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2024 U.S. Longwall Census

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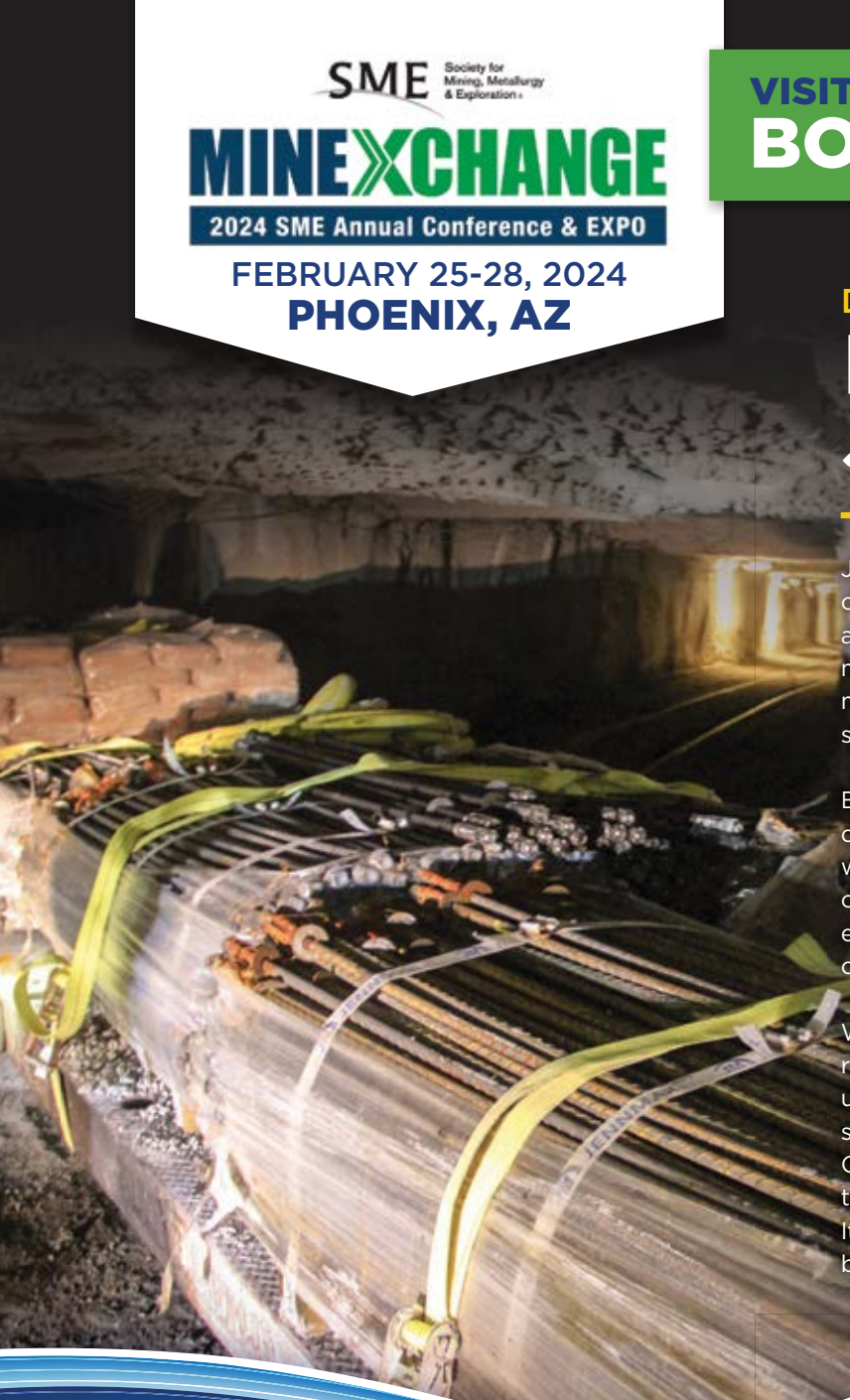

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THIS ISSUE

In this edition, Coal Age *publishes its annual U.S. Longwall Census. On the cover, Cullen Medley, Director of Maintenance, stands before Allegheny Metallurgical's new longwall at the Longview mine in West Virginia. He has been the heart of longwall design-build team, making eight trips to Europe to work with Famur, Kamat, Thiele, EEP, HBT and others on the project. (Photo: Allegheny Metallurgical)*

DEPARTMENTS

Dealing With a Big Disconnect

By Steve Fiscor
Publisher &
Editor-in-Chief

Welcome to the first edition of 2024. The Top 10 Coal Producing States and Regions table (see News, p. 7) provides production data from the Energy Information Administration and it indicates 572 million tons as of December 23, 2023. With an additional eight days remaining in the month, total coal production could be extrapolated to 585 million tons or more. The U.S. still mines a lot of coal.

It's also wintertime here in the northern hemisphere and much to everyone's surprise bitter cold has set in again. The banter about reliability is heating up with grid operators wringing their hands over how they will provide reliable power when their gas and renewable sources fail. Nothing says energy security like a large coal stockpile.

The U.S. is not alone in this conundrum of being blessed with natural resources and unable to use them. During December, the Canadian Province of Alberta had to beg Saskatchewan for a couple of hundred megawatts (see World News, p. 9). Alberta is blessed with abundant resources, including coal, natural gas and oil sands. In pursuit of unattainable climate goals, it retired much of its fossil fuel-fired capacity and Saskatchewan did not. This is happening in a lot of places.

This edition also carries an article about Sev.en Global Investments (see p. 16). I had the opportunity to discuss investment strategies with the CEO Alan Svoboda. Sev.en GI is investing in 'ESG-deprived industries.' That's climate speak for fossil fuel industries. Many banks and investment firms no longer want to be associated with coal because it runs counter to their environmental, social and governance (ESG) mandates. They have been green shamed by the anti-carbon movement into placing their money elsewhere. As they abandon these industries, someone must run the power plants and provide coal to the steel mills. Wealthy private investors are buying these assets and providing the liquidity they need, because they can see the long-term value.

When it comes to ESG and sustainability, let the record reflect that Arch Resources' Leer coal mine in West Virginia was the first mine of any type to achieve Level A verification for the Mining Association of Canada's Towards Sustainable Mining initiative (see News, p. 7). With all the battery-electric mining equipment running on hydroelectricity in Ontario, a coal mine in the U.S. set the standard. Hats off to the Leer mine!

As this edition was going to press, Alliance Resource Partners released its Q4 2023 results (see Leading Developments, p. 5). In it, the company's CEO Joe Craft said, …we should all take notice that grid planners have nearly doubled 5-year load growth forecasts…" Where will this power originate? Renewables can't keep pace and permitting delays will likely prevent new capacity from coming online anytime soon. The world is facing a big disconnect with reality when it comes to future energy demand and production, and it needs to find ways to burn coal more cleanly.

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Alliance: 2024 Production Mostly Sold

Alliance Resource Partners, L.P. saw total revenues increase $146.7 million to a record $2.6 billion during 2023, primarily due to higher coal sales revenues. Coal sales prices and coal sales revenues for 2023 were higher by 8.6% and 5.1%, respectively, compared to 2022.

"For the 2023, we once again delivered record revenues and net income, relying upon the strength of our well-contracted coal order book and the resilience of the entire ARLP team, who persevered through volatile market challenges and difficult mining conditions," said Joe Craft, chairman, president and CEO for Alliance. "Our strategic relationships with our long-standing customers were evident during Q4 2023 as we contracted an additional 12 million tons for domestic deliveries over the 2024-2028 time period at attractive, escalating prices, bringing our committed and priced order book for 2024 to more than 90% of expected shipments.

"We believe the worst of the adverse geological conditions, which delayed development of a new district at Mettiki, idling the longwall there for essentially the entire second half of 2023, are behind us," Craft said. "With the longwall at Mettiki resuming production in late December 2023, we are expecting production in the first quarter of 2024, for our Appalachia operations, to compare favorably to the first quarter of 2023."

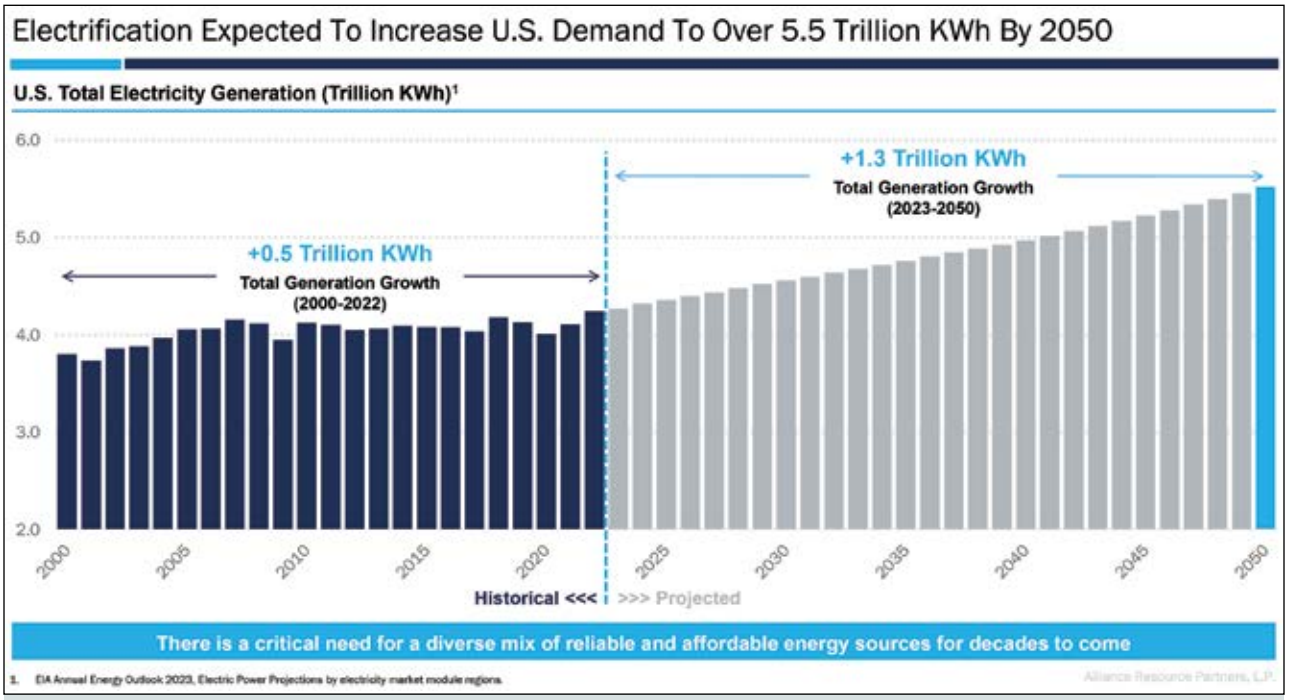
Alliance's coal sales prices per ton declined in the Appalachian and Illinois Basin (ILB) regions compared to 2022. Lower export pricing for ILB reduced coal sales prices by 4.2% in ILB. In Appalachia, coal sales price per ton decreased by 14.1% compared to 2022. ILB coal sales volumes increased by 2.1% compared to 2022. Tons sold decreased in Appalachia due to lower recoveries, fewer operating units at MC Mining, the difficult geology at Mettiki, customer plant maintenance and a longwall move at the Tunnel Ridge mine during Q4 2023.

The company ended 2023 with total coal inventory of 1.3 million tons, representing an increase of 800,000 tons compared to the end of the 2022.

"As we look to 2024, our coal sales book is expected to be equally as strong as last year and be the anchor to deliver another record year of revenues," Craft said. "Our dependability and the reliability of our coal quality is highly valued by our customers, evidenced by the premium pricing we have received, relative to the spot market, on recent commitments with domestic customers for multi-year contracts. We are entering 2024 with more than 90% of our coal sales volumes committed and priced at similar levels relative to 2023. We are expecting our production to be more consistent in 2024, believing we have moved beyond the several negative geological areas that we faced in 2023."

Last year, Alliance produced 34.9 million tons compared to 35.6 million tons in 2022. For 2024, the company is forecasting ILB volumes of 24.5-25.8 million tons, and Appalachian volumes of 9.5-10 million tons for a total of 34-35.8 million tons.

"We expect to complete the major infrastructure projects at Tunnel Ridge,



With the demand for electricity expected to increase by more than 1 terrawatt by 2050, Alliance believes the premature closure of coal-fired power plants will be delayed. (Source: EIA)

Hamilton, Warrior and the River View complex in 2024," Craft said. "ARLP will start to recognize the benefits from these strategic investments in 2025 as total capital expenditures will be significantly lower and these mines will be more productive, ensuring we maintain our position as one of the most reliable, low-cost producers in the eastern United States over the next decade. We are forecasting domestic natural gas prices to rise in 2025 as new LNG terminal capacity comes online.

"As we think about the outlook for the coal industry and the markets we serve, we should all take notice that grid planners have nearly doubled 5-year load growth forecasts in support of ongoing investments in U.S. industrial and manufacturing sectors, as well as rising energy needs associated with datacenters and artificial intelligence," Craft said. "While the speed of electrifying the transportation sector may have slowed, the enthusiasm for AI has accelerated.

"We remain confident in our projections for sustained coal demand for Alliance and the likelihood that the premature closures of coal-fired power plants in the eastern U.S. will be delayed," Craft said.

AQC Assembles Finances to Restart Dartbrook in Australia

Australian Pacific Coal Ltd. (AQC) announced that the Dartbrook Joint Venture, comprising AQC and Tetra Resources Pty. Ltd, has finalized a 3-year, $60 million debt facility with Vitol Asia Pte. Ltd., to restart the Dartbrook mine in New South Wales, Australia.

The terms of the binding debt facility agreement, first announced at the end of November, were finalized and executed following a substantial period of due diligence. The $60 million facility will cover forecast restart expenditure at Dartbrook through to first coal, including equipment acquisitions and completion of remediation works, and the acquisition of additional mining systems during ramp-up to achieve full capacity.

"This is a landmark event for AQC, our shareholders, and the Dartbrook mine," said Ayten Saridas, interim CEO for AQC. "The $60 million restart funding package we have agreed with Vitol opens the door for Dartbrook to restart production after 18 years in care and maintenance.

"Our ability to secure debt funding for Dartbrook during a period of high inflation and global tension is testament to the quality of the project, the vision and work ethic of the team of people

— *Leading Developments Continued on Page 10* —

Sasol Makes Improvements in South Africa

South African coal operator, Sasol, recently reported that mining productivity for H2 2023 was 6% higher than the same period in 2022, and Secunda Collieries' productivity was 5% higher. "Although we have seen an improvement in productivity rates since the implementation of our 'full potential program,' we experienced a challenging [Q4 2023] where productivity declined by 8% compared to [Q3 2023]," the company said. "The lower productivity was attributable to safety related incidents and operational challenges, including more difficult geological conditions than expected and delays in availability of mechanical spares for infrastructure maintenance. The latter was especially prevalent in December 2023. This resulted in a total loss in production of approximately 394,000 metric tons (mt)."

Phase two of the full potential program started at Shondoni Colliery in [Q3 2023] and Thubelisha Colliery in [Q4 2023]. "We continue to focus on complex-wide initiatives to improve cutting time, minimize production losses and actively evaluate operational factors to improve coal quality," the company said.

The coal stockpile at the Secunda Operations (SO) was 1.9 million mt at the end of 2023. An external coal purchasing program to supplement production continues to help meet SO coal volume and quality requirements. "Our Integrated Coal Quality Management Center has been operational since October 1, 2023, and as a result we have seen some improvement in coal quality supplied to SO by monitoring and managing variabilities," the company said. "However, this was not sufficient to mitigate the lower production in [Q4 2023], which negatively impacted coal quality with reduced blending capability. We continue to progress towards a final investment decision later in CY24 in relation to a destoning solution to improve coal quality."

Export sales improved in H2 2023 by 16% compared to the prior year driven by increased productivity at Thubelisha Colliery and lower volume of product diverted to the SO market.

Coal production for Sasol's South African operations was hindered by issues with safety, geology and spare parts in Q4 2023. (Photo: Sasol)

ACNR Idles Lila Canyon Indefinitely

The Lila Canyon underground coal mine, located near Price, Utah, has been idled indefinitely, according to the *Salt Lake Tribune*. A WARN notice filed with the Utah Department of Workforce Development said that as many 150 employees could be laid off by January 19, 2024. The longwall mine, which is operated by Emery County Coal Resources, a subsidiary of American Consolidated Natural Resources (ACNR), suffered a fire in September 2022 and it has been unable to recover from it. In 2021, Lila Canyon produced nearly 3.5 million tons per year, according to data from the Mine Safety and Health Administration (MSHA). While some of the coal was exported, most of it was consumed by the Hunter and Huntington power plants in Utah.

Lila Canyon (above) suffered a fire in September 2022 and has been unable to recover. (Photo: ACNR)

MSHA Issues Final Rule for Written Safety Programs

The U.S. Mine Safety and Health Administration (MSHA) published a final rule that requires mine operators to have written safety programs for surface mobile equipment, excluding belt conveyors, at surface mines and the surface areas of underground mines. The agency requires that mine operators develop programs, implement them, and update them when necessary. The written safety program must be developed and updated with input from miners and their representatives. The written safety program must include actions mine operators will take to identify hazards and risks to reduce accidents, injuries, and fatalities related to surface mobile equipment.

In recent years, powered haulage equipment and machinery have been the leading causes of serious and fatal mine accidents. "Given the number of serious and fatal machinery and powered haulage accidents that have occurred in recent years, MSHA has worked hard to issue this final rule to enhance safety protections for miners working with and around surface mobile equipment," said Assistant Secretary for Mine Safety and Health Chris Williamson. "As MSHA works with the entire mining community to implement the new rule, we strongly encourage everyone to prioritize training and to identify and eliminate machinery and powered haulage hazards that can put miners' lives and livelihoods at risk."

The agency said the final rule offers mine operators flexibility to devise a safety program that is appropriate for their specific mining conditions and operations. The new rule became effective January 19, 2024, but compliance is not required until July 17, 2024.

Peabody Closes New Revolving Credit Facility

Peabody Energy announced the closing of a new $320 million senior secured revolving credit facility maturing in January 2028, subject to certain conditions relating to the company's outstanding Convertible Senior Notes due March 1, 2028. Revolving loans under the facility bear interest at a rate of SOFR plus an applicable margin ranging from 3.50% to 4.25%, depending on the company's total net leverage ratio. At Peabody's current total net leverage ratio, the margin would be 3.50%. Letters of credit under the facility are subject to a fee equal to the applicable margin. The facility will be guaranteed by certain of Peabody's subsidiaries.

"This new revolving credit facility is intended to further enhance our financial resiliency during the period of investment at the Centurion mine as part of our strategy to reweight Pea-

body's long-term production and revenue toward premium Australian metallurgical coal," said Mark Spurbeck, CFO, Peabody Energy. "Over the past two years, we have strengthened our balance sheet and implemented an initial $1 billion share repurchase program. We are now taking the next steps to achieve our goal of making the Centurion mine a global leader in the metallurgical coal market."

PNC Bank, National Association is the administrative agent for the revolving credit facility, and PNC Capital Markets LLC acted as lead arranger and bookrunner in connection with the closing of the facility.

Leer Coal Mine Achieves Level A Verification for TSM Initiative

Arch Resources announced that its Leer longwall mine in West Virginia has achieved Level A verification for all protocols comprising the Towards Sustainable Mining (TSM) initiative. Leer is the first mine of any type to achieve and verify this performance level through TSM's new subscription program, which allows any mine anywhere in the world to implement this globally recognized sustainability initiative for the mining industry.

"Arch views leadership in all aspects of sustainability — including mine safety, environmental stewardship, community outreach, inclusion, and integrity — as the bedrock of its corporate culture and the key to its long-term success," said Paul Lang, president and CEO, Arch Resources. "On behalf of Arch's board of directors and its entire senior officer team, I want to congratulate the Leer workforce for meeting the rigorous and comprehensive requirements of the Towards Sustainable Mining initiative and — in doing so — demonstrating yet again its deep and abiding commitment to the highest standards of sustainability."

"Congratulations to Arch Resources' Leer mine for this significant accomplishment," said Pierre Gratton, CEO, Mining Association of Canada. "As TSM continues to drive performance in more and more jurisdictions around the world, it is heartening to see Arch leading the way in the U.S. This kind of achievement helps demonstrate to the world that mining is not only essential, but that it can be done responsibly."

TSM provides a set of tools and indicators that drive performance and ensure that key mining risks are managed responsibly. TSM's eight performance protocols center on indigenous and community relationships; crisis management and crisis planning; safety and health; prevention of child and forced labor;

U.S. News Continued on Page 12

Monthly Stats From Coal Country — USA

Top 10 Coal-producing States and Regions

(Thousands of Short Tons) — Week Ending (12/23/23)

	YTD '23	YTD '22	% Change
Wyoming	233,325	240,506	-3.0
West Virginia	84,930	82,147	3.4
Pennsylvania	38,493	36,725	4.8
Illinois	36,926	36,931	—
Kentucky	28,432	27,981	1.6
Montana	27,799	27,780	0.1
Indiana	24,607	23,135	6.4
North Dakota	24,001	26,306	-8.8
Texas	13,907	16,773	-17.1
Alabama	11,591	10,282	12.7
Appalachian Total	164,338	158,179	3.9
Interior Total	94,396	96,679	-2.4
Western Total	312,985	329,135	-4.9
U.S. Total	**571,719**	**583,993**	**-2.1**

Weekly Spot Prices

($/ton)		Week Ending (1/19/24)	(12/22/23)
Central Appalachia	(12,500 Btu, 1.2 SO_2)	$72.00	$76.30
Northern Appalachia	(13,000 Btu, < 3.0 SO_2)	$48.00	$50.00
Illinois Basin	(11,800 Btu, 5.0 SO_2)	$44.00	$44.25
Powder River Basin	(8,800 Btu, 0.8 SO_2)	$14.00	$14.00
Uinta Basin	(11,700 Btu, 0.8 SO_2)	$27.25	$28.40

Source: Energy Information Administration

Sanctions Weigh Heavily on Russian Coal Miners

By Vladislav Vorotnikov

By 2030, Russian coal export is expected to slump by 30% or 64 million metric tons (mt), against 2021, unless massive investments are pumped into railway infrastructure development and import-replacement of critical technologies, a forecast made by the Russian Energy Ministry envisaged.

Under the radical scenario, Russian coal production will plummet by 55 million mt or 12.5%, entailing harsh consequences for the economy of the coal mining regions. The Ministry stated that the existence of 10 communities that rely on coal mining with a total population of 700,000 is expected to be in jeopardy due to the closure of coal mines.

"Russia faces a threat of losing big markets with a total volume of supplies of 64 million mt/y," the Ministry said, adding that this figure doesn't include exports to Japan, Korea and Taiwan, the future of which is not guaranteed.

Russian coal on those markets will be replaced by supplies from Australia, Indonesia, and, to a lesser extent, from the USA, South Africa and Columbia, the Ministry reported.

The only chance to avert this slump in export is by expanding the Eastern Polygon, a Siberian railway system consisting of the Baikal Amur Mainline and Trans-Siberian Railway, to facilitate the delivery of coal to the sea ports in the Russian Far East.

In addition, substantial investments are needed to replace the import of critical Western technologies, from which Russian coal miners are barred by sanctions, the Ministry noted.

Beating these goals will take up to 1.2 trillion roubles ($14 billion), the Ministry calculated.

Russia is struggling to diversify coal exports, but supplies to Asia, Africa and the Middle East are hampered by problems with logistics, freight, and insurance, Maxim Basov, general of SUEK, the largest Russian coal producer, told local press in September 2023.

A lack of critical equipment will likely reduce Russian coal output and exports. (Photo: SUEK)

Moreover, to access new markets, Russian coal miners would have to offer their product at a considerable discount. In Asia-Pacific and Africa, the discount reaches up to 67% to 73% of regional benchmarks, a source in the Russian coal industry told local newspaper *Vedomosti*.

The sanctions have pushed the price of Russian exports below $100/mt, and in some cases to $90/mt, according to a report by the Australian Department of Industry Science and Resources. In addition, a continuing downward rally of the Russian rouble spurs operational costs in the Russian coal industry, particularly those associated with replacing equipment.

The Russian ruble has weakened by 26% this year as a result of a collapse in export revenues and growing government spending, making it the third-worst-performing global currency this year. During the past 12 months, the Russian ruble lost nearly half its value against the U.S. dollar.

The Russian coal industry has a 'critical dependence' on foreign technologies, the Energy Ministry said in a separate report. The Russian authorities are encouraging local businesses to look into the import-replacement of 78 items of mining equipment and components that are in the highest demand among the coal mines, though it would take years before any tangible results are achieved.

Queensland Premier Palaszczuk Steps Down

Queensland Premier Annastacia Palaszczuk announced she would be stepping down in mid-December. "The Premier has given her life to the public service of Queensland and done much to improve the wellbeing

of many people," said Queensland Resources Council CEO Ian Macfarlane. "Unfortunately, 18 months ago the Premier also presided over the introduction of the world's highest coal royalty tax into Queensland that has made our state uncompetitive for new investment in new resources projects.

"We have already seen Glencore cancel the development of the Valeria mine in Central Queensland, costing thousands of jobs, and BHP has openly stated it will not be investing in new projects in Queensland.

"Queensland needs a Premier and government that encourages investment and growth in the resources sector to grow jobs, exports and the state economy.

Macfarlane said it was extremely important the next Premier of Queensland was willing to be more openly supportive and encouraging of the resources sector.

"The mining and energy sector contributed A$116.8 billion to the Queensland economy in the last financial year and supported the jobs of more than 530,000 people across our supply chain," he said.

"The best outcome for Queensland in terms of jobs and business opportunities will be achieved when the State Government acknowledges the importance of the resources sector in its policy-making decisions to ensure they don't harm our sector's future.

SaskPower Keeps the Heat On in Western Canada

During mid-January, SaskPower restarted Boundary Dam's No. 4 coal-fired power unit that was originally scheduled to be removed from service in 2021. At the same time, the Alberta Electric System Operator (AESO) issued a grid alert saying the Alberta grid would face a 100- to 200-megawatt (mw) shortfall of electricity during peak evening hours.

SaskPower stepped up supplying Alberta with more than 150 mw. Alberta has retired much of its coal capacity and many Albertans blame the liberal wing of the government for mismanaging the province's electricity resources.

Demand for SaskPower was averaging 3,300 mw during January. The utility derives 51% of its power from natural gas, 37% from coal, 7% from hydro, 3% from wind, and less than 1% from solar.

The situation highlights the divide between the eastern provinces and the federal government in Ottawa and the reality of rural western Canada. In eastern Canadian, much of the power is derived from hydro and nuclear sources. Achieving net-zero is much more attainable goal for them and they are proposing country-wide policies that some western Canadians see as preposterous.

As an example, in November, the Government of Saskatchewan, which operates SaskPower, responded to the federal government's proposed Clean Electricity Regulations (CER), urging it not to proceed with the regulations as currently proposed.

"The federal government's approach, in an attempt to regulate Saskatchewan's electricity system, is unaffordable, unconstitutional, and technologically and logistically unattainable," Crown Investments Corp. Minister Dustin Duncan said. "The proposed CER will jeopardize the reliability of Saskatchewan's power grid and increase power rates to an unaffordable level."

The proposed regulations impose a net-zero electricity grid across Canada by 2035. SaskPower estimates that electricity rates would more than double by 2035 to cover the $40 billion in costs associated with compliance. It would need to expand, replace, and rebuild more than 100% of its current power generating capacity of more than 5,400 mw in 11 years while also significantly expanding its transmission infrastructure.

CIL Plans to Build Two Supercritical Power Plants

Coal India Ltd.'s (CIL) plan to build two coal-fired power plants through its subsidiaries Mahanadi Coalfields Ltd (MCL) and South Eastern Coalfields Ltd (SECL) has been approved by the cabinet of the Committee on Economic Affairs, *PSU Watch* reported. The SECL plant will be a 660-mw supercritical coal-fired power plant in Madhya Pradesh. The MCL will be a 2×800 mw (1,600 mw) Supercritical Thermal Power Plant in Odisha. India's Central Electricity Authority has projected a peak power demand of 256 gigawatts (gw) in 2024-2025, which is substantially higher than the 2023-2024 peak of 221 gw.

Chinese Coal Production Sets Another Record in 2023

China mined 4.66 billion memt of coal in 2023, a 2.9% increase form 2022, according to the National Bureau of Statistics. China is currently producing more than 400 million mt per month. The pace of domestic production increased in the second half of the year following the suspension of mining earlier in the year due to safety-related issues. China also imported nearly 475 million mt in 2023.

Indonesian Coal Output Grew in 2023

Government statistics indicate that Indonesia's coal production hit a record high of 775 million metric tons (mt) in 2023, the *Jakarta Globe* reported. The nation is major thermal coal exporter and demand from China and India remains strong. Indonesia's coal production will likely range between 750 million mt and 775 million mt in 2024, or greater.

Australia's North Goonyella Renamed Centurion

Peabody announced that its North Goonyella mine in Queensland, Australia, will now be known as the Centurion mine. In October, the company reached an agreement to acquire a large portion of the Wards Well coal

— *Worldwide News Continued on Page 14* —

— Leading Developments Continued from Page 5 —

bringing it back to market, and the commitment of our shareholders," she said. "We are excited with the potential of the Dartbrook mine and we are focused on bringing it back into production and delivering jobs and economic benefits for the people of the Hunter Valley.

Ayten said AQC now plans to accelerate work on site and complete underground works, including the installation of the a conveyor system, refurbish the coal-handling and preparation plant (CHPP) and load-out facilities, and procure the continuous miners and additional mining equipment.

As foreshadowed in the November announcement, the Dartbrook JV has entered into a coal sales and marketing agreement with Vitol for all Dartbrook coal production, including assigning coal marketing rights to Vitol for the life of the mine.

Court Rulings Opens the Door for Oakland Coal Port

A decision by Judge Noël Wise of California's Alameda County Superior Court on January 23, 2024 will extend to 2026 a lease held by developer Phil Tagami, who has sought for 10 years to build a 34-acre marine terminal at the port, from which another company would ship coal mined in the U.S. overseas, the *Mercury News* reported.

The judge sided with Tagami's claim that Oakland unfairly terminated its lease agreement with the developer and was responsible for missed deadlines that it then used against him in his attempt to pursue the project. Oakland basically tried to ban coal from city limits.

Judge Wise offered Tagami a choice. He could continue to try to build the terminal, or take nearly $318,000 in damages and walk away. Tagami chose the former.

According to the *Mercury News*, he said he always intended to see the terminal through to construction but insists that the decision of whether to ship coal would be made by Insight Terminal Solutions.

Anti-coal activists have promised to continue to fight the coal terminal.

DATELINE WASHINGTON

The Next Winter Grid Disaster

By Conor Bernstein

If the lights went out for millions of Americans on a frigid day would there be much surprise? There would be shock — and there would be plenty of finger pointing — but "surprise" is a word that might be tellingly missing.

In fact, some major regional grid operators might be more likely to be "surprised" when the power *doesn't* go out during periods of peak winter demand. You can almost see the back-patting and high fives from operators when grids squeak by as bitter cold pushes systems to the very edge, as it already has several times this year.

For even the most seasoned veterans, there's an increasing uneasiness that the grid simply may not have what it needs. The nation's grid reliability regulator, in fact, warned that 180 million people could face power shortages this winter.

Grid operators across the country are left facing increasingly unsettling questions without good answers. Will wind and solar power be able to contribute? Will the natural gas system hold up or will power plants be left without fuel? Will consumers respond to conservation requests?

Everyone is crossing their fingers and hoping for the best. It's an absurd situation, and it's also the alarming reality for the nation's increasingly unreliable supply of power.

Consider this recent conservation appeal from ERCOT, the grid operator for most of the state of Texas, for January 15. ERCOT warned that operating reserves were expected to be low due "to continued freezing temperatures, record-breaking demand and **unseasonably low wind**."

In other words, for a system that has invested billions in wind generation — no state has more wind capacity — on one of the coldest days of the year, that very capacity was expected to largely be a no-show.

People are increasingly frustrated and rightfully so. As ERCOT thanked consumers for their help in keeping the lights on, a Texas resident irreverently Tweeted back, "Thanks for not killing us this time."

Recall that in February of 2021, during Winter Storm Uri, 4.5 million Texans lost power and 246 lost their lives in freezing temperatures. As catastrophic as that event was, it could have been far worse. And the deeply unsettling reality for Texans and tens-of-millions of other Americans, is that the dynamics that enabled that disaster have only gotten worse since, not better.

Electricity demand is surging across the country, the natural gas system remains extraordinarily vulnerable to freezing temperatures, renewable intermittency is proving more problematic than boosters want to admit, and — most notably — the U.S. Environmental Protection Agency's regulatory onslaught is taking essential dispatchable capacity off the grid far faster than it can be reliably replaced. In short, operators are facing increasingly challenging circumstances with fewer of the critically important tools — notably fuel-secure coal plants — they need to keep the system online.

As capacity reserves shrink across the country, as the regulatory blitz pushes more essential capacity off the grid and demand continues to grow, we will inevitably see areas of the country that are woefully short of capacity. Recently PJM, the operator for the nation's largest grid, serving 65 million Americans, projected that peak winter demand in its service territory is projected to jump more than 30 gigawatts in the next decade. Without coal, how will they meet it?.

Conor Bernstein is a spokesperson for the National Mining Association, the industry's trade group based in Washington, D.C.

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U.S. News Continued from Page 7

tailings management; biodiversity conservation management; water stewardship; and climate change.

Arch said it would pursue TSM verification at its other metallurgical coal mines starting in 2024 as it works to extend its sustainability leadership in the mining industry and to strengthen its position as a supplier of choice to an increasingly sustainability-focused global steel industry.

Ramaco Foundation Donates to Charities in West Virginia and Wyoming

The Ramaco Foundation donated $57,500 to four charitable organizations in West Virginia and Wyoming. These charities include Jacob's Well Missions of Mingo County, West Virgina, Man Lion's Club in Man, West Virginia, and the Marine Corp Reserve (MCR) Toys for Tots programs in West Virginia and Sheridan, Wyoming.

"The Ramaco Foundation is an extension of our core interest in supporting and helping grow the quality of life in the communities where we proudly live, serve and operate," said Randall Atkins, chairman and CEO of Ramaco Resources. "These charitable organizations all do invaluable work, which strengthens the local social and economic fabric of all these communities. We are proud to do our small part to help support their missions."

Jacob's Well Missions is a non-profit organization that promotes the well-being of families and communities in resource-limited areas, including providing food and clothing to families. It takes an integrated approach toward the spiritual, social and economic development of local communities, in which community members are actively engaged in every aspect of the charity's work.

The Lion's Club of Man, West Virginia has been a staple in the community since 1985, empowering volunteers and partners to improve the health and well-being of the local population and support those in need through humanitarian services.

The primary goal of the MCR Toys for Tots is, through the gift of a new toy, to help bring the joy of Christmas and send a message of hope to America's less fortunate children.

Since its inception in late 2022, the Ramaco Foundation has provided more than $250,000 to various community groups.

PEOPLE IN THE NEWS

Daryl Edwards

Jen Williams

Australian coal operator, **Bowen Coking Coal Ltd.,** has appointed *Daryl Edwards* as CEO. He replaces *Mark Ruston* who will be pursuing other interests. Edwards has served as the company's CFO since October 2020 where the company said he has been instrumental in navigating Bowen Coking Coal from explorer through the startup phase and into production. In addition to his senior management experience, he was also responsible for sourcing and negotiating the equity and debt funding that allowed the company to become one of Queensland's newest coking coal producers. Following the appointment of Edwards as CEO, *Jen Williams*, a qualified chartered accountant, will lead the finance function at Bowen. She has served as general manager, finance, at the company for the last year and has more than 15 years of experience in various senior finance roles including at Peabody Energy and Coronado Global Resources.

Alex Moyes

Ramaco Resources has hired *Dr. Alex Moyes* as director of Critical Minerals and Planning to oversee the company's expanding rare earth element (REEs) operations. He will work with Ramaco's existing research team to manage the geological and chemical assessment of REEs located at Ramaco's Brook mine near Sheridan, Wyoming, as well as the planning and execution of the eventual recovery of these elements. Dr. Moyes previously served as vice president of economics and planning at FREYR Battery, a Norwegian company developing battery cell production facilities. Before that, he was the director of geoscience and engineering at Dominion Energy. Last year, Ramaco announced that its Brook Mine may contain the largest unconventional deposit of REEs discovered to date in the United States.

Ulrich Paschedag

Dr. Ulrich "Uli" Paschedag recently announced his plans to retire. An expert in longwall mining machinery, he has been serving as a professor at the **University of Applied Sciences Georg Agricola** (THGA) in Bochum, Germany. During his tenure, he used his extensive contacts to expand the university's Research Center of Post-Mining. Prior to his academic role, he was a successful executive that advanced coal mining techniques with a particular emphasis on longwall mining and mechanical cutting. In 1996, he was the chief engineer for Deutsche Bergbau Technik (DBT) and promoted to vice president of the product group (2007) when it was acquired by Bucyrus, which was acquired by Caterpillar. He left Caterpillar as a global product manager for underground coal to join THGA in 2015. He was the international marketing manager for Mine Technik America Inc. (MTA), before it became DBT, where he helped develop the controlled soft start technology (CST), a drive technology used extensively for longwall mining today.

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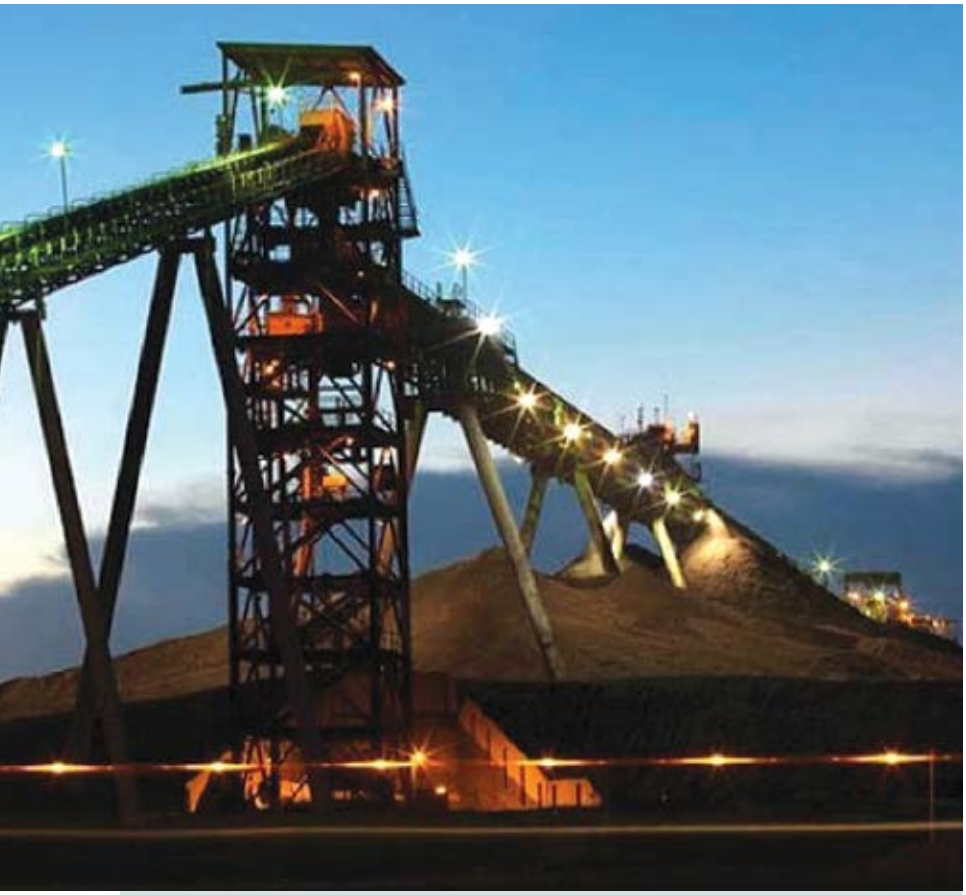
Worldwide News Continued from Page 9



The North Goonyella mine will now be known as the Centurion mine. (Photo: Peabody)

deposit adjacent to the existing North Goonyella mine. The new name reflects the pending addition of the acquired resources, creating a premier, tier-one premium hard coking coal mine with a life of 25 years or more.

"The combined resources will make the Centurion mine a global leader in the metallurgical coal market," said Jamie Frankcombe, president of Peabody's Australian Operations. "We are excited for the long future of this operation."

The Centurion mine remains on track to commence mining of development coal in the first quarter of 2024. The project is expected to reweight Peabody's long-term production and revenue toward metallurgical coal when longwall production commences in 2026.

North Goonyella was idled because of fire in the third quarter of 2018. Since commencing redevelopment in late 2022, Peabody has invested more than $53 million in ventilation, equipment, conveyors, and infrastructure updates. Prior to the Wards Well acquisition, North Goonyella had more than 70 million tons of reserves.

RBCT Repairs Conveyor

One of three conveyor belts damaged in an October 2021 fire at the Richards Bay Coal Terminal in South Africa has returned to service, *Mining Weekly* reported. The 2.2-km-conveyor belt has the capacity to move more than 3 million mt/y. The terminal hopes to restore the remaining two conveyors by July.

CALENDAR OF EVENTS

February 25-28, 2024: *Society for Mining, Metallurgy and Exploration (SME), Phoenix, Arizona, USA*. Contact: Web: www.smenet.org.

March 3-6, 2024: *Prospectors & Developers Association of Canada (PDAC), Toronto, Canada*. Contact: Web: www.pdac.ca.

April 30-May 1, 2024: *CoalProTec 2024, Central Bank Center, Lexington, Kentucky, USA*. Contact: Web: www.coalprepsociety.org.

May 18-21, 2024: *Metallurgical Coal Producers Association, Stonewall Resort, Roanoke, West Virginia, USA*. Contact: Web: www.metcoalproducers.com.

September 24-26, 2024: *MINExpo INTERNATIONAL, Las Vegas Convention Center, Las Vegas, Nevada, USA*. Contact: Web: www.minexpo.com.

October 16-18, 2024: *Coal Association of Canada Annual Conference, Pan Pacific Hotel Vancouver, in Vancouver, British Columbia, Canada*. Contact: Web: www.coal.ca.

April 6-9, 2025: *The Haulage & Loading Conference, Tucson, Arizona, USA*. Contact: Web: www.haulageandloading.com.

June 3-5, 2025: *U.S. Coal Show 2025, Pittsburgh, Pennsylvania, USA*. Contact: Web: www.uscoalshow.com.

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To build the massive infrastructure needed for renewable power generation, a substantial amount of materials and energy will be required. For example, one megawatt of onshore wind capacity requires hundreds of tons of steel and concrete, which requires hundreds of tons of coal to produce. [1][2][3]

[1] Energy Central: *Can You Make a Wind Turbine Without Fossil Fuels?*
[2] U.S. Department of Energy, National Renewable Energy Laboratory: *Renewable Energy Materials Properties Database: Summary (August 2023)*
[3] Gulhan Ozbayoglu, Comprehensive Energy Systems: *Energy Production from Coal (2018)*

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Sev.en Global Investments Sees Opportunity Where Others Do Not

Czech-based group builds a coal-powered portfolio that invests in ESG-deprived assets

By Steve Fiscor, Editor-in-Chief

Last year was an important year for Sev.en Global Investments (Sev.en GI). The investment group made several strategic acquisitions in the coal business, buying up coal reserves in the U.S. and Australia before announcing an agreement to acquire a 51% interest in Coronado Global Resources. Toward the end of the year, they signed an agreement to purchase the Mong Duong 2 coal-fired power plant in Vietnam. When investors discuss potential acquisitions these days, coal and its related industries are nowhere near the top of the list, unless it's Sev.en GI.

While the Sev.en GI name may be new to some in the industry, the group has extensive coal experience. It owns and operates coal mining operations and coal-fired heat and power plants in Central Europe and Australia. In 2019, they entered the coking coal market in a big way with the purchase of Blackhawk Mining in the U.S. Coronado will add to that met portfolio with operations in the U.S. and Australia.

Sev.en GI is part of the Sev.en Group, which is owned by Pavel Tykač, a prominent Czech entrepreneur and investor, who ranks among the world's top 300 wealthiest people, according to *Forbes*. "We belong to a private, family-owned group and the head of the family is a keen energy asset investor," said Alan Svoboda, CEO for Sev.en GI. "He understands that coal is essential to the production of power and steel. We began by acquiring assets step-by-step in Central Europe and today we have a large portfolio of coal-fired heat and power plants fully vertically integrated with mining operations. The local coal mines provide the security of supply."

Alan Svoboda (standing) and his team at Sev.en GI are investing in coal mines and coal-fired power plants. (Photo: Sev.en GI)

Power delivery systems worldwide are in a state of transition. In many places coal is being retired in favor of nuclear- and gas-fired capacity, and more renewable energy sources. During this transitory period, however, Sev.en GI believes that coal assets will remain essential, Svoboda explained. "That has become the investment theme for taking an international approach," he said.

Svoboda joined the group in 2018 with a mandate to look for international investments and establish a global presence in the energy business. Over time, the group realized that metallurgical coal is an equally robust commodity investment as an input for the steel industry. "We also learned that we could gain exposure to the business by purchasing the tenements (leases), or the rights to mine the natural resources and collect royalties from third parties," Svoboda said. "That has become another investment focus for us in both the U.S. and Australia."

Sev.en GI remains focused on conventional power generation. They are looking at coal-fired power assets in the U.S., but the American market has its own specific characteristics "The market is divided into regions with different rules and policies for compliance and pricing," Svoboda said. "Some are more regulated. Some are more liberal. It requires a

detailed understanding of the dynamics to be able to make a good decision on which assets still will have some viable future before the transition renders them obsolete."

Investing in ESG-deprived Industries

Sev.en GI is placing capital in areas where other investment groups cannot. Today, environmental, social, and governance (ESG) policies are limiting many investment decisions and forcing many investors to divest interests in carbon intensive projects. "In the past, companies were doing well by maintaining their legacy assets and investing in new projects at the same time, but over time the investment climate became polarized," Svoboda said. "A company that wants to be viewed as green needs to rid itself of legacy assets with high carbon intensity before they become toxic elements in their portfolio. Cheap credit funding has been limited. Equity investors and pension funds want to avoid any exposure to carbon-intensive industry. Today, we are seeing an outflow of equity capital and debt from what we call 'ESG-deprived industries.'

"These operations are essential for the energy transition to occur," Svoboda said. "In some rare cases, a grid operator or power supplier could close a plant because they have additional capacity, or the system is robust enough to digest that change in the supply-demand balance. In many cases, however, a transitional period is needed to adapt to the cost drivers and strengthen the grid to compensate for the intermittency of renewable sources. We are filling a gap where institutional investors are leaving assets behind that still need to have a responsible, focused owner before they can be completely shut down."

Svoboda emphasizes that Sev.en GI is not a private equity investor that would get into a business only to look for ways to exit again, "dressing up the bride for the next marriage."

In many of these cases, there may not be a next marriage. "We will likely be the final owner of the assets, but we want to be a responsible owner that invests where it makes sense to provide for the employees and the communities as long as it's economically rational," Svoboda said.

Sev.en GI is awaiting approval of its 51% acquisition of Coronado Global Resources, which operates the Curragh coking coal complex in Australia and the Buchanan mine in the U.S. (Photo: Coronado Global Resources)

Conventional power plants were commissioned to produce base load power. "Now flexibility matters because during certain periods the grid accepts renewable energy, which shrinks the demand for coal-fired power," he said. "During other periods, coal-based generation is the only way to satisfy demand."

Sev.en GI's investments usually focus on increasing that flexibility and the group is not afraid of merchant risk. Power producers are increasingly selling energy as merchants rather than relying on fixed-price contracts. "Many institutional investors cannot tolerate merchant risk because of the inherent uncertainties of the cashflow created by market volatility," Svoboda said. "Our assets in Central Europe operate as merchant assets. There are times when margins are thin, but there are other times when operations are quite profitable." Knowing how to manage merchant risk while working with conventional assets, sets Sev.en GI apart from other investors.

The Blackhawk Acquisition

Aside from being a met coal producer, another factor that made Sev.en GI's acquisition of Blackhawk Mining unusual was that it took place during the COVID-19 pandemic. "We were not allowed to travel to the U.S. to visit the mines," Svoboda said. "It was an internet transaction as we did not meet any of the people in person until months after closing. Nevertheless, we performed due diligence. We gained some metallurgical coal experience working with Corsa Coal a few years before and Blackhawk became a second met coal target for us."

That situation exemplifies Sev.en GI's readiness to take on some risk. In addition to the obstacles created by the pandemic, coal prices were low. Many parts of the economy, including steel markets, had slowed. Blackhawk's creditors were knocking at the door. Many companies were looking to cut costs and lay people off. Sev.en GI made an offer to the creditors and shareholders, many of whom were the same due to a prior bankruptcy.

"The creditors and shareholders were mainly hedge funds that were not able to get aligned as far as who would provide the capital for the company to survive," Svoboda said. "Under such circumstances, they accepted our offer. We would buy all the debt and equity and provide the capital for the business on our own. It happened, as we say, 'just a few minutes before the clock struck 12,' meaning the company was on the verge of going belly up."

In June 2020, Sev.en GI acquired Blackhawk Mining. "People were

The Kanawha Eagle mine is one of several coking coal mines operated by Blackhawk Mining, which Sev.en GI purchased in 2020. (Photo: Blackhawk Mining)

happy to see us step in, and we established a very strong bond with the management team," Svoboda said. "Blackhawk's CEO Jesse Parish is not only very knowledgeable about the coal business, he also understands the financial matters as a former CFO. He has been an exceptional CEO for us. Under his leadership and with the support of our cash and our mergers and acquisitions (M&A) team, we have managed to turn that business around.

"We began by revising mine plans and focusing operations on higher grade areas of the deposit," Svoboda said. "We were able to get the operations on track just before the current met coal boom began. During those boom times, we maximized met coal production and benefited from the market rebound and hopefully that will remain so moving forward."

Today, Blackhawk Mining is the fourth largest met coal producer with eight operations located in Kentucky and West Virginia. The company produces 7 million tons per year of hard coking coals and PCI coals.

Building a Reserve Base

Working with Blackhawk, Sev.en GI also learned about land holdings, leases, mineral rights, and royalties in the U.S. In August 2021, the company formed Golden Eagle Land Co. Golden Eagle bought four coal companies: Wildcat Coal, Blue Creek Minerals, Colt, and Ruger Coal Co. The land holding company now controls more than 2.2 billion tons of proven coal reserves in Illinois, Ohio, West Virginia, and Wyoming.

"We assembled a portfolio of land with mining rights, and it's administered by the people doing the same work for Blackhawk," Svoboda said. "We work both sides of the fence, sometimes we pay royalties and sometimes we collect royalties.

"As it is with coal mining, there are similar dynamics with the ownership of mining rights and land holdings, which are typically owned by a trust or families that have inherited the land. Many of the trustees, who were never concerned about the source of their royalties, have decided to reduce their exposure to coal. We bought those mining rights and consolidated them in a portfolio under Golden Eagle. Today, we are still searching for more."

The Coronado Acquisition

The big news last year for Sev.en GI was the agreement to acquire a 51% interest in Coronado Global Resources. The group is currently undergoing the transaction process and Svoboda could not comment in great detail, but he described it as a major step-forward transaction. "We were looking for ways to become a consolidator in the metallurgical coal industry, by adding more to our portfolio," he said. "For two years, we were chasing opportunities in the U.S., Australia, and even Canada. I feel like we turned every stone over."

The market volatility in the met coal business often complicates the deals. A sudden price swing can change the attitude of the buyer or the seller and sour the deal. "That's why we were happy that we were able to negotiate a bilateral deal with the Energy & Minerals Group (EMG), the 51% owner and a Coronado founder based in Texas," Svoboda said.

Coronado Global Resources is one of the largest met coal producers globally, supplying customers on five continents with a range of high-quality coals. They produce met coal from three mining complexes, in two of the largest coal basins in the world — the Bowen Basin in Queensland, Australia, and the Central Appalachian coalfield in the U.S. In total, they operate eight safe, highly productive coal mines with immediate access to transportation infrastructure. Coronado produced 16 million metric tons (mt) of metallurgical coal in 2022 and plans to grow production to 20.5 million mt in 2025.

Coronado was founded in 2011 by EMG, Garold Spindler, and James Campbell. Through a series of strategic acquisitions, they assembled an impressive met portfolio and eventually listed the company on the Australian Stock Exchange. "From day one, Coronado has had a strategic owner, which appealed to us," Svoboda said. "We seek control and we believe that with active oversight and financial support, we can generate some additional value for all shareholders as opposed to a passive investor."

The transaction is now pending. The two parties awaiting approvals from the different authorities in the U.S. and Australia.

Building a Power Portfolio

In late 2022, Sev.en GI acquired a 100% share in Delta Electricity which owns and operates the coal-fired Vales Point Power Station in Australia. "When Australia reopened from COVID-19, which was a year after the U.S. reopened, we flew there the very first day and began building personal relationships, which led to another private transaction where we bought a large coal plant called Delta in New South Wales from two private persons together with an adjacent coal mine," Svoboda said.

The plant is critical in supporting the security of energy supply and

network reliability as it provides 4% of annual power for the Australian national grid. "We became familiar with Australia as an investor and also with the Australian power markets," Svoboda said.

Sev.en GI began assembling an Australian power portfolio with Delta and the other two assets, under Genuity, where the company is only a minor shareholder, but things went awry. At one of the units at Genuity´s Callide C power station the turbine exploded in May 2021. Later in 2022, the cooling towers collapsed at the other unit. The power plant has been offline since the failures. "The Genuity power assets did not materialize as originally envisioned, but today we have an Australian power portfolio that includes a large coal-fired power plant that we own and manage," Svoboda said. The group now owns Delta Electricity with an adjacent mine and also Sev.en Royalties that owns a sizeable portfolio of mining rights in Australia.

Sev.en GI Enters Asia

In December 2023, Sev.en GI signed an agreement to purchase the Mong Duong 2 coal-fired power plant in Vietnam from AES Corp. "During high times, AES had a lot of interesting IPP projects all over the world," Svoboda said. "More recently, however, they have shifted from investing to divesting and this was one of their last international assets."

AES attempted to sell Mong Duong 2 a couple of years ago, but the investors, which were a financial group that lacked operating experience, did not receive approval from the Vietnamese government, Svoboda explained.

"We convinced both AES and eventually the Vietnamese representatives that we have plenty of experience in conventional power generation and that we would be a suitable owner of the asset," Svoboda said. "With that trust, AES signed a contract with us. We are still awaiting an official approval from the Vietnamese government. But given the initial contact and our profile, we are truly convinced that this is just a matter of time to get us signed off for closing the deal."

Looking toward the future, Svoboda said the focus remains the same. Sev.en GI likes coal-fired power assets, especially ones with captive coal mines. "We're interested in met and thermal mines too," Svoboda said. "Unlike other investors, we can manage both. Some mining companies are focusing on met and spinning off thermal assets." He said they are also considering steel mills as well.

"To some degree, we are an opportunistic investor, unlike a large corporation that sets unattainable targets to fund projects or service debt," he said. "The money is allocated to the best opportunities we find around the globe, and we will see where that takes us."

Longwall Operators Add Capacity for 2024

More U.S. longwall operators embrace automation technology to improve horizon control

By Steve Fiscor, Editor-in-Chief

A shearer loads coal at America's newest longwall installation, the Longview mine in West Virginia. (Photo: Allegheny Metallurgical)

America's longwall mines produced 133.1 million tons in 2023, which was down 3.1% from 137.3 million tons in 2022. Much of the decrease can be attributed to the loss of production from two mines that are no longer operating. While the official numbers haven't been tabulated yet, total U.S. coal production will likely be 585.5 million tons for 2023, a 2.1% drop over 2022. U.S. longwall production represents 22.7% of total coal production last year.

One new longwall started production in 2023, another officially ceased operations, and a new longwall is currently being installed. Century Mining LLC, operating as Allegheny Metallurgical, started its new longwall at the Longview mine in West Virginia during December. American Consolidated Natural Resources (ACNR) announced that it would idle its Emery County (Lila Canyon) mine in Utah indefinitely. Coronado Global Resources will start a second longwall at the Buchanan mine in Virginia later this year. The number of faces increased from 36 to 37, while the number of operators remained the same (32). Those numbers include two trona mines in Wyoming and five mines that will operate two longwall faces in 2024.

Last year, ACNR's longwall mines produced 46.8 million tons, followed by CONSOL Energy (26 million tons), Alliance Resource Partners (14.1 million tons) and Arch Resources (8.6 million tons). CONSOL Energy's Bailey Complex in Pennsylvania remains the leading longwall complex with nearly 11.2 million tons in 2023, followed by CONSOL Energy's Enlow Fork Complex (8.7 million tons) in Pennsylvania, and Alliance Resource Partner's Tunnel Ridge mine (7.7 million tons) in West Virginia. Tunnel Ridge produces coal from a single face, while Bailey and Enlow Fork both operate two faces. A total of 14 longwall mines produced more than 5 million tons in 2023 (see Table 2).

CONSOL Energy operates five longwall faces in the Pittsburgh No. 8 seam in southwestern Pennsylvania. The company's Harvey mine set a new production record in 2023 of 6,237,282 tons. The Harvey mine's production has grown steadily from 4.4 million tons in 2020. The Bailey Complex has produced more than 11 million tons in the last three years. Enlow Fork's 8.7 million tons is also notable as the mine averaged 6.3 million tons in the previous three years.

Signal Peak's Bull Mountains mine in Montana produced nearly 7.6 million tons in 2023. The mine operates one longwall, but it owns two faces. Last year, 159 new ZMJ shields were delivered to the mine. Signal Peak has ordered an additional 50 ZMJ shields — to be delivered in 2024 — that will complete the set.

Coronado Global Resources continues to advance its Buchanan expansion project to handle the increased production it expects from its longwall mining systems. In Q4 2023, longwall development was completed in the new South District of the mine, which will allow the Buchanan mine to operate an additional underground district with new equipment and allow

for more operational flexibility for mining from both the North and South areas of the mine.

The company also reported that Buchanan's production was impacted by poor geotechnical conditions, resulting in a 10-day production outage in December to secure additional roof support. Normal longwall operating conditions have resumed, but the event deferred roughly 132,000 tons of production. Prior to these events, Buchanan's operational performance was exceeding production forecasts.

Under a cooperative agreement between Komatsu, Becker-Warkop and Hydrotech, 385 new longwall powered roof supports were delivered to Warrior Met in Alabama (See Suppliers News, p. 38). The first face began operation in July 2023 and the second face is undergoing installation. While Komatsu has provided shields to Warrior Met in the past, this is the first set of roof supports supplied in collaboration with Becker-Warkop and Hydrotech.

Industry Demographics

Longwall ownership in the U.S. remained relatively unchanged. ACNR and the companies it controls (Foresight Energy and Hatfield Metallurgical) operate 11 longwall faces spread across Alabama (1), Illinois (4), Utah (1) and West Virginia (5). CONSOL Energy operates three mines with five longwall faces in Pennsylvania. Alliance Resource Partners, Arch Resources and Warrior Met Coal own three longwall faces.

With 10 faces, West Virginia remains the longwall leader, followed by Pennsylvania (6), Illinois (5) and Alabama (5).

Looking at the numbers, the average U.S. longwall mine operating in coal produced 4.75 million tons in 2023 compared to 4.70 million tons in 2022. On average, it has a cutting height of 94.8 in., a panel width (or face length) of 1,243.1 ft, and a panel length of 12,625.7 ft. Last year, those numbers were 95.5 in., a panel width (or face length) of 1,234.6 ft, and a panel length of 13,144.6 ft, respectively. A total of six longwall faces have face lengths of 1,500 ft or greater. A total of 11 longwalls operate in the Pittsburgh No. 8 seam. The maximum overburden on average reaches 1,148.1 ft. Except for a few mines in Utah, most are developed with 3-entry gates. Using an double-drum, ranging-arm shearer with a total power of 1,861-hp, they take a 40.6-in. cut. The average yield setting on the shields is 1,072.1 tons. All the faces except for three are high voltage (4,160 volts).

Iron Senergy's Cumberland mine operates the longest face at 1,580 ft. Coronado's Buchanan mine and ACNR's Emery County mine are the deepest at 2,000 ft, and 2,200 ft respectively. At 26,000 ft, Foresight Energy's Mach No. 1 mine has the longest panel.

Allegheny Met Starts Its Longwall

The longwall at Allegheny Metallurgical' s Longview mine began cutting coal on December 8, 2023. The entire commissioning process including the longwall start-up went well, explained Ryan Toler, general manager for the Longview mine. "Everything went as planned and we started mining just after midnight," Toler said.

One of the advantages of building a new mine, as opposed to moving from one panel to the next, is that the miners at Allegheny Met had time to test the equipment before they staged it for set-up underground. During 2023, two development sections were driving the tailgate and the headgate for the first panel. Once the start line was established between those two headings, they began to build the longwall. They set the first piece of panline on November 10.

Prior to the installation, the longwall team participated in some pre-commissioning exercises on the surface. They assembled a mini build. "We basically set the entire system up in the yard along with 25 shields," Toler said. "We brought everything online as if it were operating underground, including the electrics, the pump cars, the head drive, tail drive, shearer, etc., and performed compatibility testing and trained miners." Toler said they made modifications on a few small items, but everything worked well.

The miners broke the system down and began transporting it under-

Table 1—Longwall Installations by Parent Company (2023-2024)

Company	Ala.	Colo.	Ill.	Mont.	Pa.	Utah	Va.	W.Va.	Wyo.	Total
Allegheny Metallurgical								1		1
Alliance Resource Partners			1					2		3
ACNR						1		5		6
Arch Resources		1						2		3
Blue Mountain Energy		1								1
CONSOL Energy					5					5
Iron Senergy					1					1
Coronado Global Resources							2			2
Foresight Energy (ACNR)			4							4
Hatfield Metallurgical (ACNR)	1									1
Peabody Energy	1	1								2
Signal Peak Energy				1						1
Solvay Chemicals									1	1
Genesis Alkali									1	1
Warrior Met Coal	3									3
Wolverine Fuels						2				2
Total	**5**	**3**	**5**	**1**	**6**	**3**	**2**	**10**	**2**	**37**

ground. "We transported and stored all the shields and panline on the tailgate section prior to the completion of development," Toler said.

The miners that were transporting and building the longwall were a mix of experienced and inexperienced hands. "We hired folks without longwall experience, and we trained them," Toler said. "We had the luxury of assembling and disassembling that mini build and they participated in that before helping set it up underground. It was a positive experience."

Allegheny Met has an experienced longwall management team. "All the face foremen are experienced longwall supervisors," Toler said.

The Longview longwall has full automation capabilities. "We are not using the full automation features yet, but the shields advance automatically," Toler said.

The mine currently runs 24/7 with two 12-hour shifts per day. The current panel is expected to last until July. "Development is running as expected," Toler said. "We run two development sections, and our next gate development has advanced halfway for the next panel." When it comes time to move the longwall, Allegheny Met has a spare panline and a spare shearer like most longwall mines in the U.S.

The Longview mine was designed as a longwall mine. The conveyor system has the capacity to clear the coal from the face as fast as the shearer can cut it. "We are running a 72-in. conveyor on the mainline and it has the capacity to carry 5,700 tons an hour," Toler said.

As this edition was going to press, the Longview longwall had retreated about 1,000 ft through its first panel.

Table 2—Active US Longwall Mines (January 2024)

Company	Mine	Prod. 2023	Prod. 2022	% Change
CONSOL Energy	Bailey*	11,163,524	11,567,919	-3.5
CONSOL Energy	Enlow Fork*	8,660,839	6,291,939	37.6
Alliance Resource Partners	Tunnel Ridge	7,664,330	8,312,644	-7.8
Signal Peak Energy	Bull Mountains	7,581,000	7,431,273	2.0
ACNR	Marshall County*	7,412,191	9,640,814	-23.1
ACNR	Harrison County	7,049,832	7,039,318	0.1
Foresight Energy (ACNR)	Mach Mining	7,037,074	7,715,724	-8.8
ACNR	Marion County	6,839,719	6,813,124	0.4
ACNR	Ohio County	6,451,629	6,368,730	1.3
CONSOL Energy	Harvey	6,237,282	6,074,719	2.7
Iron Senergy	Cumberland	5,934,113	5,381,422	10.3
Foresight Energy (ACNR)	Sugar Camp*	5,791,526	6,378,465	-9.2
Alliance Resource Partners	Hamilton County	5,624,399	4,693,251	19.8
Warrior Met Coal	Blue Creek No. 7	5,141,323	4,755,684	8.1
Arch Resources	Leer	4,443,600	4,041,623	9.9
Coronado Coal	Buchanan*	3,817,459	4,309,238	-11.4
Foresight Energy (ACNR)	Deer Run	3,501,070	4,461,684	-21.5
Arch Resources	West Elk	3,130,767	4,353,703	-28.1
Wolverine Fuels	Skyline	2,786,080	2,548,123	9.3
Wolf Mining (Arch Coal)	Leer South	2,778,797	2,263,530	22.8
Wolverine Fuels	Sufco No. 1	2,690,970	3,877,118	-30.6
Hatfield Metallurgical (ACNR)	Oak Grove	2,549,279	1,835,149	38.9
Warrior Met Coal	Blue Creek No. 4	2,504,213	1,559,012	60.6
Blue Mountain Energy	Deserado	2,404,865	1,992,859	20.7
Peabody Energy	Twentymile	1,204,063	1,536,148	-21.6
Arch Resources	Mountain Laurel	1,034,656	749,643	38.0
Alliance Resource Partners	Mountain View	820,334	1,426,966	-42.5
Peabody Energy	Shoal Creek	636,582	773,054	-17.7
ACNR	Lila Canyon	159,240	2,281,289	-93.0
Allegheny Metallurgical	Longview	–	–	–
Westmoreland Mining	San Juan South	–	1,596,850	–
Total U.S. Longwall Production		**133,050,756**	**137,321,372**	**-3.1**

Note: ACNR - American Consolidated Natural Resources. Source: Mine Safety and Health Administration.
*Each of these mines operate two longwall faces.

Komatsu Advances Shearer Automation Technology

Over the last year, Komatsu has installed six new Landmark face alignment systems on U.S. longwall faces, and they have five more in the works, which will likely come online later this year. "That's a big leap for a relatively small group of mines from an automation standpoint," said Jeff Ley, control and automation manager for the Americas for Komatsu. Ley manages a team that installs longwall automation features and trains miners how to use the software.

"All of the longwalls operated by American Consolidated Natural Resources have been upgraded from memory cut to advanced shearer automation," Ley said. "They are really taking advantage of technology. They are consistently operating with automated roof and floor cuts from the tailgate to the main gate."

This year, Komatsu will also introduce the Faceboss 2.0 control system for shearers. "We already have a couple of shearers scheduled for upgrade," Ley said. "The Faceboss 2.0 system is a technology jump as far as processing power, memory storage, and system architecture with improved diagnostics. We have added web-based, human machine interface (HMI) screens that allow the user to access the shearer HMI screens from anywhere on the longwall network."

Compared to the original Faceboss system, Faceboss 2.0 has a few

Mine Company (parent)	Seam	Seam height (inches)	Cutting height (inches)	Panel width (ft)	Panel length (ft)	Over-burden (ft)	No. of gate entries	Depth of cut (inches)	Shearer Total hp	Haulage system	Roof support yield (tons)	Roof support controls (type)	Face conveyor type (strand, motors)	Face conveyor drives	Face conveyor width (mm)/ speed (fpm)	Stageloader type width, speed	Crusher	Electrical controls	Voltage to face
ALABAMA (5)																			
Blue Creek No. 4 Warrior Met Coal	Blue Creek/ Mary Lee	45	85	1,115	4,000- 13,000	1,600	4	36	Joy 7LS-1D DDR 1,840	Ultratrac 2,000	Joy 1,300	Joy RS20	Joy 42 TIB 3x1,200	Joy	1,000/ 305	JWR 1,300 mm, 420 fpm	JWR	Line Power	4,160
Blue Creek No. 7 North Warrior Met Coal	Blue Creek/ Mary Lee	53	69	1,060	7,000- 8,000	1,600	4	36	Joy 7LS-1D DDR 1,840	Ultratrac 2,000	Joy 1,150	Joy RS20	Joy 42 TIB 3x1,000	Joy	1,000/ 305	JWR 1,300 mm, 420 fpm	JWR	Line Power	4,160
Blue Creek No. 7 East Warrior Met Coal	Blue Creek/ Mary Lee	53	80	1,040	4,000- 13,000	1,600	4	36	Joy 7LS-1D DDR 1,840	Ultratrac 2,000	Joy 1,150	Joy RS20	Joy 42 TIB 3x1,200	Joy	1,000/ 305	JWR 1,300 mm, 420 fpm	JWR	Line Power	4,160
Oak Grove Hatfield Metallurgical (ACNR)	Blue Creek	55	80	1,215	6,000	680	4	36	Joy 7LS-1D DDR 1,840	Ultratrac 2,000	ZMJ 1,020	—	CEMI 48 TIB 3x1,900	—	1,000/ 384	CEMI 1,200 mm, 378 fpm	CEMI	Service Machine	4,160
Shoal Creek Peabody Energy	Mary Lee/ Blue Creek	84- 132	84- 132	1,000	11,000	1,150	3	42	Joy 7LS5 DDR 2,091	Ultratrac 2,000	Joy 955	Tiefenbach	HBT 48 TIB 3x1,000	HBT CST	1,342/ 320	HBT 1,424 mm, 385 fpm	HBT	Service Machine	4,160
COLORADO (3)																			
Deserado Blue Mountain Energy	B	132	108	760	7,000	1,100- 1,300	3	30	Joy 7LS2 DDR 1,458	Ultratrac 2,000	Joy 910	Joy RS20s	Joy 38 TIB 2x1,074	Joy —	860/ 450	Joy 1,220 mm, 410 fpm	Joy	Service Machine	2,300
Twentymile Peabody Energy	Wadge	108	108	1,000	12,000- 15,000	1,400- 1,650	3	39.4	Joy 7LS5 DDR 2,360	Ultratrac 2,000	HBT 1,327	—	Tianning 48 TIB 3x1,900	HBT CST	1,188/ 371	HBT 1,588 mm, 520 fpm	HBT	Service Machine	4,160
West Elk Arch Resources	E	108- 168	108- 156	1,100	3,000- 7,000	400- 1,100	3	42	Joy 7LS5 DDR 2,360	Jumbotrac	HBT 1,271	HBT PMC-R	HBT 48 TIB 3x1,650	HBT CST	1,188/ 371	HBT 1,388 mm, 464 fpm	HBT	Service Machine	4,160
ILLINOIS (5)																			
Deer Run Foresight Energy (ACNR)	Herrin No. 6	96	96	1,400	15,000	600	3	42	Joy 7LS2A DDR 2,054	Jumbotrac 2,000	HBT 1,200	—	HBT/HBT CSTs 48 TIB 3x1,900	HBT CST	1,000 371	HBT 1,388 mm, VFD	HBT	Intermountain Electrical	4,160
Mach No. 1 Foresight Energy (ACNR)	Herrin No. 6	68	84	1,400	26,000	400	3	42	Joy 7LS2A DDR 2,054	Jumbotrac 2,000	HBT 1,200	—	HBT/HBT CSTs 48 TIB 3x2,200	HBT CST	1,000 383	HBT 1,376 mm, VFD	HBT	Intermountain Electrical/SMC	4,160
Sugar Camp M-Class (idle) Foresight Energy (ACNR)	Herrin No. 6	72	86	1,400	19,000	900	3	42	Joy 7LS2A DDR 2,054	Jumbotrac 2,000	HBT 1,200	—	CEMI/HBT CSTs 48 TIB 3x2,200	HBT CST	1,000 383	CEMI/HBT 1,376 mm, VFD	HBT	Intermountain Electrical/SMC	4,160
Sugar Camp Viking Foresight Energy (ACNR)	Herrin No. 6	72	86	1,400	19,000	900	3	42	Joy 7LS2A DDR 2,054	Jumbotrac 2,000	HBT 1,200	—	CEMI/HBT CSTs 48 TIB 3x2,200	HBT CST	1,000 383	CEMI/HBT 1,376 mm, VFD	HBT	Intermountain Electrical/SMC	4,160
Hamilton County Coal No. 1 Alliance Resource Partners	Herrin No. 6	76	84	1,400	19,000	1,000	3	42	Joy 7LS1D DDR 1,840	Ultratrac 2,000	Joy 1,320	Joy RS20S	Joy 52 Big-T 3x1,650	Joy TTT	1,188/ 378	Joy 1,388 mm, 464 fpm	HBT	Intermountain Electrical	4,160

Legend: DDR 2,000 means double-drum ranging arm shearer with 2,000 hp installed. VFD—variable frequency drive; SS—single strand; TIB—twin strand inboard; 42 TIB 2 x 1,000 means 42-mm chain, twin strand inboard, two 1,000-hp motors.
Note: ACNR—American Consolidated Natural Resources; CEMI = Centralia Equipment and Machine, Inc.; PSS = PSSystems, Inc.; and ZMJ = Zhengzhou Coal Mining Machinery; HBT = HBT Americas.

new pieces of hardware. The layout of the IO modules and the sensors have been changed to improve diagnostics and reliability, Ley explained. "The HMI is very, very different," he said. "The previous system used an off-the-shelf product for its HMI. The HMI for Faceboss 2.0 control system was developed by us in-house here [in the Pittsburgh area], so there are no dongles or licenses to pay for."

When it comes to longwall automation, the previous control system had reached its capacity. The new Faceboss 2.0 control system can be installed during a rebuild and it will enable longwall operators to use more automation features, explained Shawn Franklin, production manager-longwall shearers for Komatsu. "When you consider the overall cost of a shearer rebuild, the cost of the technology upgrade is almost negligible," he said. "It's just something that we plan to do at rebuild, and then of course the training that comes along with it will be a vital aspect of it as well."

As longwall mining moves toward autonomous operation, the Faceboss 2.0 system provides the building blocks to establish remote management from the surface.

Safety is a primary driver and autonomous operations remove operators from the face," Franklin said. "We also have a lack of skilled operators these days. Some mines are embracing this technology to compensate for that."

"Our goal is to give an operator on the surface the tools to plan the cutting sequence instead of just reacting live to what's happening underground," Ley said. "We want to be able to tell the shearer and the roof supports what to do ahead of time instead of reacting to seam changes in real time. We are focused on the equipment and technology that can get us to that point."

If the engineers know that the seam narrows in a certain zone or that the longwall will encounter pitches and rolls as it retreats through the panel, then they can program that into the system. "Today, an operator has to manually steer the cutting drums to account for these variations in the seam," Ley said. "Our goal is to get to a point where the system does that automatically."

Looking toward the future, Komatsu will be introducing a new control system (RS20N) for roof supports and armored face conveyors (AFCs) in the next year or two. The company will also display a new ranging arm at MINExpo later this year.

The RS 20N will replace the RS 20S and the N stands for network. "What the RS 20N brings to the table is a high speed one gigabit per second backbone along the roof supports," Ley said. "Once we have that high-speed communication link, that opens up the window for us to stream live video, connect to smart sensors and other emerging technologies that will bring us closer to the fully autonomous shearer." Ley estimates that the RS 20N will provide approximately 10 times more bandwidth than any other systems offered today.

The RS 20N can also be extended onto the AFC. "We are introducing

The shearer makes its first pass at the Longview mine on December 8, 2023. (Photo: Allegheny Metallurgical)

Mine Company (parent)	Seam	Seam height (inches)	Cutting height (inches)	Panel width (ft)	Panel length (ft)	Over-burden (ft)	No. of gate entries	Depth of cut (inches)	Shearer Total hp	Haulage system	Roof support yield (tons)	Roof support controls (type)	Face conveyor type (strand, motors)	Face conveyor drives	Face conveyor width (mm)/ speed (fpm)	Stageloader type width, speed	Crusher	Electrical controls	Voltage to face
MONTANA (1)																			
Bull Mountains Signal Peak Energy	Mammoth	120-180	120-174	1,400	4,600 22,000	200-850	3	42	Joy 7LS5 DDR 2,535	Jumbotrac 2000	ZMJ 1,349	HBT PMC-R	HBT 48 TIB 3x1,900	HBT CST	1,088/ 376	HBT 1,388 mm, 464 fpm	HBT	Intermountain Electrical	4,160
PENNSYLVANIA (6)																			
Bailey - Dry Ridge CONSOL Energy	Pittsburgh No. 8	62-72	92	1,501	15,027	400-1,000	3	42	Joy 7LS2A DDR 1,692	Ultratrac 2,000	HBT 969	—	Longwall Associates 48 TIB 3x1,900	HBT CST	988/ 378	HBT 1,188 mm, 528 fpm	HBT	Line Power	4,160
Bailey - Crabapple CONSOL Energy	Pittsburgh No. 8	62-72	93	1,576	12,240	500-1,400	3	42	Joy 7LS2A DDR 1,692	Ultratrac 2,000	HBT 969	—	Longwall Associates 48 TIB 3x1,900	HBT CST	988/ 378	HBT 1,188 mm, 528 fpm	HBT	Line Power	4,160
Harvey CONSOL Energy	Pittsburgh No. 8	62-72	86	1,456	14,730	800-1,200	3	42	Joy 7LS2A DDR 1,692	Super GearRack	HBT 969	HBT —	Longwall Associates 48 TIB 3x1,900	HBT CST	988/ 378	HBT 1,188 mm, 528 fpm	HBT	Line Power	4,160
Cumberland Iron Senergy	Pittsburgh No. 8	72-84	96-102	1,380-1,580	11,000-15,000	600-1,200	3	42	Joy 7LS2A DDR 1,692	Jumbo Track 2,000	HBT 1,096	HBT PMC-R	HBT 48 TIB 3x1,900	HBT CST	988/ 371	HBT 1,388 mm, 420 fpm	HBT	Becker/ SMC	4,160
Enlow Fork - H Side CONSOL Energy	Pittsburgh No. 8	62-72	86	1,538	15,290	600-1,200	3	42	Joy 7LS2A DDR 1,692	Super GearRack	Joy 1,005	HBT PMC-R	HBT 48 TIB 3x1,900	HBT CST	988/ 371	HBT 1,188 mm, 525 fpm	HBT	Line Power	4,160
Enlow Fork - G Side CONSOL Energy	Pittsburgh No. 8	62-72	86	1,510	14,035	600-1,200	3	42	Joy 7LS2A DDR 1,692	Super GearRack	Joy 1,005	HBT PMC-R	HBT 48 TIB 3x1,900	HBT CST	988/ 371	HBT 1,188 mm, 525 fpm	HBT	Line Power	4,160
UTAH (3)																			
SUFCO No. 1 Wolverine Fuels	Upper Hiawatha	84-216	96-156	1,110	2,400-4,000	800-1,800	3	42	Joy 7LS2A DDR 1,940	Ultratrac 2000	Joy 1,100	Joy RS20s	Joy 48 TIB 3x1,650	HBT CST	1,000/ 374	HBT 1,388 mm, 464 fpm	HBT	Service Machine	4,160
Skyline Wolverine Fuels	Lower O'Connor A	84-200	96-144	850	6,000	500-1,600	2	36	Joy 7LS2A DDR 1,940	Jumbotrac 2000	HBT 1,007	—	HBT 42 TIB 2x1,200	HBT CST	888/ 340	HBT 1,388 mm, 450 fpm	HBT	Line Power	4,160
Lila Canyon (Emery County) ACNR (Idled Indefinitely)	Lower Sunnyside	168	144	847	4,500-5,000	2,200	2	42	Cat EL2000 DDR 2,004	Ultratrac 2,000	ZMJ 1,250	HBT PMC-R	CEMI 48 TIB 3x1,000		1,000/ 312	CEMI 1,200 mm, 531 fpm	CEMI	Intermountain Electrical	2,300
VIRGINIA (2)																			
Buchanan-North Coronado Global Resources	Pocahontas No. 3	60-76	70	700	11,500	1,400-2,000	4	42	Joy 7LS1D DDR 1,317	Super GearRack 2,000	Joy 1,024	Joy RS20s	Joy/Longwall Associates 42 TIB 3x800	——	1,000/ 357	Longwall Associates 1,294 mm, 485 fpm	JOY	Line Power	4,160
Buchanan-South Coronado Global Resources	Pocahontas No. 3	60-76	70	1,000	9,200	1,400-2,000	3	42	Joy 7LS1D DDR 1,317	Super GearRack 2,000	Swanson 1,024	Tiefenbach AS65-2020	Joy/Longwall Associates 42 TIB 3x800	——	1,000/ 357	Longwall Associates 1,294 mm, 485 fpm	LWA	Line Power	4,160

Legend: DDR 2,000 means double-drum ranging arm shearer with 2,000 hp installed. VFD—variable frequency drive; SS—single strand; TIB—twin strand inboard; 42 TIB 2 x 1,000 means 42-mm chain, twin strand inboard, two 1,000-hp motors.
Note: ACNR—American Consolidated Natural Resources; CEMI = Centralia Equipment and Machine, Inc.; PSS = PSSystems, Inc.; and ZMJ = Zhengzhou Coal Mining Machinery; HBT = HBT Americas.

The new Faceboss 2.0 system will provide more automation features. (Photo: Komatsu)

a new AFC control system that uses a lot of the same hardware used for the roof support control system," Ley said. "Longwall operators can share hardware between the two. It's a completely intrinsically safe system with plug-and-play hardware and sensors. Because it's intrinsically safe, the cabling does not have to pass through bulky, expensive explosion-proof enclosures, which also reduces the footprint."

Komatsu will unveil a new prototype ranging arm, the J7500, at MINExpo. "At MINExpo 2021, we had had a 3D model we were discussing with longwall operators," Franklin said. "It was still conceptual then, but we will be building the J7500 soon and testing it."

Komatsu has been working with the National Institute for Occupational Safety and Health (NIOSH) on a seam detection project. In 2021, NIOSH awarded Komatsu with a contract to develop technologies and sensors that could be used to detect the coal-rock interface. "We have been evaluating ways to detect the seam with various sensors, vibration, audio, advanced imaging, etc., which would ultimately improve horizon control," Franklin said. "We collected data from the Leer mine, and we have some encouraging results. We are confident that we can detect the coal-rock interface using advanced analytics. We will be wrapping that project up later this year and NIOSH will publish the report."

Mine Company (parent)	Seam	Seam height (inches)	Cutting height (inches)	Panel width (ft)	Panel length (ft)	Over-burden (ft)	No. of gate entries	Depth of cut (inches)	Shearer Total hp	Haulage system	Roof support yield (tons)	Roof support controls (type)	Face conveyor type (strand, motors)	Face conveyor drives	Face conveyor width (mm)/ speed (fpm)	Stageloader type width, speed	Crusher	Electrical controls	Voltage to face
WEST VIRGINIA (10)																			
Harrison County ACNR	Pittsburgh No. 8	79	94	1,518	13,300	1,100	3	39	Joy 7LS1D DDR 1,880	Ultratrac 2,000	HBT 862	——	CEMI 48 TIB 3x1,900	HBT CST	1,000/ 378	CEMI 1,200 mm, 531 fpm	HBT	Line Power	4,160
Leer Arch Resources	Lower Kittanning	54-96	72-96	1,200	5,000-10,000	280-750	3	42	Joy 7LS1D DDR 1,840	Ultratrac 2,000	Joy 1,040	Joy RS20s	Joy 48 TIB 3x1,340	Joy	1,000/ 337	Joy 1,294 mm, 515 fpm	Joy	Inter Mountain	4,160
Leer South Arch Resources	Lower Kittanning	54	78	1,200	5,000-8,500	900	3	42	Joy 7LS1D DDR 2,000	Ultratrac 2,000	Joy 1,040	Joy RS20s	Joy 48 TIB 3x1,350	Joy	1,000/ 376	Joy 1,294 mm, 443 fpm	Joy	Service Machine	4,160
Longview Allegheny Metallurgical	Lower Kittanning	75	84	1,206	11,200	650-1,300	3	42	Joy 7LS1D DDR 1,840	Super GearRack 2,000	Famur 1,102	HBT PMCR 1.0	Longwall Associates 48mm 3x1,900	HBT CST	1,000/ 376	Longwall Associates 1,294 mm, 487 fpm	LWA/ HBT	Becker/ SMC	4,160
Marion County ACNR	Pittsburgh No. 8	88	88	1,438	14,376	1,150	3	42	Joy 7LS1D DDR 1,880	Ultratrac 2,000	ZMJ 937	——	CEMI/HBT CSTs 48 TIB 3x1,900	——	1,000/ 378	CEMI/HBT 1,200 mm, 531 fpm	HBT	Line Power	4,160
Marshall County West ACNR	Pittsburgh No. 8	96	95	1,498	10,500	950	3	42	Joy 7LS1D DDR 1,880	Ultratrac 2,000	ZMJ 937	——	CEMI/HBT CSTs 48 TIB 3x1,900	——	1,000/ 378	CEMI/HBT 1,200 mm, 531 fpm	HBT	Line Power	4,160
Marshall County East ACNR	Pittsburgh No. 8	96	98	1,498	11,000	950	3	42	Joy 7LS1A DDR 1,880	Ultratrac 2,000	ZMJ 937	——	CEMI/HBT CSTs 48 TIB 3x1,900	——	1,000/ 378	CEMI/HBT 1,200 mm, 531 fpm	HBT	Line Power	4,160
Mountain View Alliance Resource Partners	Upper Freeport	88-108	78-108	850	4,000-6,000	600	3	42	Joy 7LS1A DDR 1,330	Ultratrac 2,000	Joy 815	Joy RS20s	Longwall Associates 38 TIB 2x700	——	950/ 229	Joy 1,200 mm, 312 fpm	Longwall Associates	Line Power	2,300
Ohio County ACNR	Pittsburgh No. 8	72	88	1,541	15,000	680	3	42	Joy 7SL1D DDR 1,880	Ultratrac 2,000	Cat 862	——	CEMI/HBT CSTs 48 TIB 3x1,900	——	1,000/ 378	CEMI/HBT 1,200 mm, 531 fpm	HBT	Line Power	4,160
Tunnel Ridge Alliance Resource Partners	Pittsburgh No. 8	62-72	80-84	1,200	17,000-20,000	400-725	3	42	Joy 7LS1D DDR 1,840	Ultratrac 2,000	PSS 1,020	HBT PMC-R	Joy 48 TIB 3x1,200	——	1,000/ 360	Joy 1,294 mm, 443 fpm	Joy	Line Power	4,160
WYOMING (2)																			
Green River Solvay Chemicals	Bed 17	96-144	96-132	625	8,750	1,600	3	34	Joy 7LS5 DDR 2,360	Joy JumboTrack 2,000	Famur 800	SeeTech ——	Longwall Associates 42 TIB 2x1,000	LWA	1,100/ 330	HBT 1,388 mm, 477 fpm	HBT	Service Machine	4,160
Westvaco Genesis Alkali LLC	Bed 17	96-132	96-132	750	9,400	1,500	4	38	Joy 7LS5 DDR 2,360	Ultratrac 2,000	Joy 870	Joy RS20s	Joy 42 TIB 2x1,072	——	1,100/ 268	Joy 1,294 mm, 385 fpm	Joy	Service Machine	4,160

Legend: DDR 2,000 means double-drum ranging arm shearer with 2,000 hp installed. VFD—variable frequency drive; SS—single strand; TIB—twin strand inboard; 42 TIB 2 x 1,000 means 42-mm chain, twin strand inboard, two 1,000-hp motors.
Note: ACNR—American Consolidated Natural Resources; CEMI = Centralia Equipment and Machine, Inc.; PSS = PSSystems, Inc.; and ZMJ = Zhengzhou Coal Mining Machinery; HBT = HBT Americas.

Rigs Offer Automation, Remote Control, Integration

Drill rig OEMs race to perfect autonomous and remote control solutions and technologies, and eye horizontal integration

By Jesse Morton, Technical Writer

The big innovations in surface drilling include key advances in autonomous and remote control technologies and solutions. Both are said to improve rig performance and uptime while offering safety and sustainability benefits. Separately, one OEM announced a partnership for horizontal integration. As digital solutions proliferate in mining, the demand is growing for those solutions to be capable of integrating. Certainly, suppliers will take action to meet that demand. Meanwhile, an OEM reported that demand remains solid for basic, relatively low-tech rigs, revealing another, less discussed trend in demand that suppliers are also willing to meet.

Epiroc expanded the Pit Viper series with two new rigs that can come with autonomous and remote control capabilities. Above, an autonomous Pit Viper 271. (Photo: Epiroc)

New Rigs Offer Autonomous Drilling

Epiroc announced the Pit Viper 231 E and the Pit Viper 235 E, electric-driven blasthole drills equipped with the Rig Control System (RCS) for autonomous and remote control capabilities.

The Pit Viper 231 E can drill 152- to 250-mm dia. holes to 16.1 m deep. The Pit Viper 235 E can drill 171- to 270-mm dia. holes.

An expert at Epiroc said the drills are key additions to the popular series. The rigs "maintain the legendary productivity and reliability of the Pit Viper line," said Yara Hussein, global product manager, mid-range blasthole solutions. They offer the "full range of drilling options to meet current and future needs."

Autonomous and remote control capabilities can help a miner resolve current needs. "These electric-driven drills can potentially address labor constraints by offering advanced automation that enhances safety and productivity from a control room," she said.

"Epiroc's proprietary RCS offers advanced on-board and off-board automation that significantly enhances safety, accuracy, and productivity," Hussein said. "RCS allows the operators to instead become controllers and, along with their management, choose their desired level of interaction with the harsh drilling conditions."

Both rigs offer increased uptime and lower costs. "The elimination of traditional fuel consumption gives substantial operational cost savings," Hussein said.

"The electric motors Epiroc designs into the electric range ensures increased life of the powertrain," she said. "The reduced maintenance intrusion and reduced circulation of fuel means no fuel filters or risks of system contamination, which reduces the mine's operational expenses."

The rigs provide operators with "safe, clean, and more sustainable operations," she said. "Electrification options like our hydraulic cable reel coupled with the precision of RCS take out operator manual intervention and creates the most comfortable conditions for a driller." The rigs produce less noise than their diesel equivalents.

The Pit Viper 231 E and 235 E can help an operation achieve sustainability goals. "The electric drill range answers the customers' needs for a zero-emission solution to align with increasingly stringent environmental

The new Pit Viper 231 E can drill 250-mm dia. holes to 16.1 m deep. (Image: Epiroc)

The new Pit Viper 235 E can drill 270-mm dia. holes. (Image: Epiroc)

regulations," Hussein said. "The Pit Viper 231 E and Pit Viper 235 E showcase a proactive approach to reducing CO_2 emissions, aligning with sustainability goals, and positioning the operation favorably for investment."

The announcement caps decades of researching, developing, and supplying electric drilling solutions. "The first electric drill, Pit Viper 351 E, was designed in 2002, followed by the development of Drill Master L E in 2007, the Drill Master 75 E, Pit Viper 271 E and Pit Viper 275 E in 2009," Hussein said. "And now the Pit Viper 231 E and Pit Viper 235 E complete the full hole range offering."

Separately, Epiroc reported it will deploy a fifth Pit Viper in April 2024 to join the fleet at IAMGOLD Corp.'s Côté Gold Project, an open pit mine in the Sudbury District of Ontario. The rigs are equipped with Mobius for Drills, which imports drill plans, collects data, and enables multi-machine control; and 3D-P, Epiroc's connectivity solution.

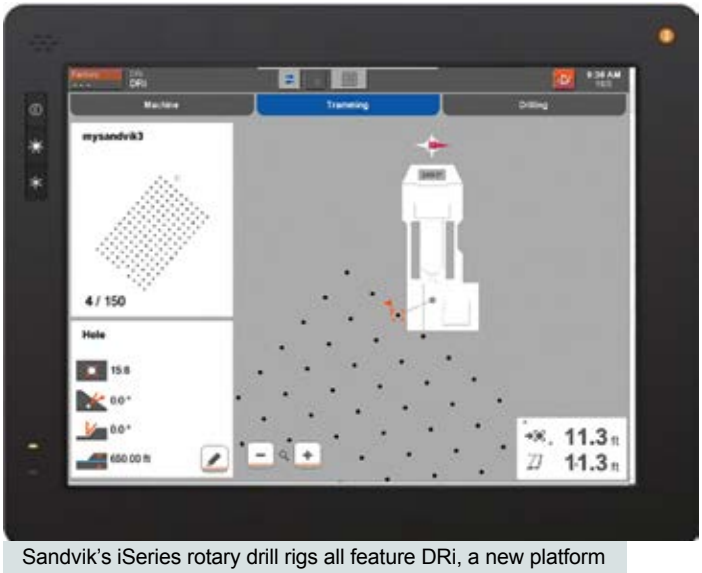
Leadership at the mine said the fleet will help the mine become the first fully automated haulage and drilling mine in Canada. "The existing four Pit Viper rigs are progressing towards full autonomous mode," said Francis Letarte-Lavoie, operations manager, Côté Gold.

More recently, Epiroc said that its surface drill rigs are now verified to be compatible with HVO100 fuel, and customers can immediately begin using it as an alternative to, or mixed with, diesel. Use of the hydrotreated vegetable oil gives "a substantial reduction of particulates and other harmful substances, including greenhouse gases."

The development is an important step in helping the supplier and its customers meet sustainability goals, Epiroc said. "Epiroc has ambitious sustainability targets for 2030, and we continuously strive to improve our offering by finding more sustainable solutions," said Martin Johansson, global product portfolio manager, Epiroc Surface division.

The HVO100 is compatible with the product ranges of SmartROC, FlexiROC, PowerROC, Christensen, Explorac and Boyles.

In October, Epiroc announced the new generation of the SmartROC C50, which will feature a new smart graphical interface and improved fuel efficiency. "The new generation of SmartROC C50 is now fitted with an



Sandvik's iSeries rotary drill rigs all feature DRi, a new platform that supports autonomous, remote control, and machine monitoring systems and technologies. Above a drill pattern supported by DRi. (Image: Sandvik)

Sandvik's new electric-cabled surface down-the-hole (DTH) drill rig is capable of drilling 229-mm holes and can tram for 7 hours powered by a battery pack.

updated RCS, which improves fuel efficiency up to 5%," Epiroc said. "The smart RCS system constantly monitors compressor load and keep track of engine RPM to ensure no fuel is wasted and that environmental impact is kept to a minimum."

The new technology offers the precision and consistency that leads to improved productivity. "The SmartROC C50 delivers improved blast-results," said Ulf Gyllander, global product manager, Epiroc. "It will be beneficial throughout the operation, and the smart technology assists the operator every step of the way."

Common Control Platform Speeds Evolution

Sandvik automation and drill rig experts revealed how iSeries rotary drill rig models now evolve in unison.

The DR410i, DR412i, DR413i, and DR416i all feature DRi, a new platform built on the Sandvik Intelligent Control System Architecture (SICA). The common platform supports autonomous, remote control, and machine monitoring systems and technologies. It allows the supplier to offer the exact same features, updates and upgrades, as soon as they are available, on each model.

"Prior to DRi, Sandvik had to develop new features and copy them over, one model at a time, but now, Sandvik can develop it once and make it available across all iSeries models," said Demetre Harris, product manager, surface automation, rotary drills. "With DRi, all iSeries drills are on the same platform, meaning one software version, making control features, tools and upgrades easy to deploy, support, and enhance."

Customers with multiple iSeries units report the common platform facilitates maintenance and offers efficiencies that translate to savings. “Our customers have commended Sandvik on the design of our drilling solutions and the ease to troubleshoot our drilling machines,” said Nellaiappan Subbiah, product manager, rotary drills.

“This is all made possible through DRi, and the technology and capabilities built on the platform,” he said. “The DRi platform makes troubleshooting easier for maintenance specialists both at the rig and remotely from the factory through our patented onboard diagnostic capabilities and our remote connectivity options.”

DRi enables updates and upgrades to be rapidly deployed across a fleet of iSeries machines. “We can roll out changes across all the models because they’re all sharing the same platform,” Harris said.

“When new features are added, the customer has the luxury of accessing all the new benefits across all products,” he said. The common control system helps reduce the amount of operator training needed on a new iSeries model. “Overall, DRi has allowed Sandvik to deploy, support, and train more efficiently, and to get new features and improvements out of the factory, tested, drilling in the pit, and satisfying customer needs faster than before.”

Once made in Austria, the mining-class RTD32 rig, above, will be made in Pennsylvania. (Photo: RTDrill)

Common hardware, such as PLCs, joysticks, sensors and controls, streamlines and simplifies inventory management. “This allows large mining organizations to share stock and even operators across different mining

operations with the same or different iSeries drill models if the need ever arises," Subbiah said.

The common platform and the technologies and capabilities it supports help operators achieve desired performance metrics. The DRi control system has "functional interlocks, alerts and warnings to help the operator in operating the machine in a safer manner, ensuring that productivity and utilization targets are met while eliminating machine abuse," Harris said. "Mining operations can perform diagnostics and monitor performance to catch a problem before it impacts production."

Machine health and operator performance data can be analyzed by Sandvik specialists who can advise on optimizing machine utilization and productivity. "The data can then be fed into Sandvik Digital Solutions such as MySandvik Onsite and MySandvik Productivity to be visualized through dashboards to report the rig health, work modes, utilization and productivity," Subbiah said. The resulting information allows "top performers to be recognized, improvements to be identified, and actions to be taken that lead to increased productivity, lower costs, and higher profits."

The popular RTD55 has minimal sensors, giving it superior uptime and speed of meters drilled, RTDrill said. (Photo: RTDrill)

The DRi platform also allows the data from a rig to be integrated with that of solutions by other OEMs "to help accurately plan for blasting and achieve optimal fragmentation," he said.

SICA has been used by Sandvik mining solutions for more than 15 years. Development of DRi launched in 2020. "The first model to receive it was the DR410i in 2021," Harris said. "Every rig model that received the DRi upgrade has been fully tested and validated at the factory and in the pit," he said. "The DRi extension of SICA has been in place for a little more than a year, and has streamlined development, support and change management of our iSeries drilling solutions."

Currently there are more than 1,000 iSeries machines connected to the cloud for data analytics. "Each connection boosts the production and utilization for large mining houses," Subbiah said. "The benefits provided through Sandvik digital solutions because of DRi have assisted mining operations with lowering blasting costs, improving efficiency, and increasing productivity."

Separately, in late November, Sandvik announced an electric surface down-the-hole (DTH) drill rig that is capable of drilling 229-mm holes. With a 180-m cable, the unit can also be powered by a battery pack for an hour of drilling or up to 7 hours of tramming. The battery pack can help increase rig uptime, Sandvik said.

"The battery means greater freedom and flexibility and more efficient use of time, as the rig can drill immediately while the cable is being set up," said Lauri Laihanen, vice president, R&D, Surface Drilling Division.

The 1,000-volt cable tightens itself automatically, and is wound on a single layer. The rig is currently scheduled for field testing, Sandvik reported.

In May, 2022, Sandvik introduced a smaller top-hammer battery-electric concept surface drill rig that is being tested at construction sites.

Big OEMs Partner on Integration

Caterpillar and Orica reported partnering to explore opportunities to improve real-time data exchange and to integrate workflows. They will initially seek to integrate Orica's Rhino, BlastIQ, and FRAGTrack technologies with Cat MineStar Terrain.

The integration could give high-fidelity rock property information, enabling improvements to on-bench safety, drilling and blasting program accuracy and productivity, and higher quality blast outcomes that generate enhanced mill performance, Orica said. Going forward, the partnership will seek opportunities to optimize the entire value chain from mine to mill.

Orica said the development speaks to an industry trend. "The mining industry requires greater collaboration amongst its leading technology players to build connected workflows across different domains to address the current issue of value-leakage arising from traditional and disconnected silos," said Rajkumar Mathiravedu, vice president, Orica Digital Solutions. "Collaborative end-to-end ecosystems are critical to harnessing the full potential of advances in sensors, data processing and intelligence to enable the development of safer, more sustainable, and productive methods of resource recovery."

Popular Rigs Now Made in U.S.

RTDrill said the RTD28 and RTD32 will now be manufactured in the U.S. "Those two models were previously manufactured in our factory in Austria," said Bruno Lordey, territory manager, Eastern U.S. and Canada. "However, now, their production has been moved to our factory in Philipsburg, Pennsylvania," he said. "So today we can proudly say that all our drill rigs are 100% manufactured in the USA."

The larger unit, the RTD32, is routinely sold to mines "thanks to its compressor holding 406 PSI and the ability to drill holes up to 203 mm dia. for a maximum depth of 49 m," Lordey said.

The articulated DTH rig offers high productivity. "The RTD32 would be a great addition to any fleet. Many different options can be added to it," he said. "Even for mining exploration drilling or grade control, we have the capability of adding a reverse circulation kit thanks to our sister company, Technidrill, which makes that kit along with reverse circulation tools such as drill pipes and subs."

Earlier this year RTDrill reported it deployed an RTD32 to a surface operation in Kentucky, U.S., where it was drilling 2.4 m per minute. The company also published photos of an RTD55 rig prepped for delivery and loaded on a transit truck at the factory in Pennsylvania.

The RTD55 is the most popular mining rig the supplier sells. Customers select it for the superior uptime and speed of meters drilled, RTDrill said.

The model is designed for rotary and DTH multipass, has 9.1-m drill pipes in a carousel that can hold up to six. For DTH, it can drill a 172-mm hole to 60 m. Equipped with a dual-motor system rotary head, it can drill hole sizes up to 229 mm. The rotary head can deliver up to 7,300 Nm torque.

The rig comes with either a (Tier-III or -IV) Cat C15 or a Cummins QSX 15 (up to 433-kW) engine with a low- or high-pressure (8.6- or 25.5-Bar) compressor that delivers up to 31.1-m^3/min. The two-man, falling-object protection certified, air-conditioned cab features electric-hydraulic controls.

Other than those controls, the unit is made with relatively few electronic components and sensors, meaning it can sustain abuse without stopping, giving it high availability.

The supplier expects "a significant growth in production," Lordey said. "We are really excited about it," he said. "Don't forget to stop and see us in September in Las Vegas at MINExpo to learn more about our drill rigs and our expertise."

This article was published previously in the January 2024 edition of Engineering & Mining Journal.

Analysis Technology Saves Mine 4.5% in Fuel Consumption

One of Indonesia's largest coal mining contractors has partnered with British technology and engineering company, McLaren Applied, to expedite the process of decarbonizing its operations.

PT Pamapersada Nusantara's (PAMA) fleet of haul trucks carry 100-ton payloads over steep, uneven ground, operating in a dynamic environment. Variables such as payload, weather, terrain and route all affect the driving technique required to ensure maximum efficiency. With fuel representing 25%-30% of a mine's operating expenses, any gain in efficiency can have a large impact on pollution, productivity and costs.

According to McLaren Applied, the application of accurate, real-time fuel analytics can provide a cost-effective way to influence both consumption and emissions, increasing efficiency and accelerating decarbonization. The company said that while traditional fuel analytics can only provide mine managers with performance reports for the previous day or shift — too late to keep pace with the rapidly changing situation — its Fuel Analytics Service is more advanced, using Formula 1-derived technology to collect detailed live data from multiple sensors onboard PAMA's fleet, transmitting it to cloud-based servers and using it to inform a machine learning-based algorithm. The Fuel Analytics Service references the data received against a full digital model of the mine, using specially developed AI tools to instantaneously calculate what changes the driver should make to optimize fuel efficiency.

Learning from the behaviors of the most efficient drivers over the last three days' worth of data, the model instructs vehicle operators in real time, offering live feedback to ensure optimal driving. With different drivers' styles better suited to various aspects of the dynamically changing environment, the most efficient among them may not always be the same, providing all employees with an opportunity to learn and improve.

The latest information is used to regularly re-train the model, providing recommendations for each new shift. The compound effect of this feedback loop, said McLaren Applied, means that individual drivers that follow the recommendations become more efficient. This, in turn, helps the algorithm teach the entire group to match their improved results.

Only those drivers objectively analyzed to be performing less efficiently require manual intervention from mangers, saving time and money by allowing better-performing employees to continue working while lower performers benefit from more focused training.

Since implementing Fuel Analytics Service on the trucks at its MTBU mine, data has shown fuel savings of up to 4.5% across the selected cycles or routes versus a control group of drivers not yet using the system. Extrapolated across the total fuel required to operate PAMA's mining operations each year, the potential for immediate and impactful efficiency gains is clear, according to McLaren Applied.

When examined more granularly, the top 25% of PAMA's drivers using Fuel Analytics were found to save up to 6.5% in fuel and carbon emissions, while simultaneously improving their cycle time by 5.6%.

The company said this improvement in productivity in particular, achieved due to the Fuel Analytic Service's real-time recommenda-

After implementing an advanced fuel analytics program at one of its mines, an Indonesian coal-mining contractor found that the top 25% of haul truck drivers using the program's recommendations saved up to 6.5% in fuel and carbon emissions, while improving cycle times by 5.6%. (Photo: PT Pamapersada)

US COAL SHOW

CALL FOR PRESENTATIONS

David L. Lawrence Convention Center, Pittsburgh, Pa.
June 3-5, 2025

The U.S. Coal Show combines a continuing education program with an exposition to create a dynamic peer-to-peer networking event for coal mining professionals and suppliers. The organizing committee for the technical program is looking for 20- to 25-min. presentations and the desired subject matter includes:

- Longwall Mining
- Safety & Training Programs
- Room-and-Pillar Mining
- Surface Operations
- Mine Power Systems
- Proximity Detection
- Collision Avoidance
- Ventilation Techniques
- Optimizing Operations
- Methane Drainage and Capture
- Sustainability Programs
- Coal Handling and Storage
- Ground Control
- Roof Bolting

To participate, prospective speakers should submit a 100-word (or less) presentation description to Steve Fiscor (sfiscor@mining-media.com) by September 5, 2024.
uscoalshow.com

tions, demonstrates how smoother, more consistent inputs can reduce braking and acceleration, benefitting both speed and efficiency. And, the efficiency gains seen to date can be further linked to key secondary benefits — reduced maintenance requirements and costs, thanks to decreased wear and tear on the mechanical components of the heavy trucks due to smoother, less frequent inputs, can lead to long-term positive financial and operational outcomes.

Nine months after its introduction, PAMA is in the process of expanding the Fuel Analytic Service use to a second site. McLaren Applied said the technology will remain applicable even when electric and/or hydrogen trucks enter service, with the gains in efficiency offered by the service continuing to offer cost, productivity and efficiency improvements.

AI-powered Lone Worker Protection

A Switzerland-based technology group recently pointed to studies estimating that in Europe alone, there may be as many as 10 million lone workers, many of whom function in high-risk environments and could benefit from connected wearable IoT solutions designed to enhance safety and productivity. It's a universal problem that has been exacerbated since the global COVID-19 pandemic changed the nature of work — and the workforce — in many industrial sectors, resulting in smaller employee rosters and more reliance on lone workers. A 2022 study of 250 lone worker professionals in North America indicated that almost one in five reported having an accident and encountering difficulty getting help, while just under half reported feeling generally unsafe about their work conditions.

As a potential solution, Conextivity Group highlighted its Wearin' brand's lone worker protection equipment, designed to reliably detect falls and alert a control center in the event of an accident. Wearin' and Fischer Connectors comprise the group's two core businesses focused on connectivity solutions that manage power and data flows seamlessly from sensors and devices.

Based on IoT technology and powered by AI, the Wearin' product incorporates two platforms, one physical and the other digital, communicating with each other in real time. A device attached to the worker's vest, called the Wearin' Brain, embeds three safety alert and detection systems: one to alert the control center via an SOS button that can be activated manually in the event of an accident; an inertial sensor that can automatically detect a fall in case the alert cannot be raised manually;

and GPS to pinpoint the precise location of the worker.

Data and alerts are sent and collected via the cloud to the Wearin' dashboard integrated into a central monitoring system, allowing recipients to take appropriate emergency and rescue measures according to the alerts they have received.

Alvaro Goncalves, technical director at Wearin', explained that in addition to the SOS button, the fall detection sensor and the GPS system, a 10-hour battery allows the Brain to last an entire shift without additional charging, and an LTE module provides for secure data transmission to the alarm center.

The fall detection sensor designed by Wearin' minimizes the risk of false positives experienced with other, less advanced competing products, according to the company. Aurélie Balsa, embedded software manager at Wearin', noted that: "The critical problem faced by this type of system is the frequency of false positives and the impact they have on the worker. The detection provided by other products is sometimes so unreliable that users, annoyed by repeated false alarms, end up disconnecting the system altogether. Wearin's solution comprises hardware, firmware and embedded algorithms. Based on data from our accelerometer and gyroscope, our algorithms reduce false positives to less than 1%."

Jonathan Brossard, CEO of Conextivity Group, commented: "The trend we're seeing in this sector is a strong and genuine concern on the part of companies for the health and safety of their employees. These companies no longer want to limit themselves to ticking the boxes on safety checklists provided by regulatory authorities. They demand real solutions to the real-life issues specific to their operations."

Conextivity Group, developer of the Wearin' lone worker protection system shown here, said it provides an end-to-end connectivity solution that's reliable, modular and scalable, capable of adapting to the specific requirements of each client.

Komatsu, Becker-Warkop and Hydrotech Deliver New Shields

The first set of roof supports (above) were installed during July 2023. (Photo: Komatsu)

Under a cooperative agreement between Komatsu, Becker-Warkop and Hydrotech, 385 new longwall powered roof supports have been delivered to a U.S. longwall coal producer in Alabama. The first face began operation in July and the second face is undergoing installation. While Komatsu has provided powered roof supports to this producer in the past, this is the first solution supplied in collaboration with Becker-Warkop and Hydrotech.

The new Joy-designed supports also include Joy's Faceboss RS20s roof support controls. The longwalls enter operation at mines which have seam heights of 45 inches and 53 inches respectively, and the 1,700-mm (67-in.) wide supports feature a maximum operating height of 2,946 mm (116 in.) and have 380 mm bore legs.

Other longwall equipment at this mine was supplied by Komatsu including three Joy 7LS1D shearers and three armored face conveyors (AFCs), including the first U.S.-sourced Joy panline.

Alliance Introduces Infinitum Motor Technology

Infinitum and Matrix Design Group, a subsidiary of Alliance Resource Partners, announced an agreement to jointly develop and distribute high-efficiency, reliable motors and advanced motor controllers designed specifically for the mining industry. Infinitum created the sustainable air-core motor.

Under the agreement, Matrix will integrate Infinitum's smaller, lighter motor technology into mining equipment operated by Alliance's mines to provide performance validation in a production environment for the jointly developed products. In addition to supporting installations at Alliance operations, Matrix plans to offer the products to other mining companies worldwide.

"This collaboration with Infinitum represents a natural progression and extension of our strategic investment in the company," said Joe Craft, chairman, president, and CEO for Alliance. "We believe their groundbreaking motor technology will bring much needed innovation to the mining industry by delivering more efficient and higher performing production equipment, which will enable companies such as ours to improve mining processes, reduce operating costs, and boost productivity."

Infinitum's patented motor technology will replace traditional, heavy iron-core motors with a motor system that is 50% smaller and lighter, uses 66% less copper, and consumes 10% less energy, and is expected to offer mining companies and equipment manufacturers a more efficient, reliable alternative.

"Working with Alliance and Matrix expands Infinitum's ability to sustainably power heavy machinery with our lightweight, power-dense motors that use less energy, material and waste," said Ben Schuler, founder and CEO, Infinitum. "We're excited to join forces with a mining leader like Alliance to make a greater impact towards electrifying and decarbonizing heavy industry."

The Aircore EC motors are 50% smaller, use 66% less copper and consume 10% less power than conventional iron-core motors. (Photo: Infinitum)

Expect More in '24

The Coal Preparation Society of America (CPSA) is bringing back the Coal Processing Technology Conference and Exhibition to the Central Bank Center. As last year, it will be a joint conference with the Society of Mining Engineers, Central Appalachian Section with parallel technical sessions.

The majority of our exhibitors along with some new ones will be back on the floor which is 75% booked. Check out the latest floor plan at www.coalprepsociety.org under the events tab and book a booth with the exhibitor application. Lunches will be served on the exhibit floor thanks to our sponsors: Elgin and FLSmidth.

Monday, April 29 is exhibitor setup and features two workshops as part of our technical program (total of up to 13 Professional Development Hours for the conference):

- Efficient Magnetite Utilization and Recovery - Topics include the fundamentals, what affects heavy medium circuit performance, control systems, and the best maintenance practices.
- Screen Application, Operation and Maintenance - Topics include a review of the many types of screens available for coal sizing and dewatering operations along with screen monitoring and optimization.


Photo - Wall Street Journal

Tuesday, April 30, the conference begins with a keynote address by Randall Atkins, Founder and CEO of Ramaco Resources, a leading operator and developer of high-quality, low-cost metallurgical coal. As recently featured in the Wall Street Journal, they have commenced development of the Brook Mine in Wyoming, the first new rare earth elements mine in the U.S. since 1952. Ramaco is also working on commerical development of patented coal-to-products technology to help create vehicle batteries, infrastructure materials and a wide range of consumer products. This is in line with the technologies that will be discussed in the CoalProTec, Rare Earth Elements and Critical Materials Derived from Coal-Based Materials technical session on Wednesday morning.

The exhibit hall opens after the keynote and following a quick tour of the exhibit hall, join us for our Kentucky BBQ lunch and our annual membership meeting where you will learn what new programs and training opportunities the CPSA will be offering to *further the knowledge of coal preparation*. The technical sessions begin Tuesday afternoon with both the SME/CAS and the CPSA having paper presentations on timely topics such as: Plant Operations and Modifications and the search for Rare Earths and Critical Minerals.

Our Members Night Out is Tuesday evening at Club C at the Center. With help from our sponsors, Conn-Weld and Polydeck, it has been expanded to feature bourbon tasting, hors d'oeuvres, dinner and Josh Fletcher, an entertaining mentalist. A warning about the show - be careful what you think! The evening will close with a DJ and for the adventureous, karaoke. It is a great networking opportunity so reserve a seat or an entire table, but do so soon because this event always sells out.

Wednesday, May 1 there are morning and afternoon technical sessions with a lunch that includes a raffle of some very nice items provided by many of our exhibitors and the CPSA will also be giving away a couple of expanded 2nd editions of the popular reference book, "Ask Mr. Prep". It will also be on sale at the registration desk. The conference wraps up Wednesday afternoon with the Innovative Coal Cleaning Methods and Technologies session.

You can register for the conference and exhibition, book your seat(s) at Members Night Out, sign up to exhibit, buy "Ask Mr. Prep" and advertise in our quarterly journal at www.coalprepsociety.org.

Preliminary Program

The technical program will feature parallel tracks for coal processing and mining, each with three sessions:

Session 1: Tuesday, April 30, 2:00-4:00 PM
Session 2: Wednesday, May 1, 9:00-11:00 AM
Session 3: Wednesday, May 1, 2:00-4:00 PM

CPSA Session 1: Plant Operations and Modifications

Lessons Learned from a 40 Year Career in Coal Prepartion
Dan Yanchak, Consol Energy

Mach Supercharger Upgrade
Dylan Connel, Jason Williams and Jeff Walkup, American Consolidted

Robindale Filter Press Installation Project
Jon Bobbers, Robindale Energy

Enhancing Efficiency and Addressing Challenges in Coal Mining Prep Plants: The Role of Chemical Reagents
James Criss and Tim Kane, SNF

Precision Flow of Solids in Bulk Material Handling Equipment
Michael Williams and Greg Clark, Tassco

CPSA Session 2: Rare Earth Elements and Critical Materials Derived from Coal-Based Materials

Coal to Carbon Research at Penn State
Dr. Barbara Arnold J.H. Adair, A. Dahi Taleghani, A. Gharpure, J.P. Mathews, S.V. Pisupati and R.L. Vander Wal
Pennslyvania State University

Advanced Carbon Processing : The CFOAM Process
Dr. Olsen, Consol Energy

Rare Earth Elements and Critical Materials Production from Coal-Based Sources
Dr. Rick Honaker, Uiversity of Kentucky

Floc Flotation: Unconventional Fine Coal Recovery
Anthony Toney, Mike Barish and James C. Fisher II, Somerset International

CPSA Session 3: Innovative Coal Cleaning Methods and Technologies

Plant Assessment of a Low-Density Cutpoint Spiral Concentrator
John Nielson, Arch Coal

Enhanced Fine Coal Recovery Using Dense Medium Cyclone
Chao Zhao, Zhigang Wang and Jimmy Yu, The Daniels Company

Full-Scale Industrial Trial of REFLUX™ Flotation Cell
S. Saurabha, L. Christodouloua and R. Jain, FLSmidth Company

Whole of Plant Ultra-fine Particle Dewatering for Valorization and Dry Stacking
Mike Barish, Somerset International

Fine Coal Washability Analysis Using a Laboratory Concentrating Table
Dr. Barbara Arnold, Christian Stoudt and Chase Gleason, Penn State University

SME Session 1: **Panel Discussion – Topic Pending**

SME Session 2: **Geotechnical and Safety-Related Topics in Mining**

Geologic Assessment Tools – Simple but Effective
Joe Wickline, Arch Resources, Inc. – Leer South

Improving Operator Safety: Advanced Analytics for High Energy Loading Impacts
Michael Redford and Stephen Redford, Matrix Analytics Group

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Zach Agioutantis, Jesus Romero, Ernesto Maldonado, University of Kentucky

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Gaobo Zhao, University of Kentucky

Evaluating Novel Dust Controls
Steven Schafrik, Ph.D.[1], Festus Animah[2], Emily Sarver, Ph.D.[2],[1]University of Kentucky, [2]Virginia Tech

Tools and Methods Used to Predict Seismic Events Caused by Longwall Mining in Buchanan County, VA
Stephen Morgan, Coronado Global Resources Inc.

SME Session 3: **Environmental and Ethical Issues, the Search for Rare Earth and Critical Minerals**

Overview & Advancements of the Evolve Central Appalachia Rare Earth & Critical Minerals Project
Dr. Richard Bishop, Virginia Tech Mining & Minerals Engineering

Wicking Wells – A New Method to Remove Total Dissolved Solids from Groundwater
Shane McDonald, PG, HDR, Inc.

Evolve-CAPP Rare Earth and Critical Minerals Update of Sampling, Screening, and Laboratory Test Work
Kevin Andrews, Marshall Miller & Associates

When Molehills Become Mountains: Navigating Ethical Issues in Engineering
Dana Howard, Stoll Keenon Ogden, PLLC

Carbon Management in Mining and Related Industries
Dr. Nino Ripepi, Virginia Tech Mining & Minerals Engineering

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Member's Night Out

This Year, All in One Location!

During the 2024 CoalProTec Conference & Exhibition

Don't miss our biggest member event on **April 30, 2024**, during the CoalProTech Conference & Exhibition in Lexington, Kentucky! And this year, we'll enjoy a venue all in one location–at the Central Bank Center "Club C."

Schedule

We'll kick the evening off at 6:00 p.m. with hors d'oeuvres and a bourbon tasting of two of Kentucky's finest distilleries. The fine ryes and bourbons of the **James E. Pepper Distilling Co.** are an iconic line of Kentucky whiskeys, originally produced during the American Revolution. Today, the company's limited production uses locally sourced ingredients, aged in new toasted charred Kentucky oak barrels. The **Brothers Wright Distilling Company** is known for producing premium four-grain whiskeys in the heart of central Appalachia. Their uniquely crafted bourbon is aged deep within a coal mine from the early 1900s in new charred oak barrels! The tasting will be followed by a **buffet dinner with full bar** at 7 p.m.

Afterwards, sit back and enjoy the evening's entertainment, beginning with **Mentalist, Josh Fletcher**. Josh can climb inside people's minds, read their thoughts, influence their decisions, and blur the lines of possibility! His act is followed by a live DJ and dancing from 8:30-10:00.

Mentalist, Josh Fletcher

Tickets

Member Ticket options include:
$150 indvidual
$1200 for a table of 8
Purchase your tickets online today at **www.coalprepsociety.org**
For more information, contact Kathryn Dew, **coalprepsociety@gmail.com.**

POLYDECK CONN WELD COAL ProTec coal processing technology SME CENTRAL APPALACHIAN SECTION

Over the past 15 years, Matrix has become a leader in collision avoidance and proximity detection technologies, providing safety and productivity solutions for Alliance and many other mining companies. Infinitum, Alliance, and Matrix have collaborated since 2022, when Alliance made an initial investment in Infinitum as part of the company's Series D funding.

Martin Engineering Celebrates 20 years of Growth in Africa

Martin Engineering recently celebrated its 20th anniversary of growth across the African continent. The company first entered Africa in November 2003 with the acquisition of South African business Scorpio Conveyor Products.

Two decades later Martin Engineering has grown significantly, with employee numbers increasing 10-fold to almost 200 people, and a customer base that now spans 10 countries and a range of industries across Africa. The business also has plans for further growth thanks to an ambitious team of technical experts and an innovative range of products that deliver cleaner, safer and more productive materials handling.

Joining the 20th anniversary celebrations was global CEO Robert Nogaj who traveled to Martin's regional headquarters in Emalahleni, Mpumalanga, South Africa to meet employees and business partners who have played a key role in Martin's success.

"The African continent is a global supplier of essential minerals and metals, and an important market for Martin," Nogaj said. "Over the past two decades we have made substantial investments in our production facilities and introduced new technologies that have helped our African business to grow and evolve. Yet the most important investment we have made is in supporting and developing our people, fostering talent and promoting diversity in the workplace.

Martin is among the few engineering firms in South Africa that have achieved ISO45001 (health and safety management) accreditation, reflecting the company's commitment to maintaining high safety standards and fostering a true safety culture. .

ABD said it is able to automate existing vehicle fleets safely, rapidly and cost-effectively while minimizing disruption to operations. (Photo: ABD)

ABD Brings Indigo Drive Autonomy to Australia

ABD Solutions recently established an Australian operation in Perth, Western Australia, to support the growing demand for its Indigo Drive fleet autonomy solution in the Australian market, particularly in the mining and resources sector.

The company is now set to introduce in-country demonstrations of Indigo Drive in the coming months. Indigo Drive, an adaptable and versatile solution, expedites the implementation of fleet autonomy by automating existing fleets and infrastructure, ensuring swift and cost-effective deployment. In operation, Indigo Drive creates safer, more productive sites while tackling driver shortages and reducing emissions. This translates into operational savings through reduced fuel costs, better fleet utilization, and more efficient staffing.

"We're excited to bring our autonomous solution to the Australian market," said Andrew Van Der Merwe, general manager, ABD for Australia. "The mining industry in Australia has a huge demand for flexible automation solutions that can be implemented across a range of vehicle types from any manufacturer, while causing minimal disruption to existing operations. I believe Indigo Drive is the perfect solution for the Australian mining industry, especially with the focus on tackling driver shortages, improving fleet productivity, and the continuing drive to improve safety."

Using its Indigo Drive system, ABD Solutions automates existing vehicle fleets safely, rapidly and cost-effectively while minimizing disruption to operations.

The Martin South Africa Team gather in front of the African headquarters in Emalahleni, two hours outside of Johannesburg.

Komatsu Introduces GD955-7 Motor Grader

The new GD955-7 motor grader offers operators the control and precision needed to build and maintain haul roads for truck fleets of 100 tons and up, Komatsu reported. This new machine weighs 52 tons and stands out with 426 horsepower @ 1,9000 rpm horsepower delivering powerful downforce pressure to the 18-ft blade for efficient grading performance. A 20-ft blade is an option for this machine too. "With significant increases in operating weight, blade downforce pressure and working travel speeds, this new size class motor grader will be a smart choice for increased efficiency on our customer's mine sites," said Joseph Sollitt, director of mining support equipment for Komatsu Ltd.

With faster working travel speeds compared to the previous model, Komatsu said it engineered the GD955-7 to increase grading efficiency while helping reduce maintenance requirements and total cost of ownership.

Despite its large size, the GD955-7 offers excellent maneuverability. It can execute tight U-turns on a standard 100-ton class haul road without the need to fully cut the wheel or correct course. The long wheelbase and large, 27° articulation angle allow a tight turning radius and provide maneuverability for narrow haul road applications in confined spaces and around obstacles.

The newly adopted, long-life circle bearing allows for smooth and precise rotation of the moldboard while eliminating the need for circle play adjustments or replacing wear plates. Coupled with a standard auto-lubrication system, the GD955-7 is engineered to help reduce planned and unplanned maintenance downtime while helping to extend life to overhaul.
www.komatsu.com

Matrix Adds AI Feature to Collision Avoidance

Matrix Design Group, a leading technology provider for industrial and mining safety and productivity, is introducing OmniPro Vision AI, a state-of-the-art collision avoidance system. This highly powerful system is designed to provide alerts when pedestrians, vehicles and other potential hazards are detected in the path of mobile equipment.

OmniPro Vision AI allows for fully customizable zones and the ability to work in low-light and all-weather conditions, making it suitable for a wide range of equipment applications and operating environments.

With its high-speed processing rate, OmniPro Vision AI minimizes false positives and nuisance alerts that often desensitize workers to alarms. Operating without the need for personal wearable devices or tags, OmniPro Vision AI is capable of identifying individuals wearing PPE and pedestrians in any posture, including standing sideways, crouching, kneeling, or in partial view. OmniPro Vision AI allows for visual and audible zone breach alerts for both equipment operators and pedestrians and easily integrates with OEM controls for slowing and disabling machine movement.

OmniPro Vision AI also can be aligned with the OmniPro InFocus cloud application, which delivers 24/7 access to an advanced dashboard with real-time metrics and analytics. OmniPro InFocus provides management with essential operational insights and intelligence to make the best decisions for the operation. All data, including zone breach incidents and timestamped photos, are recorded and stored for future reference and reporting. Essential reporting, including average daily breaches per machine and trending breaches over time, is available, along with custom reporting and analytics.
MatrixTeam.com/OmniPro

Return Training Bracket

Precision Pulley & Idler (PPI) recently released the patented Return Training Bracket, a new belt training device. Conveyor belt tracking has always been a challenge in the material handling industry, leading to the development of many belt training devices. Often these devices have proven to be ineffective or very cost prohibitive.

One of the most effective methods for training a belt is known as knocking or skewing idlers. This process is often overlooked due to the amount of labor, and safety concerns, involved in adjusting brackets to fine tune the belt path.

PPI's introduction of the Return Training Bracket allows the user to use

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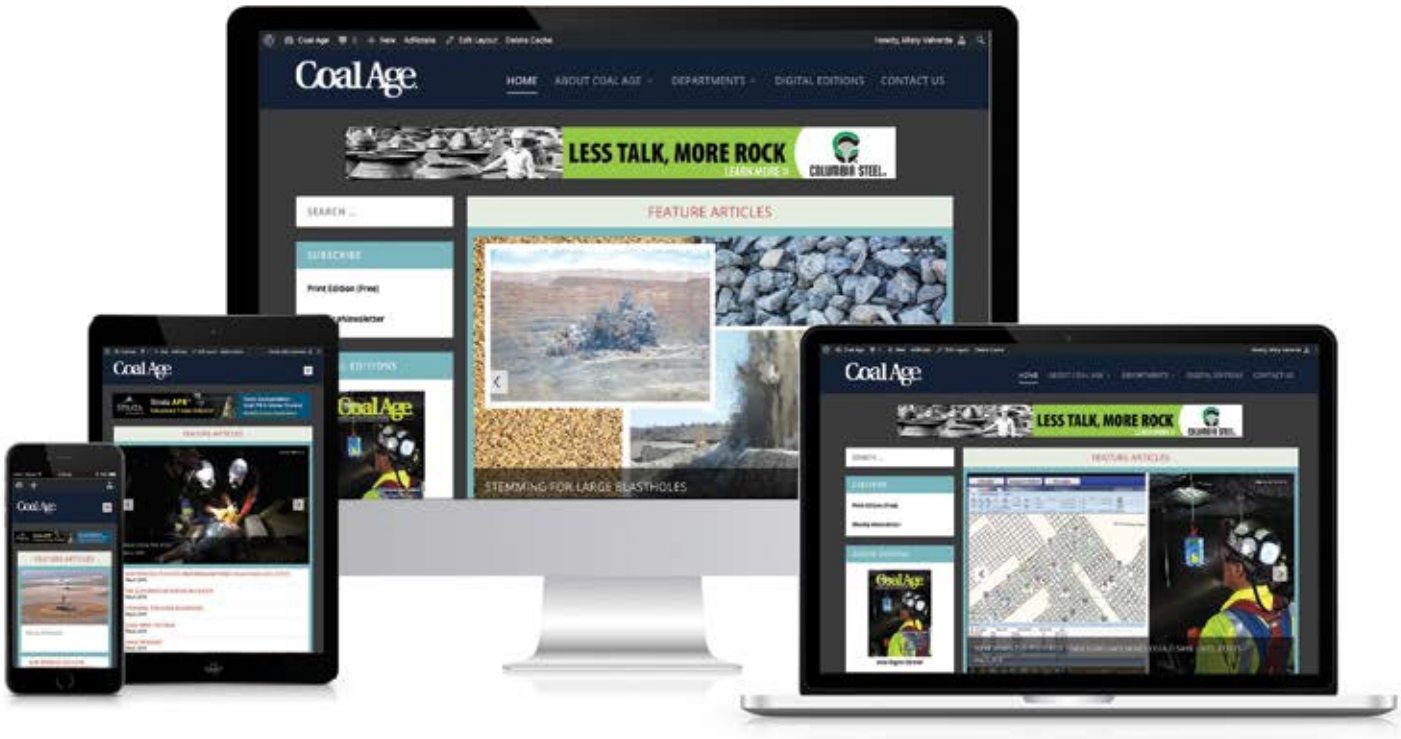

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the proven method of knocking idlers while significantly reducing the amount of labor needed. The engineered design allows the drop bracket to remain bolted to conveyor framework while allowing easy roll adjustments.

By strategically positioning PPI's Return Training Brackets in a conveyor system, the user will have the ability to easily train a belt as conditions change within the application.

"Users have been seeking a simple cost-effective solution to train their belts, and PPI has hit the mark with this product," said PPI Industry Product Manager Mike Roozeboom. "Users know knocking idlers is an extremely effective way to train a belt, we've just taken difficulty out of that process." The Return Training Bracket will interchange with PPI standard CEMA B, C, & D return rolls with 4.5-in. drop brackets.
www.ppi-global.com

Real-time Oil Monitoring

The SENSE-2 oil condition monitoring kit provides real-time data about machine oil quality to optimize maintenance and reduce operating costs.

The SENSE-2 is plug-and-play and accurately identifies when oil reaches the end of its life, superseding traditional time-based maintenance schedules, which can result in oil being discarded prematurely — with the potential of wasting up to 50% of its useful life.

"Our SENSE-2 real-time monitoring utilizes our world-leading sensor technology and associated analytics to detect any issues before any damage occurs, identifying subtle changes in equipment condition early," said Chris Greenwood, CEO, Tan Delta Systems. "It can be fitted easily and efficiently to any existing equipment in any application and is configurable to any oil type."

The system was adopted by an oil sands mine in Canada on a 785D mining truck with the aim to increase the oil service intervals, reduce the number of oil changes and wastage while maintaining the integrity of the equipment and preventing failure.

The results following the installation of SENSE-2 was doubling the service intervals from 500 to 1,000 hours, reducing oil costs by 50% and eliminating the risk of failure from oil contamination or wear, this resulted in a return on investment of 160% in the first year.
www.tandeltasystems.com

Water Truck Tanks

Philippi-Hagenbuch's patented HiVol Water Tanks feature a stable, square design that improves stability and maximizes hauling capacity. Each tank is custom engineered to haul the greatest possible volume for the specific make and model of off-highway articulated or rigid frame haul truck. The tanks feature easy-to-use, operator-friendly controls and the ability to spray the entire width of a haul road with one pass. HiVol Water Tanks are built with a superior-grade steel for increased longevity.

The HiVol Water Tanks can be engineered for new haul trucks and as a retrofit for older trucks. Operations often incorporate the tanks onto their aging haul trucks to convert them to water trucks, extending equipment life.

Philippi-Hagenbuch engineers each tank to achieve the lowest weight and greatest possible hauling capacity. This can range up to 60,000 gallons. The square design, along with internal surge stabilizers and a baffling system that results in full compartmentalization of the water, minimizes churning to improve vehicle stability.

Each tank features corrosion-resistant Hardox 450 steel, which is over 300% harder and more corrosion-resistant than the steel used in most other water tanks on the market, equating to an exceptionally long water tank life. HiVol Water Tanks utilizing Hardox HiAce acidic-resistant steel are also available as an option for highly acidic environments. Philippi-Hagenbuch also offers an insulated water tank design for cold weather conditions, with optional heating for use in environments as cold as -40°F/C.

"After more than 23 years on the market, none of our water tanks are showing signs of rust, corrosion or failure," said Josh Swank, Philippi-Hagenbuch vice president of sales and marketing. "The high-quality steel ensures they won't rust or wear down quickly. Most water tanks on the market only last 5-7 years, but the first water tanks we engineered are still out on the jobsite today."

Philippi-Hagenbuch water tanks feature rear-mounted spray heads, an optional remote-controlled water cannon and individual in-cab analog controls that are straightforward and easy to use. This provides the operator with precise — yet simplified — water control. The horizontal spray heads operate separately, allowing the use of any or all spray heads at the same time. The remote-controlled water cannon enables operators to spray water from 150 to 200 feet away.
www.philsystems.com

CONSULTANTS, SERVICES

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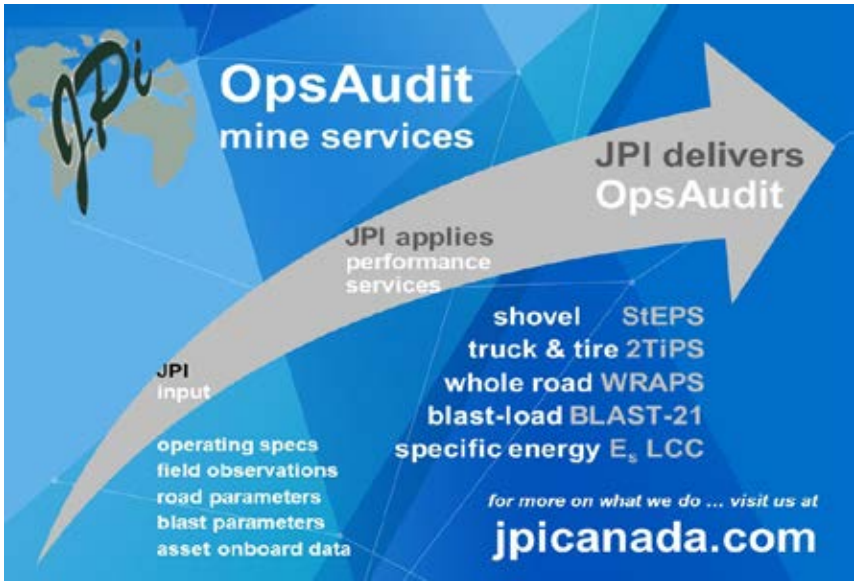
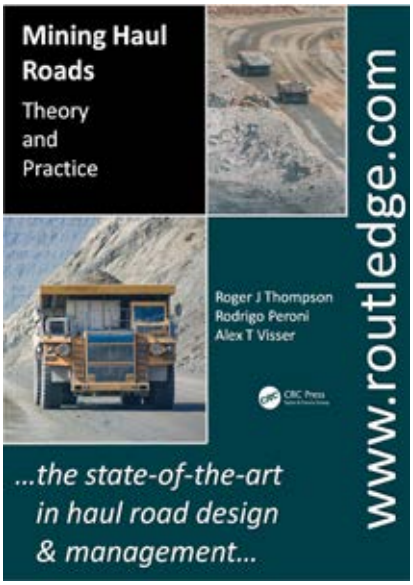




Industrial Facilities Test Emerging Clean Energy Techniques

Babcock & Wilcox (B&W) and Black Hills Energy recently announced that the companies have received a $16 million grant from the Wyoming Energy Authority to fund the permitting, engineering and development activities for a clean hydrogen generation facility with carbon dioxide (CO_2) capture and sequestration at Black Hills Energy's Neil Simpson power plant in Gillette, Wyoming.

The plant design intends to use B&W's BrightLoop technology to produce clean energy from coal, while CO_2 emissions will be sequestered, or put to beneficial use. As designed, the plant will be capable of producing 15 tons of clean hydrogen per day using the BrightLoop process, which is a patented chemical looping technology.

"We look forward to working closely with our partner, Black Hills Energy, as we complete engineering, begin construction, and move toward completion of this commercial-scale project," said B&W Chief Technology Officer Brandy Johnson. "This project supports Wyoming's efforts to use an abundant and affordable natural resource to produce clean energy, while showing the flexibility and versatility of B&W's BrightLoop technology.

"Together we will be forging a new path for Wyoming's and America's clean energy future, helping combat climate change while supporting jobs in Wyoming's energy industry," Johnson said.

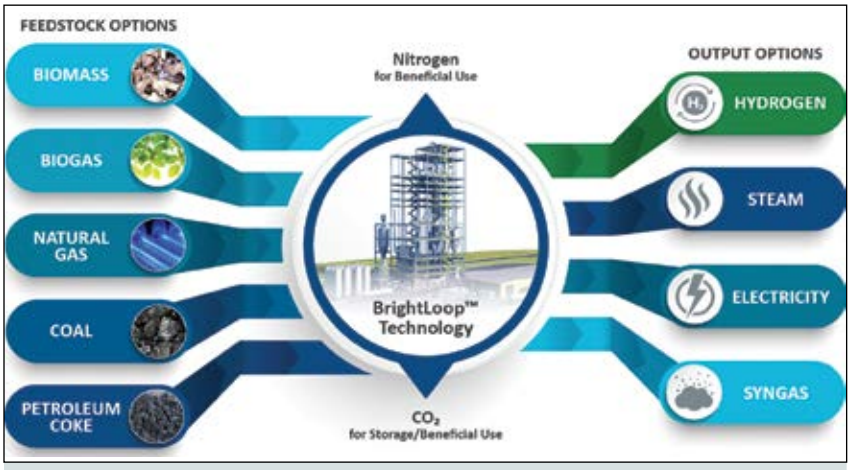
B&W's BrightLoop chemical looping technology is part of its ClimateBright suite of decarbonization and hydrogen technologies. The BrightLoop process uses a proprietary, regenerable particle and has been demonstrated to effectively separate CO_2 while producing hydrogen, steam and/or syngas.

GTI Teams With U.S. Steel and DOE

GTI Energy, a leader in carbon management technologies, has been selected for new funding from the U.S. Department of Energy for a project that will advance innovative carbon management technologies.

GTI Energy will demonstrate its advanced ROTA-CA carbon capture technology at U. S. Steel's Edgar Thomson steel mill in Braddock, Pa. The project will assess the readiness of carbon capture technology for commercial scale-up and widescale deployment. ROTA-CAP is GTI Energy's modular, scalable, integrated industrial carbon capture system that uses novel approaches to intensify the carbon capture process, reducing the size and cost compared to current processes.

"GTI Energy is not merely testing innovative carbon management solutions, we are demonstrating their real-world viability and economic potential," said Don Stevenson, vice president of carbon management and conversion for GTI Energy.



The BrightLoop process uses chemical looping technology to produce clean energy. (Graphic: B&W)

8 Rivers Develops Comorant

8 Rivers Capital, LLC, is developing the Cormorant Clean Energy Project, an ultra-low-carbon ammonia production facility in Port Arthur, Texas. The Cormorant project will be powered by 8 Rivers' proprietary 8RH2 hydrogen process, representing the first commercial deployment of the technology.

Cormorant will produce an estimated 880,000 metric tons (mt) of ammonia and capture more than 1.4 million mt of CO_2 annually, with a greater than 99% CO_2 capture rate. The site is also expected to bring in more than $1 billion in investment to the region and create more than 1,000 new construction jobs from 2024 to 2027.

$8RH_2$ is an ultra-low-carbon hydrogen process that harnesses oxy-combustion to eliminate CO_2 emissions and lower costs. At Cormorant, hydrogen produced by $8RH_2$ will be turned into ultra-low-carbon ammonia. Power plant operators, especially in Asia, are looking to co-fire ammonia to reduce CO_2 emissions.

"Clean fuels like hydrogen and ammonia are paramount to the energy transition, and the Gulf Coast region's rich history of industrial manufacturing and transportation makes it the perfect environment to demonstrate the game-changing potential of this technology," said Steve Milward, COO at 8 Rivers.

The Cormorant Clean Energy Project couples technology innovation with industry-proven process equipment, and represents an efficient and affordable path to decarbonization for hard-to-abate industries like shipping, heavy transportation, aviation, and power generation. Hydrogen and hydrogen-derived ammonia are two key low-carbon alternatives that can replace fossil fuels. $8RH_2$ provides the key to scaling ultra-low-carbon hydrogen and ammonia production to industrial production scale at Cormorant.

Standing by your side

The Joy brand has an unrivaled legacy with mining operations as a trusted partner, continuously innovating. Since its inception in 1919, Joy has been at the forefront of underground mining technology. As part of Komatsu, we continue to deliver innovative and sustainable mining solutions improving everyday life. **You can count on Komatsu as a committed partner for your complete longwall system rebuilds.**

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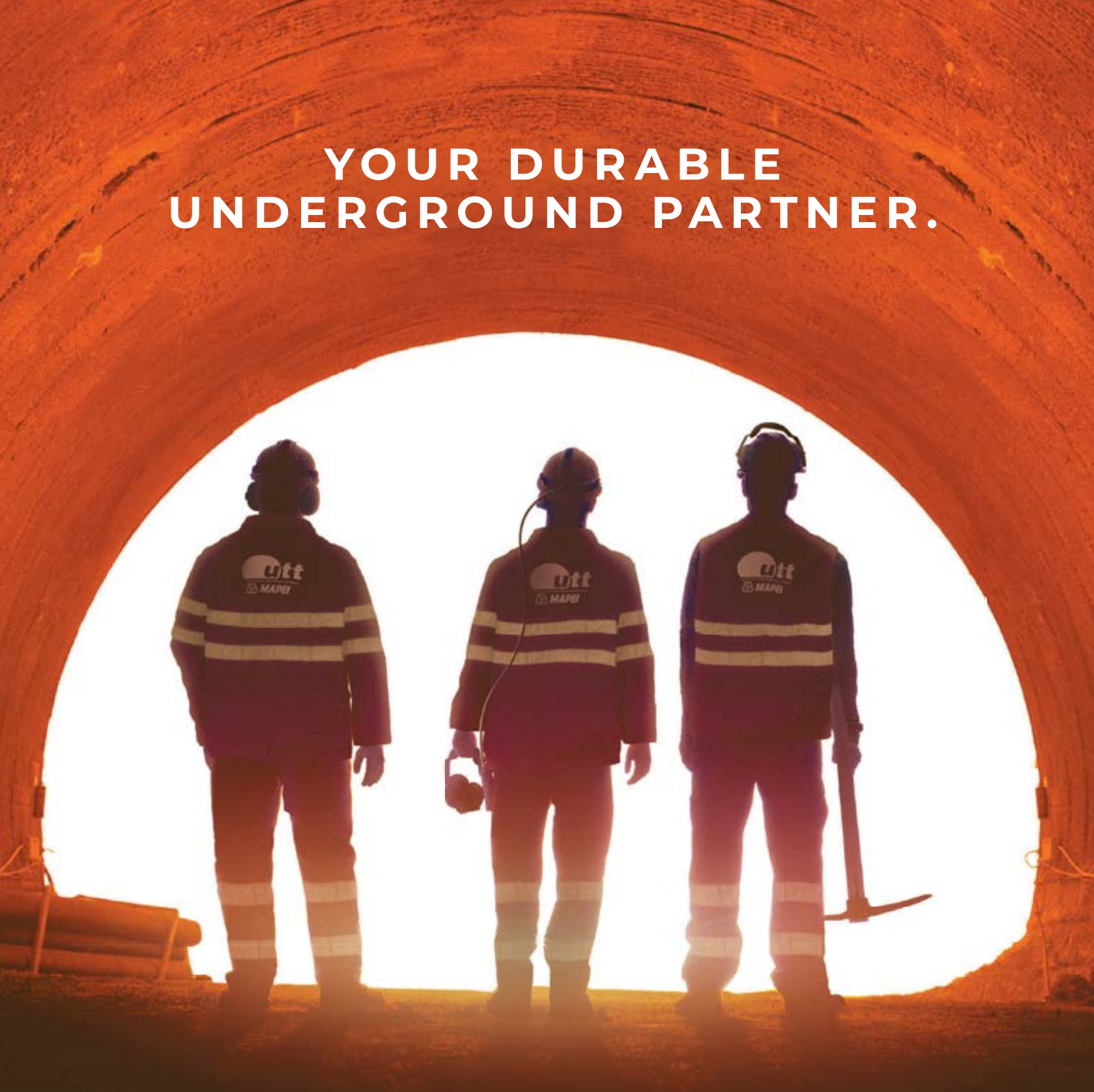

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