020. However, gas outburst-related disasters have recently increased in China.

Researchers have paid particular attention in recent years to gas accident characteristics to create more effective prediction methods. Multiple studies have tackled issues with different approaches, including numerical modelling and algorithms.

It is difficult to accurately predict outbursts due to several real-world factors, including errors and delays in prediction results. To improve models and enhance onsite decision-making, influencing factors must be obtained in real-time. Designing reliable and accurate systems which can predict disasters is crucial for mine operators.

CHARACTERISTICS AND INDICATORS OF MINING OUTBURSTS

Outbursts are complex, dynamic processes that are caused by gas and pressure. They can also be triggered by mechanical and physical coal seam properties.

Outbursts proceed in four stages:

- Where they evolve
- Form
- Develop
- Terminate

Gas emission quantities undergo dynamic changes during



an outburst. Several indicators can be used to analyze gas emission characteristics and predict the probability of disasters before they occur. Accurate analysis improves the reliability of systems.

USING NEURAL NETWORKS TO ASSESS GAS AND COAL OUTBURTS IN MINES

Artificial intelligence is increasingly being utilised in the mining industry to perform tasks that would otherwise be laborious and unreliable when using human operators. Employing neural networks to analyze gas and coal outbursts improves real-time detection and prediction. This, in turn, significantly improves safety for mine workers. Neural networks can help circumvent issues with real-time delays in parameter capture.

GAS OUTBURST STUDY USING DEEP LEARNING AND NEURAL NETWORKS

The authors have considered gas emission as a main factor due to its easily attainable real-time data. Moreover, gas emission characterises the entire process of gas outbursts. The research has proposed a deep learning and neural network-based approach to providing accurate early warning capabilities for mining operations to improve worker safety and mitigate equipment and economic losses for mine companies.

A total of six indicators were used in the research to detect gas outbursts. The methods employed provide accurate information on the dynamic gas outburst process and can characterise variations.

Two indicators, MAPE and RMSE, demonstrated the neural network and machine learning method's accuracy. By calculating the combined differences between each of the six indicators, the proposed evaluation model was developed. The novel was based on a Recurrent Neural Network.

The system was applied to a previous outburst disaster that occurred in China in 2021. The early warning indicators were thoroughly evaluated in the paper. Using historical data, the model detected abnormal gas emission changes four days before the disaster happened. Further gas emission data from other mines was used to verify the accuracy of the proposed early warning system.

Frequent orange warnings were initiated by the model, demonstrating the sensitivity of the early warning system to gas outbursts. Continuous red warnings were also initiated over the period of a few days before the simulated disaster occurred.

Abnormal changes were successfully detected and captured by the model. Furthermore, the model confirmed that gas emission quantities undergo abnormal changes right before an accident occurs, which agrees with established occurrence laws.

IMPROVING THE EARLY WARNING OF GAS OUTBURSTS

The novel early warning system developed in the research has the potential to significantly improve mine safety by accurately and reliably predicting gas outburst accidents before they claim the lives of workers and destroy equipment. In coal mining, gas outbursts are a critical occurrence that can lead to reduced productivity and profitability for mines.

The deep learning and neural network-based model has been verified on real-world historical gas outburst accident data, attesting to its powerful ability to prevent disasters in the future. Along with other disruptive technologies such as automation and data connectivity in mines, this system will help to significantly improve the safety, productivity, and economic viability of coal mines in the future.

Written by: Reginald Davey



A brief guide to mining equipment and its uses



Mining is an important part of the modern world since most consumer products these days require the use of mined minerals. Additionally, coal and uranium also provide a huge contribution to the nation's energy and nuclear power supply. With a demand that large, it should not be a surprise that mines can be found in all countries. **Since mining is so essential for modern life, mining equipment is also in high demand.** Different types of heavy equipment are used in the mining industry to meet the requirements of mining operations. Coal International highlights a range of equipment available to the modern mine.

Mining can either be done underground or at the surface level. There are a few different factors that determine the type of mining that is required and what equipment will be needed for it. These factors include the type of material you will be mining and the environment you will be working in.

There are three main steps involved in the mining process. They are:

EXTRACTION

In the extraction process, there is drilling, blasting, and digging involved to remove material from the mining site.

MATERIAL HANDLING

The second step in the mining process involves sorting and loading material. The material then goes to either the waste area or the processing site.

MATERIAL PROCESSING

The last step of the process includes grinding, refining, and smelting the mined ore and turning it into the final finished products at an off-site plant.

Heavy Equipment Used in Mining

There are a lot of diverse types of equipment that are used at a mining site. This can include everything from large mining trucks and dozers to electric rope shovels. While mining trucks and loaders were made specifically for this industry, **there is other equipment used in mining that was not designed specifically for the industry.**

WHEEL LOADERS

When it comes to picking up and moving material around on a mining site, there is not anything that can do it like a large wheel loader. Wheel loaders are extremely versatile, and as the size of the machine increases, so does the capacity of its bucket. This means that the load capacity increases as well. While they are able to manage heavy loads, it is important that you match the loader's capabilities with the material's density and volume.

MOTOR GRADERS

Most mines do not have any direct access to roads. You will find that even the mines that are near huge roadways need to have separate roads built within the area to move

material and transport mined goods outside the site. Motor graders can be found working around mining sites to make these roads, and people in the mining industry often search for used graders for sale in maintaining these roads as they are known to be reliable machines. This type of equipment also ensures that the roads are properly graded at all times and have proper drainage. Since motor graders maintain the roads that are used to transport material around the mining site, they are crucial for ensuring efficient mining operations.

DRAGLINES

These are huge excavators with a bucket that collects material from the ground and dumps it elsewhere on the site. Draglines are used a lot in surface mining as they can move and prepare the surface. These excavators are great for the job as they create less emissions than other removal methods and can also cut into high walls and remove material.

MINING DRILLS

Accurate drilling helps make every other aspect of a mining operation smoother, safer, and more productive. Even minor deviations from the pattern can have a significant



impact, with unevenly blasted material that is harder and more costly to manage, resulting in a higher cost per ton for the entire operation.

With high precision and more accurate depth tracking, autonomous drills can work far more accurately to plan. That means more accurate blasting and better-shot material, less time spent removing overburden, and higher productivity. New generation mining drills are available in a variety of feed lengths, boom configurations and carrier size class are productive solutions for all mining types. When you need to meet your drilling and blasting needs at the lowest cost per meter drilled, these powerful and reliable systems make P&H drills your best choice. The powerful and rugged rotary carriages can provide ample torque and bit loading through the toughest rock conditions in the world.

There has been the development of new-age underground jumbo drill rigs as well. The rigs are equipped with up to four booms, covering cross-sections. This comes with a reliable Direct Control System, DCS, or with the computerised Rig Control System to which various levels of automation may



be added. Several models of the face drill rigs are available with an optional zero-emission battery-electric driveline.

A BRIEF LOOK AT INDIA AND EQUIPMENT NEEDS

India possesses significant mineral resources, ranking among the top ten global producers of mica, barites, coal and lignite, iron ore, chromite, bauxite, and manganese. During 2018, India mined 95 different minerals from 1,531 mines. In 2017, India produced an estimated \$17 million in minerals (excluding atomic minerals).

Coal production leads the Indian mining industry, accounting for 78% of total mineral sector production. India's coal reserve is estimated at 301.5 billion tons (10% of global reserves). India's demand for coal continues to increase to meet the needs of coal-based thermal power plants and the steel industry. The coal mining industry accounts for about 80% of India's demand for mining equipment used for open pit mines, which account for 90% of India's mining operations. The most attractive niche sector for U.S. exports is high-end, specialised coal mining equipment.

India allows 100% foreign direct investment (FDI) in mining and exploration of non-core minerals like gold, silver, and diamonds, as well as in oil exploration and captive mining of coal and lignite and in coal processing (washing and sizing). India allows 50% FDI through joint ventures with a public-sector unit. To meet energy demand, India is upgrading the equipment and technologies used in many of its mines, particularly in the coal sector.

Many mining projects across the country were stalled by court cases, environmental, regulatory and land acquisition issues and general delays in government decision-making in past several years. Given that the new coal block allocation process started early in 2018, and Coal India received a healthy procurement budget to issue tenders for new mining equipment in 2019, we anticipate growth in the mining industry and higher demand for new mining equipment.

OPPORTUNITIES

Coal India Limited (CIL) is the single largest coal producer in the world. CIL operates 369 mines (174 underground, 177 opencasts and 18 mixed) and produced 567 million ton of coal from April 2017 to March 2018. It produced 606 million ton of coal during the period of April through December 2018. It also operates 15 coal washeries (11 coking and 4 non-coking). The Ministry of Coal directly administers CIL. CIL also oversees the activities of Central Mine Planning and Design Institute Ltd. (CMPDIL), which acts as a centralised planning organization assisting in mining operations and design. CIL runs a large fleet of 5100 heavy earth-moving machineries including 35 draglines, 695

shovels, 2781 dump trucks, 969 dozers, and 675 blast-hole drills. The details of current CIL tenders and investment opportunities, as well as an explanation of the procurement process, are available at .

CIL has 114 ongoing coal mining projects which are under various stages of implementation. Eleven coal blocks have been allotted to subsidiaries that have a combined capacity to produce more than 100 million tons of coal per annum. Four additional coal mining projects with a capacity of 24.60 million ton per annum and total capital investment of \$593 million were approved by CIL. To enhance production, CIL will be seeking to improve railway links, modernise its technology (exploration augmentation, introduction of high-capacity equipment, operator independent truck dispatch system, introduction of continuous miner technology on large scale, long wall technology at selected places), and increase coal washing operations.

NMDC Limited is India's largest iron ore producer and exporter, mining over 30 million tons per year from its three fully mechanised mines. It has been provided with targets by the Ministry of Mines to increase output to 75 million tons by 2020. NDMC is acquiring new mining leases in iron ore, coal, and diamonds.

Two other government-owned companies in South India – Singareni Collieries Ltd. in Andhra Pradesh, and Neyveli Lignite Corporation in Tamil Nadu – are important end-users of coal mining equipment. In the private sector, Tata Iron and Steel Company Ltd. (Tata Steel) in Jamshedpur, Jharkhand, continues to be a major buyer of equipment for its captive coal mines. India's private sector power utility companies like Reliance, CESC, Jindal Steel, and Tata are also working on projects to develop, own, and operate captive coal mines which will require the latest technologies



and equipment. Other large mining companies in India include Essel Mining, Rungta Mines, Orissa Minerals Development Company, Vedanta Resources, Hindalco, and Steel Authority of India.

Small-scale opportunities exist in the used equipment market, despite the lack of a common trading platform. Mining equipment rental is slowly growing. While companies with large fleets like Quippo, Sanghvi Movers, and ABG are entering the market, small fleet owners (less than 10 machines on average) still provide most services.

Given the competitive landscape that is evolving the mining industry is seeing a demand for digging to greater depths. For mining companies to remain competitive, this will require further innovative designs and technologies that improve the capability, efficiency, and reliability of mining systems responsible for sensing, analysing, extraction, and refinement. Manufacturers are now coping with the demand and coming with machines that fit the terrain requirements. Discussed below are some most common types of equipment used in mining.

EARTHMOVERS

Several types of construction equipment are used in the mining sector such as hydraulic excavators, wheel loaders, backhoe loaders, bulldozers, dump trucks, tipplers, graders, pavers, asphalt drum/wet mix plants, breakers, vibratory compactors, cranes, forklifts, dozers, off-highway dumpers, drills, scrapers, motor graders, rope shovels, etc. This equipment performs a variety of functions like preparation of the ground, excavation, haulage of material, dumping/laying in a specified manner, earthmoving, material handling, road construction etc. Among all the equipment employed in the mining sector, earth moving equipment is most widely used. Most used



earthmoving equipment that is used to help move earth and excavate the land in mining are excavators, backhoe loaders and dump trucks.

The new generation excavator has a cab for an operator and can be driven using wheels, or the more familiar tracks. An excavator can be used for many types of construction jobs and fitted with special attachments most suitable for each project. Excavators are used in mining to remove earth and materials like coal. They work by digging with a hydraulic arm and hauling away with a bucket. Many different types of excavators are used in both small- and large-scale mining operations.

Backhoe Loaders are also employed in several mining works. Modern loaders are designed to achieve greater operating hours due to a robust structural design and modular components, provide the best possible fuel consumption levels due to the power regeneration capacity of the Hybrid Drive technology, and are equipped with the latest safety features that meet global requirements recognised by leading mining industry safety councils.

Dump trucks are also used as earth moving equipment in mining. Modern dump trucks come with customised cylinder engines designed to ensure excellent driving characteristics, high reliability, and excellent fuel efficiency. The engine's power is available virtually from idling speed, which ensures excellent starting traction. This power stays with you throughout and maximum torque is available high up the rev range. A wide economic speed range of 1050-1600 rpm helps to get the maximum fuel efficiency.

CRUSHING EQUIPMENT

Modern crushing equipment is engineered to deliver the highest productivity in mines, quarries, and civil engineering projects and offers advanced, proven screening and crushing equipment for any size-reduction challenge. Whether you are producing several sized aggregates or crushing tons of hard rock ore, modern equipment delivers the robustness and versatility you need.

From large primary jaws and gyrators to cone and impact crushers for tertiary

and quaternary finishing, modern crushing equipment is manufactured to meet your material reduction requirements. The crushers are built to perform with the lowest cost per ton, featuring a unique combination of crusher cavity design, crushing forces, reliability, and safety. Chambers with heavy, durable plates or jaws are the main components of most crushing equipment. After the raw material is fed into the crusher, the plates come together to reduce the size. These heavy-duty plates move both up and down, creating enough force and pressure to reduce the size of the material significantly. Crushing equipment is specially configured to break down the hard rock matter or gravel to a manageable size for transportation or conveying. They are valuable pieces of equipment in the industry because they reduce the costs associated with the handling of larger sized material and also ensure efficient liberation of elements of interest in downstream processing of the material.

BELT CONVEYORS

Belt conveyors are used prolifically throughout the mining industry, carrying ores, concentrates, and tailings throughout every stage of the mining cycle, from initial excavation, through beneficiation, to the production of a refined material ready for market, and each step in between.

Belt conveyors are customised and combined in an endless array of configurations, making each handling system as unique as the material it carries. The diverse configurability of belt conveyors has made them essential in feeding process operations, transporting material to the storage, and navigating material through load-out.



They can automate otherwise-arduous tasks, reduce labour requirements and human-material interaction, and effortlessly manoeuvre through difficult terrain and spatial restrictions. There are several types of conveyors, namely, in-plant, overland, pipe, shiftable, extendable, and relocatable and underground.

FEEDING EQUIPMENT

When faced with the material of varied sizes and densities, from dry and abrasive to wet and sticky, you can count on our feeders to convey it efficiently and consistently to the next stage in your process. Modern feeding equipment is engineered and designed with an intense commitment to quality and attention to detail, providing many years of service life.

In modern feeding equipment when the plate feeder works, the electromotor and the reducer drives the sprocket with alveolus structure to rotate, so that the hauling chain that engages with the chain wheel will drag the material through in which there are materials to move forward. The supporting device-hauling chain moves on the thrust wheel and the riding wheel props with the conveying through to bear the weight of the materials and the running devices. The materials are pushed from the storage bin above the tail to the conveying trough and move along with it to the chute mouth with housing and then are discharged. Feeding equipment is ideally suited for feeding large, lumpy, abrasive, and heavy materials during wet, sticky, or frozen operations. The rugged equipment and parts, as well as carefully selected maintenance and optimization services are the preferred choice for material handling in minerals processing operations around the world.

SCREENING EQUIPMENT

Screening equipment caters to any mineral processing application. From single-screen panels to double trommel screen configurations, modern equipment has screening equipment to suit your mineral processing requirements. Modern screens are injection moulded or hand casting a combination of high-quality materials. They are added with specialised aperture configurations which reduce



Screening equipment.



Mineral Feeding Equipment.

pegging and blinding. Modern screens come in two different configurations: a sloped screen design, which is ideal for high-capacity sorting operations, and a linear screen design that allows the unit to double as a conveyor or feeder.

Modern models produce a unique gyratory vibration motion that creates a more even product distribution, and it can be extremely useful in separating materials with different shapes in different angles. The unit's easy-tension screening material allows operators to make minute adjustments without extended downtime. These models of rectangular screeners and separators are designed and oriented to improve mining materials processes by separating different materials sizes as well as de-dusting mining materials from unwanted undersize particles.

AUTOMATED EQUIPMENT

Apart from conventional equipment the need for precise details has enabled the need for automated equipment in mining. The advances in mining equipment are very promising. Incorporating automated systems that offer greater productivity, proposing modern technologies to aid in the discovery and accurate quantifying of deposits, and



systems capable of real-time analysis to increase efficiency and profitability, all stand to not only change but modernise the entire mining industry. Some of the pivotal ones are explained.

Drone – The new Elios drone is the first drone outfitted with a rotating carbon fibre protective frame, or cage, which protects the propellers, camera, and drone body from damage as well as keeping it stable in the air upon collision.

Blasting machine – New advancements in micro-explosives used in conjunction with computer-assisted-design and timing look promising to reduce the dangers associated with blasting. Using micro-explosives would also result in greater control fragment size – reducing the cost, time, and energy requirement for downstream crushing and grinding.

Battery operated drill rig – This is capable of drilling blast patterns more quickly and accurately than any human or human operated equipment, unlike their diesel or gas counterparts, do not produce harmful exhaust fumes. Battery powered drill rigs also reduce the maintenance costs and if equipped with rapid chargers, or replaceable batteries, would contribute

to the long-standing need of creating continuous mining operations.

Underground ore carriers – These are being outfitted with radar and laser scanners that allow them to navigate in the dark through areas that pose breathing hazards. Advancements in battery technology are leading to the development of battery electric vehicles (BEVs) for mining – both above and below ground.



Sandvik AutoMine drilling system.



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Boom or Bust



Global Energy Monitor's 'Boom and Bust Coal 2022' report finds that after rising in 2020 for the first time since 2015, total coal power capacity under development declined 13% last year, from 525 gigawatts (GW) to 457 GW, a record low. 34 countries have new coal plants under consideration, down from 41 countries in January 2021.

Global coal plant capacity under development shrank 13% in 2021, according to Global Energy Monitor's eighth annual survey of the coal plant pipeline, but steeper cuts are needed to achieve climate goals.

According to a Rystad Energy analysis, if the conflict in Ukraine continues and gets worse, coal production in Europe could increase by 11% in 2022. But, even in the context of the war in Ukraine, the European Commission insists on the need to continue the decarbonization of the energy system, to achieve the climate goals, set for 2030 and 2050, mainly reducing the greenhouse gas (GHG) emissions.

Where are the European countries in the goal of giving up coal in the context of the war in Ukraine?

The European Commission prioritises energy efficiency, but also wants to build an energy sector that is mostly based on the 'smart' integration of renewable sources, while quickly distancing itself from coal and gas, for the decarbonization of the energy sector. The Transition Fund under the European Green Deal is aimed at the most economically and socially disadvantaged territories in the face of the energy transition, and in particular the coal-dependent ones.

CALLS TO ACCELERATE THE END OF COAL IN EUROPE

An analysis by Climact indicates that the European ambition of strengthening the climate goal in 2030 would lead to a decrease in coal use to 2% of EU's energy mix (compared to 17% in 2020).

According to Ember (an energy think tank that uses data-driven insights to shift the world from coal to clean electricity), in the next decade, renewable electricity generation will almost double to deliver nearly 60% of EU electricity by 2030. This growth is driven by wind and solar, which will account for at least 40% of supply. Despite this progress, fossil fuels are still expected to generate about 25% of EU electricity by 2030, with coal power only halving over the next decade and no plan to reduce fossil gas. As a result, the EU is not on track to deliver the EU Commission's recommended 55% reduction in total emissions by 2030. To achieve this target, progress needs to be made in seven key countries and wind and solar deployment plans must increase by a third.

The United Nations' Intergovernmental Panel on Climate Change (IPCC) warns that if humanity continues to rely on planned and existing fossil fuel infrastructure, then we are set to face a dangerous three-degree temperature rise by mid-century.

Their most recent report released in early April 2022, entitled 'Mitigation of Climate Change,' found that our current emissions cutting actions are indeed having a positive impact. Nevertheless, a massive rollout in ever more powerful and efficient renewables will not be enough. Key to our remaining pathways towards successful climate action is the closure of all existing coal-fired power plants in Europe and throughout all OECD nations by 2030 while

calling a halt to any planned additional coal and fossil gas infrastructure. Followed by the closure of nearly all coal-fired plants worldwide by 2040.

Lately, several European Member States have announced coal phase-out targets. According to a 2019 report by Europe Beyond Coal, 15 European countries (EU and non-EU) have announced such a target by 2030 (UK, Ireland, France, Italy, Portugal, Denmark, Sweden, Finland, Greece, Austria, Slovakia, Hungary) or after 2030 (Germany).

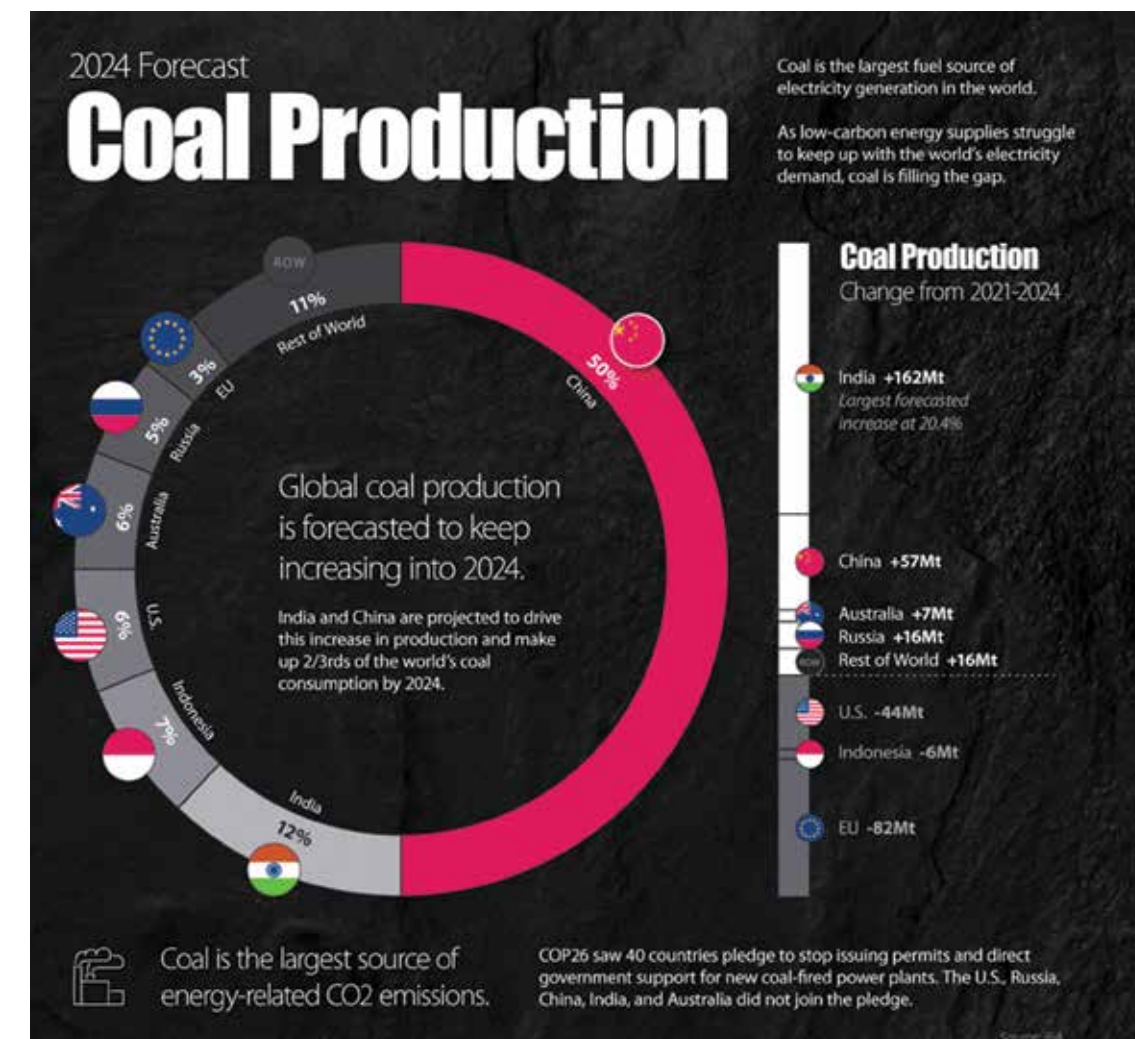
For several countries (Norway, Iceland, Belgium, Switzerland, Albania, Estonia, Latvia, Lithuania, and Cyprus), the report did not mention any coal-fired power plants in operation. Since the date of this report, other seven countries (22 in total) have made new announcements in this respect.

Poland announced on September 8, 2020, an update to its 2040 energy strategy, targeting the development of nuclear power (a capacity of 6 to 9 GW) and wind power (of 8 to 11 GW offshore). Therefore, coal share in power generation, currently 75%, would amount to 37%-56% in 2030 and 11-28% in 2040. It should be noted that Poland will benefit from the Transition Fund the most.

In the **Czech Republic**, the new government announced on January 7, 2022, that it would gradually give up coal by 2033, through a strategy to decarbonise the heating of buildings.

In **Germany**, former chancellor Angela Merkel had stated in April 2021 that coal phase-out was planned for 2038 at the latest, as provided in its 2019 Climate Plan. Economy and Climate Minister Robert Habeck did not exclude however the postponement of coal and nuclear power elimination, saying that "there are no taboos" in such discussions.

In **France**, in April 2019, the Minister for Ecological Transition presented a roadmap for closing, by 2022, the last coal-fired power plants, closure provided in the Climate Plan. It was based on a report prepared by RTE (Power Transmission Grid), which presents additional analyses on the power demand-supply balance in France during 2019-2023. Moreover, the energy-climate law provides for a cap for greenhouse gas emissions, as of January 1,



2022, for power generation facilities based on fossil fuels, which emit over 0.55 tons of CO2e per MWh. The issued decree allowed stopping two of the last four coal-fired power plants in Metropolitan France. Due to the reduced availability of the nuclear fleet with the shutdown of Chooz and Civaux reactors, a new decree was published, for an exceptional derogation from the GHG emissions cap for the two power plants operational, and then a decrease in this cap.

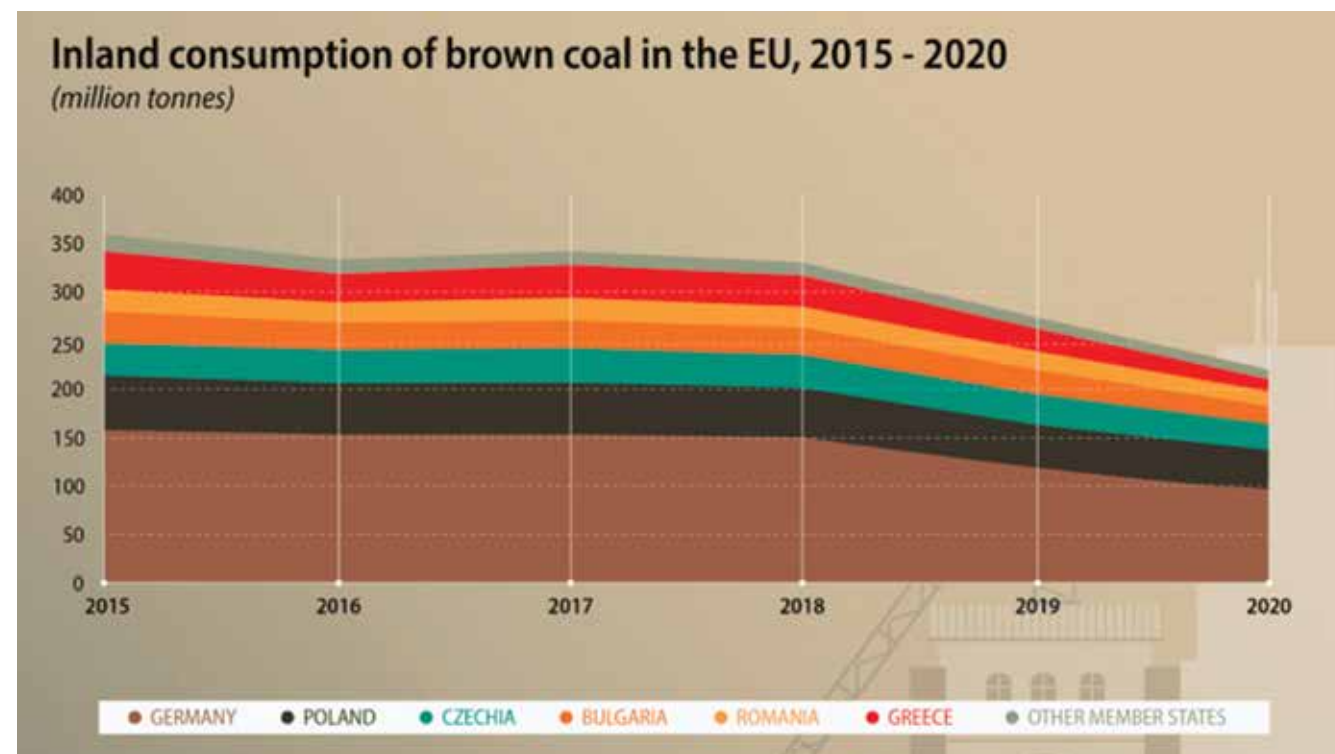
The UK on June 30, 2021, indicated that it planned to reach its target of shutting down coal-fired power plants in October 2024, i.e., a year ahead.

ROMANIA TO RESTART COAL-FIRED POWER PLANTS

Currently, hydropower plants in Romania have a total capacity of 6,644 MWh, i.e., 35.8% of the total. Hydrocarbon-based (gas, heavy fuel oil) power plants have a total power of 2,835 MW (15.4%), nuclear reactors – 1,413 MW (7.6%), photovoltaic panels – 1,393 (7.5%) and biomass power plants – 106.8 MW (0.6%).

Romania will have to restart, in force majeure regime and temporarily, coal-fired power plants, this solution being aimed at achieving energy independence in the shortest possible time, Environment Minister Tanczos Barna says.

Romania's net coal production totalled, in the first 11 months of 2021, 2.958 million tons of oil equivalent, being



IEA forecasts.

by 17.5% (440,800 toe) higher than in the similar period of 2020, according to data centralised by the National Institute of Statistics (INS). In the mentioned period, Romania imported 440,600 tonne of net coal, by 38,700 toe (9.6%) more than the quantity imported the year before in the similar period.

The National Commission for Strategy and Prognosis (CNSP) estimated for 2021 a coal production of 3.020 million toe, up 9.9% compared to 2020, and imports of 370,000 toe, down 12.1%. For 2022, CNSP forecasts a production of 2.935 million toe, down 2.8%, and imports of 270,000 toe, decreasing by 27%.

According to the National Energy Strategy, total coal production will plunge from 32 TWh in 2030 to 12 TWh in 2050, continuing the trend of diminishing coal use in the energy mix (45 TWh in 2020).

For 2030, the modelling results in the chosen Optimal Scenario show that the energy produced from coal will register a slight decrease, to 15.8 TWh, and will have a share of 20.6%.

Thermal power plants in Romania are on average 44 years old, the oldest being Paroseni, commissioned in 1964, and the newest – unit 2 of Craiova thermal power plant, in 1989. 17 coal mining exploitations are still active in the country, but some of them are in the process of being closed. The oldest coal mine in Romania, opened in Petrila in 1859, was closed in October 2015. The following should take advantage of EU's new policy: Complexul Energetic Oltenia (company that is titleholder of the mines in Oltenia basin, plus the three lignite-

fired power plants: Turceni, Rovinari and Craiova) and Complexul Energetic Hunedoara (titleholder of hard coal mines in Jiu Valley and the power plants in Deva and Paroseni). Complexul Energetic Oltenia will give up coal starting with 2026. Only three groups, totalling 1,000 MW, will be maintained as strategic reserve, until 2030. Coal-fired energy will be produced only if needed.

The International Energy Agency (IEA) has published a report on the state of the world's coal in 2021, which showed a recovery in coal consumption related to the post-Covid-19 crisis, including in Europe. The IEA has forecast a decline in coal consumption in Europe and the United States between 2021 and 2024 (through an increase in renewable energy and a return to gas), but offset by a sharp rise in Asia, mainly in China and India.

As this report was published before the conflict in Ukraine, these forecasts have become partially outdated, at least for Europe, given the consequences of the conflict on fossil fuel prices, especially gas, and on the evolution of EU Member States' supply options.

GEOPOLITICAL CRISIS: BEYOND THE CLIMATE PROBLEM, EU'S ENERGY SOVEREIGNTY

The European Commission on March 8, 2022, announced a plan to make the EU independent from Russian fossil fuel imports way before 2030. In addition to gas, the statement highlights the importance of coal imports from Russia (which account for 45% of imports). Thus, the EC states that "following the invasion of Ukraine, the case for a rapid clean energy transition has never been stronger and clearer".

However, in the face of a very sharp rise in the price of imported fossil fuels, coal remains a short-term alternative for several Member States and other European countries. Thus, according to the international media, the planned closure of some coal-fired power plants in Germany and the UK has already been postponed. On March 24, 2022, the German government announced the possibility of "suspending the planned shutdown of certain coal-fired power plants".

For its part, Italy is considering whether it is necessary to use other energy sources, such as coal.

In France, the Émile-Huchet thermal power plant from Saint-Avold (Moselle), whose shut-down was initially scheduled for March 31, 2022, could exceptionally be used in the following winter as well.

5 KEY ELEMENTS TO UNDERSTAND HOW THE INVASION OF UKRAINE WILL AFFECT THE ENERGY TRANSITION IN EUROPE

On March 24, 2022, researchers at the European University Institute's School of Transnational Governance published an analysis that identifies five key elements for understanding how the invasion of Ukraine will affect the energy transition in Europe.

1. In the short term, rising energy prices could encourage a temporary rise in GHG emissions related to energy production.
2. The crisis could strengthen the desire to save fossil fuels, by energy efficiency and using renewable sources.
3. The crisis emphasises even more the need for a fair transition from a social point of view.
4. While the Member States consider, in this context, major changes in the rules of the European energy market and of the regulated electricity market in particular, researchers point to the unwanted risks for the stability of these markets and investments and emphasise the importance of a high carbon price signal.
5. Even with the development of low-carbon energy, the EU will still have to import green hydrogen, rare earths and materials needed for batteries and renewable energy.

Written by: **Rona Rita David**

NEWS, PLANT AND EQUIPMENT

Queensland joins fight against thermal coal tax

The Queensland Resources Council (QRC) is the latest body to slam proposed thermal coal export taxes.

The Federal Government announced the proposed taxes in a move the NSW Minerals Council called a harmful broken election promise.

Now, QRC has called for cool heads and common sense to prevail over politics.

"Introducing a new mining tax on the resources sector, on top of the billions in taxes and charges coal and gas companies already pay to state and federal governments, will kill off investor interest in future resources projects in Australia, it's as simple as that," QRC chief executive Ian Macfarlane said.

"The resources sector

is already Australia's highest company taxpayer by far, and on top of that companies pay substantial royalties, taxes and charges to state governments.

"Companies will simply walk away from investing in Australia if government taxes keep going up."

Macfarlane advised the Victorian and New South Wales governments to "take a leaf out of Queensland's book" and develop their own gas fields to meet the growing needs of their populations in an effort to reduce power prices.

"Queensland had the foresight to develop its coal seam gas fields 20-plus years ago, which involved local and international companies investing billions of dollars into expanding the gas industry,



to the enormous benefit of Australians living and working on the east coast now," he said.

Macfarlane said introducing a new energy tax would be the last straw for international investors and cripple any chance of Australia becoming the 'energy superpower' it has the potential to be.

He said that if the proposed tax goes ahead, investors would be likely to direct their capital into projects in other countries instead of Australia.

"Companies need stable government policy settings so they can make responsible, long-term decisions on behalf of investors," Macfarlane said. "Moving the goal posts once a project is already financed and off the ground is poor form and poor practice, and a clear disincentive to future investment."

"Introducing new taxes is not an issue the resources sector will take lying down, and we will fight it every step of the way."

What is gravity energy storage?

Australian start-up Green Gravity recently announced it will work with coal miner Yancoal on a test site for the new green energy technology, but how does gravity energy storage work?

The elevator pitch for Green Gravity's energy storage solution is fairly simple: "(it) harnesses the fundamental principles of gravity and kinetic energy to store and dispatch energy by lifting and lowering heavy-weighted objects".

In other words, gravity energy storage involves lowering weights from a significant height to convert potential energy into carbon-free electricity.

"Like pumped hydro, we use the gravitational potential energy of a mass moving between two heights. However, rather than water between two dams, Green Gravity requires much less space by using very dense materials," Green Gravity said on its website.

"To overcome friction, a vertical height available from a mine shaft is used rather than an incline on the

side of a hill."

The idea is to raise the weights when excess renewable energy is available (ie when solar power is at higher levels around the middle of the day), and then lower them at the moment the power is needed.

Green Gravity, a new company started by former BHP executive Mark Swinnerton, aims to produce energy by using the technology in the hundreds of old mine shafts that lay dormant across Australia.

The first cab off the rank may be the 108-year-old Austar coal mine near Cessnock in New South Wales, which has been in care and maintenance since 2020.

Green Gravity and Yancoal have signed a Memorandum of Understanding (MoU) to start a pre-feasibility study to determine whether the technology could work in decommissioned ventilation shafts. The study is expected to conclude next year.

"This study represents an outstanding opportunity for Green Gravity and Yancoal

to identify

new economic potential at the former Austar mine site, add regional jobs, demonstrate re-use options for legacy coal mining, and deliver a better environmental outcome," Swinnerton said.

"Successfully identifying the best method of fitting gravitational technology at the former Austar mine site will create a template for beneficial re-use of legacy mining sites for Yancoal, and for thousands of other mines around the country.

"By re-using mining assets, costs can be kept low. By using gravity as the fuel, we dispense with consuming the critical water, land and chemicals which other storage technologies rely on."

Green Gravity's technology is similar to concepts used by other companies, but according to Swinnerton, the fact his company uses disused mine shafts, rather than purpose-built towers, is an advantage.

"They have to build a tall building hundreds of metres high and suspend tens of thousands of tonnes at the

top of the roof," he said.

"It is going to have to be a fairly big set of steel beams with good geotechnical engineering and everything else to make that work.

"I don't have to do any of that. I can dispense with the construction of a building and simply use what was already there – a hole that somebody else already drilled and used and is now redundant."

This type of renewable energy storage could represent something of a 'holy grail' for the resources sector in that it does not require the significant investment in land, water and chemicals that other storage technologies may need.

"Decarbonisation of the energy system needs rapid deployment of renewable energy. To manage the inherent variability of renewables, energy storage must be added to our electricity grids," Green Gravity said.

"Our technology solution utilises conventional mechanical components to enable low-cost energy storage to be installed at legacy mine sites."



Stanwell and Anglo American in green energy deal

Anglo American's steelmaking coal business in Australia will be powered by 100% renewable energy from 2025, as part of a 10-year deal with Queensland government-owned energy generator, Stanwell.

In what will be Stanwell's biggest ever retail deal, the company will supply Anglo American with renewable electricity, powering their five steelmaking coal operations across Central Queensland's Bowen Basin.

Premier Annastacia Palaszczuk said the Queensland Energy and Jobs Plan was answering the call of businesses and industries wanting to decarbonise, while delivering huge investment in the regions and 100,000 more good jobs.

"This partnership with Anglo American and Stanwell demonstrates the strong shift to clean energy from Queensland businesses," she said.

"Stanwell is one of Queensland's major energy

suppliers, and until recently has been known only for coal-fired energy generation."

The deal will power all electrical equipment at Anglo American's mines in Moranbah, Middlesbrough and Moura, including draglines, longwall equipment, conveyors, coal preparation facilities, lighting and ventilation and cooling infrastructure, water treatment plant and administration facilities.

Anglo American chief executive in Australia, Dan van der Westhuizen, said the energy supply would effectively remove all Scope 2 emissions from Anglo American's steelmaking coal business in Australia from 2025.

"Securing 100% renewables from Stanwell is a major step towards our target of carbon neutral operations in Australia – and globally – by 2040," he said.

"Many of the metals and minerals we produce – including steelmaking coal

– are critical to supporting decarbonisation projects and the transition to renewable energy, as an essential component of solar, wind, hydro, bioenergy and hydrogen power generation.

"We are committed to playing our part against climate change, including through renewable energy use and accelerating a number of technologies to abate our on-site emissions, from electrifying our mobile equipment to capturing the methane from our steelmaking coal operations.

"I am delighted that we have been able to support Stanwell Corporation in its investment in 650MW of renewables capacity for Queensland, which will result in this mutually beneficial arrangement that brings both environmental and economic benefits compared with our current energy mix and provides a large investment in renewable energy generation for Queensland."

Stanwell CEO, Michael

O'Rourke, said the agency was pleased to be able to provide Anglo American with a bespoke, new energy solution.

"Stanwell is able to secure flexible and secure agreements like this one, because of our extensive pipeline of renewable energy projects," he said.

"Stanwell Energy is unique in its approach when it comes to its service offering. Our dedicated account managers work with customers to develop tailored energy contracts that provide flexibility, security, and access to renewable options.

"Our energy team is committed to sourcing renewable energy projects that allow us to provide exceptional value to our customers."

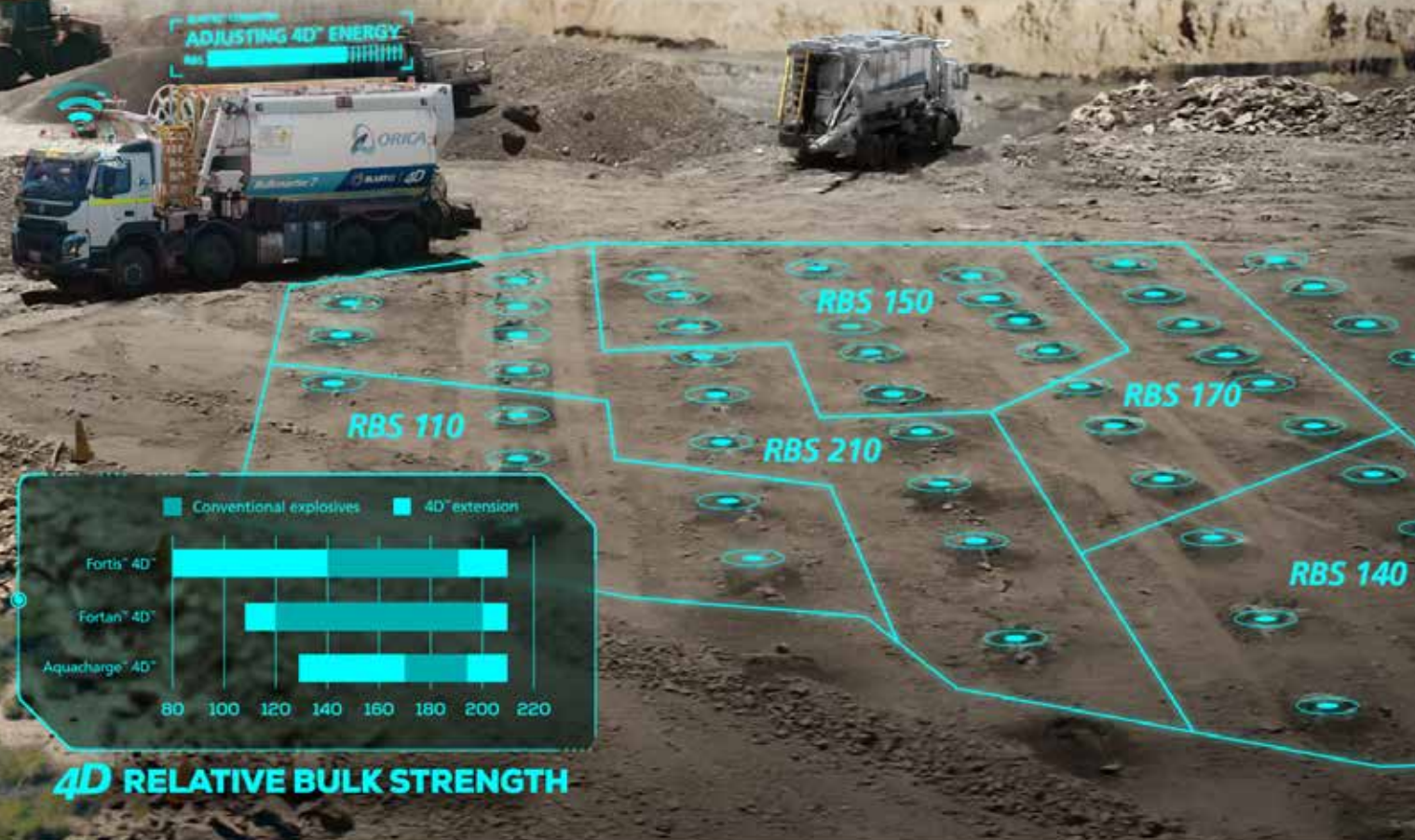
The partnership with Anglo American Steelmaking Coal Pty Ltd will be linked to renewable energy from the Clarke Creek Wind Farm and Blue Grass Solar projects.



The Austar coal mine is home to a number of decommissioned ventilation shafts.

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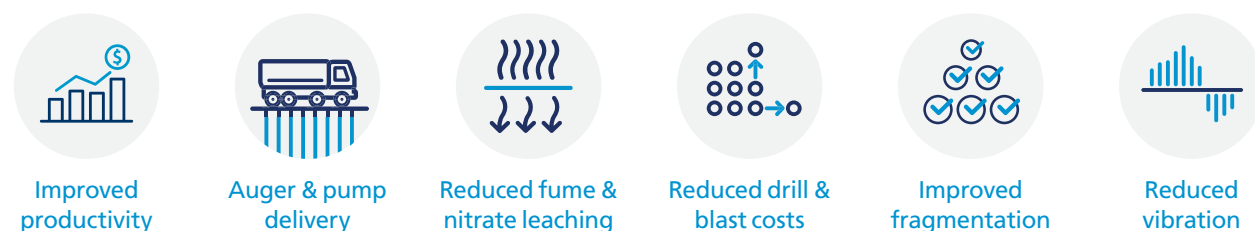
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ORICA

A new advanced bulk explosives system by Orica is gaining traction as one of the world's leading mining and infrastructure solutions providers demonstrates how the technology can intuitively tailor energy matched to geology in real time.

In most cases, the total energy in a blast hole charged with gassed emulsion products is limited by the physics of hydrostatic compression and the presence of water. The latest 4D™ bulk explosives technology from Orica overcomes these limitations by controlling and changing the final density of gassed emulsion products. The 4D™ system, which is currently available to the surface mining segment, offers an increased range of energies, delivering up to a 43% reduction in relative bulk strength and 23% more energy for soft rock applications.

Manufactured by an upgraded Mobile Manufacturing Unit (MMU™) equipped with Orica's LOADPlus™ process control system, 4D™ simplifies the job of the blast designer by offering a greater range of relative bulk strength while maintaining the required sensitivity and performance. In soft, wet ground, the 4D™ bulk system is able to offer low energy, waterproof options for blasting without bulky density modifiers such as polystyrene or organic material.

As relative bulk strength depends on formulation, conventional products with the same average in-hole density may not deliver the same energy. This leads to differences in energy factor when loading wet and dry hole products in the same blast. With 4D™, blast designers can now select the required 4D™ energy irrespective of hole conditions and ensure product quality and consistency as a result of the automated manufacture and loading processes.

In softer geology, the lower energy can be used to reduce over-blasting in soft, wet ground resulting in lower explosives consumption and a reduction in overall blasting costs. Improved vibration control and a reduction in post-blast fume can also be achieved with the technology's ability to match the required energy to geology in wet conditions.

By matching energy to the rock profile, mines can achieve a more consistent muck-pile with improved excavation productivity. Sites with long sleep times benefit from the technology's ability to auger-load low energy, water-resistant 4D™ explosives into dry holes, providing insurance from adverse weather events.

The 4D™ system is the culmination of Orica's advanced range of technologies, including Orica's proprietary emulsion chemistry that enables rapid chemical sensitisation and significantly lower densities to be achieved and maintained. Central to the 4D™ innovation is an upgraded fleet of Bulkmaster™ and Pumpmaster™ MMU™, equipped with a new chemical gassing system and an upgraded LOADPlus™ smart loading system.

A 4D™ capable MMU™ also integrates with Orica's next-generation blast optimisation platform, BlastIQ™ that synthesises as-loaded blast data to drive continuous improvements in blast quality control and assurance. Additionally, with a suite of advanced applications that seamlessly interface with the BlastIQ™ such as SHOTPlus™, blast designs can be wirelessly transferred to the MMU™ to streamline hole loading, making manual input and errors a thing of the past.

When used holistically, these technologies can offer mines greater flexibility, control, accuracy and efficiency in blasting, with domains being identified across the bench based on historical drill and blast records, from measure-while-drilling data or prior benches.

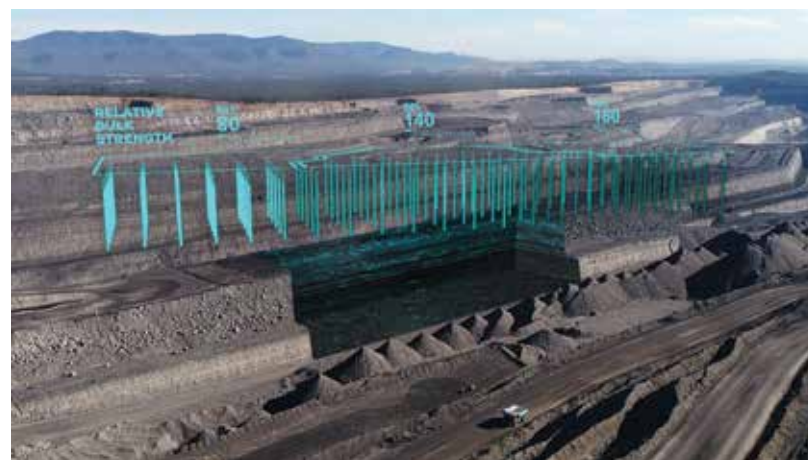
In a year since 4D™ made its debut, Orica have loaded and fired more than 5,000 tonnes of 4D™ products in blast holes as deep as 50 metres. Numerous sites in Australia and Asia that have used 4D™ have experienced lower explosives consumption with no fume events or other environmental exceedances. In anticipation of the growing demand for 4D™ as a staple in the bulk explosives systems portfolio of mine operators, Orica has stepped up preparations for the



Unique emulsion blended with porous prills enables augered explosives loading in dry and dewatered holes which is much faster than pumped loading.



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4D™ enables the seamless matching of the required energy to rock strength, to target the desired blast outcomes.

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Are prices driving high energy costs?

In what has been described as “the biggest clash between the mining industry and Federal Government in more than a decade”, Australian coal miners are set to launch a multimillion-dollar advertising campaign against a proposed cap on coal prices.

The news comes after the Australian Energy Regulator affirmed its belief that soaring coal prices are driving high energy costs.

The federal Treasury has recommended the Federal Government temporarily place a cap coal and gas prices to help drive down energy prices.

“The energy price increases are ... significantly reducing the profits of many businesses and raising questions about their viability,” Treasury said in a statement recently.

“This would suggest to us that interventions that directly address the higher domestic thermal coal and gas prices are more likely to be optimal.”

But the Minerals Council of Australia (MCA), whose members include major coal players BHP, Glencore and Whitehaven, has previously argued against the idea that coal is behind spiking Australian energy costs, instead placing the blame on

gas and renewables.

MCA chief executive Tania Constable has indicated her organisation is “already having discussions with the government” about potential interventions and an ad campaign would be about “standing up for families, standing up for small businesses across regional Australia”.

“We can’t afford to see jobs go in regional Australia,” she said. “When bad policies emerge, the mining industry is going to look at those individually and as a whole and what sort of impacts they’re having.”

Constable said it was misleading to place the blame on coal.

“If a price cap of \$70 per tonne of coal is introduced by the government, most mines dedicated to a power station will not be able to meet the costs of production,” she said.

“The vast majority of coal production for domestic use is mined at sites dedicated to the domestic power stations and serviced by dedicated supply infrastructure, such as conveyors from the run-of-mine plant to the power-station fuel stacks. Each generator also has specific needs around coal quality, ash, and energy content and

trace elements.”

Constable said coal pricing for domestic power stations depends on the commercial relationship between the mine and the power station, reflecting the cost of mining and transport. It is supplied under contracts with price, quality and volume conditions, with terms measured in years.

“It is worth noting that the energy security issues that emerged in early June were as a consequence of mechanical failures in generation, taking out almost half the available generation capacity in the market, not a shortage of coal,” Constable said.

“Specifically, the electricity price and supply security crisis in June was the result of a shortage of electricity generation when mechanical failures forced more than 10 generator units across Victoria, New South Wales and Queensland to shut down.

“This drove the electricity price escalation in Australia, which resulted from a shortage of electricity supply, not a shortage of coal or high international coal prices as a result of the Ukraine–Russia conflict.”

The Australian Energy Regulator, however, sees the situation differently. The government body believes rising international demand

and prices for Australian coal, which have soared to more than \$US400 a tonne in 2022, can also have a significant impact on wholesale electricity prices.

The regulator told Nine newspapers it monitors coal

market prices because they “impact electricity prices in the national energy market”.

“(The Australian Energy Regulator) said one driver of power prices came when more coal than usual was bought on the spot market after domestic supply was reduced by wet weather,” the papers reported. “This meant soaring international coal prices were unusually influential in driving up wholesale prices.”

The MCA is not the only resources organisation planning a campaign in defence of coal.

The Queensland Resources Council (QRC) recently announced it was launching a large-scale media campaign to warn about the potential impact of a proposed thermal coal tax.

The ‘Keep Queensland Competitive’ campaign will be launched on behalf of the state’s entire resources sector.

“The Queensland Government has severely damaged the state’s international reputation as a reliable place for resources investment by more than doubling the coal royalty tax rate to the highest in the world, without warning and without consultation,” QRC chief executive Ian Macfarlane said.

Support for Australian coal has also come from international sources, with Japanese ambassador Shingo Yamagami recently emerging as a vocal critic of the Queensland Government’s decision in June to introduce a tiered royalty rate many say is aimed at cashing in on record coal prices driven by Russia’s invasion of Ukraine.

“Japanese coal companies are yet to see any glimmer of hope that the situation will improve,” Yamagami told the QRC’s annual forum in Brisbane.







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