

# Coal Age®

The Magazine for Coal Mining and Processing Professionals

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A photograph of a longwall coal mining operation. The scene is dimly lit, with bright lights illuminating the coal face and the machinery. A worker in a yellow safety vest is visible in the distance. The machinery includes a conveyor belt and various cables. The text "US Longwall Census" is overlaid on the right side of the image.

## US Longwall Census

— Fewer faces produced more coal last year

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# Coal Age

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*This month, Coal Age takes an in-depth look at longwall mining in the United States with its annual U.S. Longwall Census. On the cover, the Cumberland mine's 1,580-ft longwall face is the longest in the country. (Photo: Iron Senergy)*

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## ENERGY CONCERNS GROW



**BY STEVE FISCOR**  
PUBLISHER &  
EDITOR-IN-CHIEF

From a production and pricing standpoint, last year turned out to be a good year for most U.S. coal operators. Preliminary figures for the Energy Information Administration indicated total U.S. coal production for 2021 should reach 580 million tons, an increase of more than 40 million tons (nearly 8%) over 2020. This month, *Coal Age* publishes the U.S. Longwall Census, and coal production from U.S. longwalls grew by more than 21 million tons. Spot prices for thermal coals from most of the U.S. regions remain high (see Weekly Spot Prices, p. 7) and spot prices for metallurgical-grade coals are significantly higher than thermal prices. Coal-fired power generation in the U.S. increased 20.9% year-over-year as total power demand increased 4.4%.

Coal production, as *Coal Age* documented last month, continues to grow worldwide. For the first time, China's output eclipsed the 4-billion-metric-ton (mt) level. China reported that its coal production for 2021 increased 4.7% to 4.07 billion mt (or 4.48 billion tons). Yes, that is nearly eight times the level of the U.S. China's 2021 power consumption rose 10.3% year-on-year. The story is the same for almost every major coal-producing region (India, Indonesia, Australia, etc.)

Increased demand for energy and a lack of fuel supply diversity is driving energy prices higher. On a dollar-per-million Btu basis, spot prices for coal are high, but natural gas is nearly triple that figure in the U.S. and even higher for Europe and other natural gas importers. While this is good news for miners and other workers employed in the energy field, it's bad news for the economy and consumers. Increasing energy costs are contributing to inflationary pressures and driving costs for goods and services higher.

Energy has become a focal point for many conversations, whether its Russia's leverage over Germany or where the electrical grid will fail in the U.S. this winter. Had people been more informed energy-wise, these situations could have been avoided. Policymakers played favorites with fuel for power generation and selected natural gas and renewables as the path forward. Now, society is charting an all-electric course without giving much thought to how it will generate that electricity.

The time has come for the energy industry to recalibrate. It's already evident that the world's growing appetite for electricity will only be satisfied by using all available fuels. That electricity should be generated as cleanly as possible, but it also must remain affordable. Coal could play a pivotal role in providing for tomorrow's energy needs while holding inflationary pressures at bay by serving as a hedge against swings in natural gas prices and availability.

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# INDONESIA SAYS 48 COAL VESSELS ARE RELEASED FOR EXPORT



The coal export ban is lifted for several companies, including Geo Energy's Sungai Danau Jaya mine (above). (Photo: Geo Energy)

So far, 48 coal vessels are set to depart from Indonesia, a senior Trade Ministry official said on January 18, and the country's broader coal export ban was lifted for companies that have completed 100% of their domestic market obligations (DMO), as reported by *Reuters*. The DMO requires them to supply 25% of their annual output locally.

The world's biggest thermal coal exporter implemented an export ban on January 1 as coal inventories at local power plants were at critically low levels, to avoid widespread outage.

"As of today, 48 vessels have been released from a total of 29 companies," senior official Indrasari Wisnu Wardhana said.

Trade Minister Muhammad Lutfi said once miners fulfilled their DMO, they would be allowed to resume exports.

Authorities have blamed the supply crunch on poor compliance with the DMO policy that requires coal miners to sell 25% of their output to local buyers, with a \$70 per metric ton

price cap for power generators, which is lower than current market prices.

Energy Minister Arifin Tasrif said, out of 578 coal miners, 139 have fulfilled their DMO requirements.

Indonesia banned exports because of concerns it could not meet its own power demand, according to *Reuters*. The move could create an Asian coal shortage. China, India, Japan and South Korea consumed three quarters of Indonesia's coal exports in 2021.

Indonesia enacted the ban due to low stockpiles at domestic power plants, though the government plans to reevaluate the decision.

According to *Reuters*, Ridwan Jamaludin, the director general of minerals and coal at the Indonesian energy ministry, said that without the ban, almost 20 power plants would have to shut down.

PLN said the government has taken a policy to ensure that its primary energy needs, especially coal, can be met and, thanks to this support, the

potential power outages for 10 million PLN customers can be avoided.

The Indonesian Coal Mining Association (ICMA) called for the ban to be revoked since it was "taken hastily without being discussed with business players."

## BHP Adjusts Coal Expectations

BHP has adjusted its full-year outlook for metallurgical coal as tough conditions continued. The metallurgical coal guidance has been reduced as a result of significant wet weather impacts and COVID-19 related labor constraints. Metallurgical coal production for the full year is now targeted at between 38 million and 41 million metric tons (mt), down from the previous estimate of between 39 million and 44 million mt.

Metallurgical coal production for the December quarter was stagnant compared with the previous quarter, reaching 8.8 million mt, but down 8% in the half-year, to 17.6 million mt.

BHP reported that Queensland coal production decreased due to significant wet weather, with double the amount of rainfall, coupled with COVID-19 related labor constraints impacting stripping and mine productivity across most operations. A longwall move was successfully executed at Broadmeadow and the Caval Ridge wash plant maintenance was also completed on time during the December quarter.

Following the recent easing of Queensland's border restrictions, COVID-19 related absenteeism has increased and remains a risk for the remainder of the year.

Meanwhile, energy coal production was down 30% in the December quarter, compared with the September quarter, reaching 2.9 million mt, while half-year production was up 5%, to 7.2 million mt.

Energy coal production was impacted by significant weather events during the quarter under review, with BHP reporting three times the amount of rainfall in this quarter, which impacted stripping and mine productivity. This was partly offset by mining in lower strip ratio areas.

### Wyoming Energy Resources Council Approves 3 Projects

The Wyoming Energy Authority and the Energy Resources Council recommended three grant funding requests. Two requests are for carbon capture utilization and storage (CCUS) projects and one is for a hydrogen production project.

On March 20, the Wyoming Energy Authority opened a Request for Proposals (RFP) for the CCUS Deployment Project and received 17 proposals on October 22 when it closed. The Energy Resources Council approved funding for two projects during their meeting on January 18. A third project was also recommended for funding through the Economic Development Funds Innovation Subaccount.

The Wyoming Energy Authority plans to make progress toward the construction of a project deploying CCUS and enhancing the viability of Wyoming's carbon-based energy economy. As such, these three projects leverage existing resources and infrastructure within Wyoming, test configurations of these resources and infrastructure to establish technical feasibility, and establish the economic viability of the projects, according to the energy authority.

The three projects considered at the meeting include Tallgrass Energy, "Eastern Wyoming Sequestration Hub," which requested \$4,109,990 for studying the potential to sequester CO<sub>2</sub> in the Wyoming Denver-Julesburg Basin in support of the development of a commercial scale sequestration hub in eastern Wyoming. The information from this phase of the project will provide the basis for full

implementation of a regional sequestration hub, which includes Tallgrass's development of a multistate CO<sub>2</sub> transmission system.

North Shore Energy and Starwood Energy Group's Project Phoenix requested \$4,262,500 for a joint exploration in the development of a state-of-the-art ammonia complex with on-site carbon capture and sequestration capabilities at existing depleted hydrocarbon reservoirs and processing facilities near Evanston, Wyoming. When fully developed, the project will be a very low-cost producer of low carbon ammonia, will permanently store CO<sub>2</sub> underground, will re-purpose existing infrastructure, and retain and create new jobs in southwest Wyoming. Energy Resources Council recommended funding in full.

8 Rivers' "The 8RH2 Process for Producing Clean Hydrogen with Autothermal Reforming and Carbon Capture" requested \$150,000 to conduct a Pre-Front-End Engineering Design (Pre-FEED) study for a newbuild 8 Rivers Hydrogen (8 RH2) plant in Wyoming aiming for an eventual FEED study followed by project construction. The facility would use autothermal reforming to produce 100 million ft<sup>3</sup>/day of clean hydrogen with up to 99% carbon capture for sequestration in Evanston, Wyoming. Energy Resources Council recommended funding in full through the Economic Development Funds Innovation Subaccount.

The recommendations from the Energy Resources Council will be forwarded to the governor for final approval.

### TRANSALTA COMPLETES COAL PHASEOUT IN CANADA

TransAlta Corp. has achieved full phase-out of coal power in Canada. The company completed the last of three planned coal to gas conversions (CTG) at its Alberta Thermal power generation facilities.

The CTG reduces the company's carbon emissions by almost 50% from around 0.86 metric tons (mt) of carbon equivalent per MWh to around 0.43 mt of carbon equivalent per MWh.

"The full conversion of Keephills Unit 3 (KH3) from thermal coal to natural gas is a significant milestone for TransAlta in its transition off coal," President

and CEO of TransAlta John Kousinioris said. "We are pleased to have completed this important step, nine years ahead of the government target. Our coal transition is among the most meaningful carbon emissions reduction achievements in Canadian history."

TransAlta has invested \$295 million in its CTG program since 2019, which also included the conversions of its Sundance Unit 6, Keephills Unit 2 and Sheerness Units 1 and 2, plus the construction of new high-volume gas delivery infrastructure.



Mining operations at the Highvale mine (above) ends on December 31, 2021. Full mine reclamation begins the next day.



# EPA Will Enforce Coal Ash Pond Cleanup

On January 11, the U.S. Environmental Protection Agency (EPA) took steps toward finalizing a federal permitting program for the disposal of coal ash and establish regulations for coal ash surface impoundments. Actions include proposing decisions on requests for extensions to the current deadline for initiating closure of unlined coal combustion residuals (CCR) surface impoundments; putting several facilities on notice regarding their obligations to comply with CCR regulations; and laying out plans for future regulatory actions to ensure coal ash impoundments meet environmental and safety standards.

The EPA said it will work with states during the decision process.

“Coal ash surface impoundments and landfills must operate and close in a manner that protects public health and the environment,” EPA Administrator Michael S. Regan said.

The EPA’s regulations required most of the approximately 500 unlined coal ash surface impoundments nationwide to stop receiving waste and begin closure by April 2021. The regulations outlined a process for facilities to apply for two types of extensions to the closure deadline.

The EPA received and reviewed 57 applications from CCR facilities requesting deadline extensions. It determined 52 were complete. Four were incomplete, which included the Dallman Power station in Illinois, Erickson Generating Station in Michigan, Meramec Energy Center in Missouri, and Sioux Energy Center in Missouri. One, Greenidge in New York, is ineligible for an extension.

Of the 52 complete applications received, the EPA said it conducted technical analyses and is proposing determinations on four applications, with more determinations planned in the coming months.



An aerial photo showing the four coal ash ponds near the Erickson Power Station in Michigan.

The EPA is proposing denying three requests for deadline extensions after identifying several potential deficiencies with groundwater monitoring, cleanup and closure activities, including a lack of monitoring wells, improper monitoring techniques, faulty identification of other sources of groundwater contamination, and insufficient evaluations of clean-up technologies. The EPA is proposing a conditional approval for one request, which would require the facility to fix groundwater monitoring issues.

The EPA is also notifying facilities of compliance obligations where the agency has information concerning the possible presence of issues. The concerns include improper groundwater monitoring, insufficient clean-up information, and the regulation of inactive surface impoundments.

The EPA will work in collaboration with states on facility compliance. The EPA said it will also continue to review state-level CCR program applications to ensure they are as protective as federal regulations.

In April 2015, the EPA promulgated a comprehensive set of requirements for the management of coal ash in landfills and impoundments.

The comment period began on January 25 when the proposed determinations are posted in the docket in Regulations.gov, and end on February 23. For a list of the individual determinations and how to comment, visit [www.epa.gov/coalash/coal-combustion-residuals-ccr-part-implementation](http://www.epa.gov/coalash/coal-combustion-residuals-ccr-part-implementation).

## Alliance Sees Steady Growth for 2022

Alliance Resource Partners L.P. reported increased coal sales and production volumes.

Coal sales volumes increased 14.4% and oil and gas prices rose by 88.2% in 2021 to drive total revenues higher by 18.2% to \$1.57 billion, compared to \$1.33 billion for 2020.

“ARLP continued to benefit from favorable market conditions during the 2021 quarter, posting significant increases over the 2020 quarter to coal and oil and gas sales volumes, total revenues, net income and EBITDA,” President and CEO Joe Craft said. “To meet our contractual commitments, our coal operations worked overtime to increase coal sales volumes by 606,000 tons and our marketing team’s efforts to capture the benefits of a rising market re-



sulted in price realizations increasing by \$2.54 per ton, both as compared to the sequential quarter.”

The company secured new agreements during the 2021 quarter for the delivery of approximately 13.3 million tons through 2024. With these new contracts, ARLP enters 2022 with approximately 89% of its anticipated coal sales volumes priced and committed.

“Higher natural gas and coal prices combined with a stronger export market were the primary factors that contributed to ARLP’s 2021 full-year performance exceeding our initial expectations,” Craft said. “During 2021, ARLP generated \$302.2 million of free cash flow, reduced total debt and finance lease obligations by \$161.5 million, improved total leverage to 0.93 times and increased liquidity by \$105.4 million.”

Through the end of 2021, coal-fired generation in U.S. markets increased 20.9% year-over-year as total power demand increased 4.4% and high natural gas prices buoyed coal demand, Craft said. He added that demand and pricing for U.S. coal in the export market continues to be attractive, supported by increased power demand, high natural gas and LNG prices and a lack of global supply response along with supply disruptions.

The company anticipates steady growth from the coal royalties segment during 2022.

## Wyoming CarbonSAFE Project Drills Second Exploratory Well at Dry Fork Station

Led by the University of Wyoming School of Energy Resources (SER) and in collaboration with Basin Electric Power Cooperative, a team of researchers and partners on the Wyoming CarbonSAFE Project recently began drilling a second deep test well for site characterization. Spudding of the test well near Basin Electric’s Dry Fork Station near Gillette began December 23 and the well is nearing completion.

“This second well will lead to valuable information to fully characterize a second carbon storage site in Wyoming — taking another step toward building a carbon capture, utilization and storage (CCUS) industry in the state,” SER Executive Director Holly Krutka said. “I am proud of the team in SER’s Center for Economic Geology

Research and our project partners for their dedication in the adverse weather and over the holidays to advance this project.”

The U.S. Department of Energy-funded Carbon Storage Assurance Facility Enterprise (CarbonSAFE) ini-

— U.S. News Continued on Page 10 —

## MONTHLY STATS FROM COAL COUNTRY — USA

### TOP 10 COAL-PRODUCING STATES AND REGIONS

(Thousands of Short Tons)	Week Ending (1/15/22)		
	YTD '22	YTD '21	% Change
Wyoming	9,149	8,618	6.2
West Virginia	3,359	3,248	3.4
Pennsylvania	2,024	1,923	5.3
Illinois	1,789	1,830	-2.3
Montana	1,093	1,073	1.8
Kentucky	1,085	1,076	0.8
North Dakota	1,034	1,144	-9.6
Indiana	717	798	-10.1
Texas	558	609	-8.4
Utah	464	511	-9.2
Appalachian Total	6,760	6,674	1.3
Interior Total	3,865	4,081	-5.3
Western Total	12,508	12,176	2.7
<b>U.S. Total</b>	<b>23,133</b>	<b>22,931</b>	<b>0.9</b>

### WEEKLY SPOT PRICES

(\$/ton)		Week Ending	
		(1/31/22)	(12/31/21)
Central Appalachia	(12,500 Btu, 1.2 SO <sub>2</sub> )	\$89.70	\$92.50
Northern Appalachia	(13,000 Btu, < 3.0 SO <sub>2</sub> )	\$73.35	\$74.20
Illinois Basin	(11,800 Btu, 5.0 SO <sub>2</sub> )	\$75.50	\$44.55
Powder River Basin	(8,800 Btu, 0.8 SO <sub>2</sub> )	\$23.90	\$30.10
Uinta Basin	(11,700 Btu, 0.8 SO <sub>2</sub> )	\$29.35	\$33.15

Source: Energy Information Administration

# PUTIN CONSIDERS PHASING OUT UNDERGROUND COAL MINING



A change in policy could sideline some of Russia's most productive mines.

BY VLADISLAV VOROTNIKOV

Russian President Vladimir Putin instructed the government to make the Russian coal mining industry fully safe, possibly by prohibiting underground coal mining in the country. He ordered the government to conduct negotiations with labor unions and “all other involved organizations,” and to either fully prohibit launching new underground coal mines, gradually shut down all coal mines with high risks of accidents, or design and introduce new mining technologies sufficient to exclude risks of “mass accidents,” the Kremlin website said.

The new order has been issued based on the presidential meeting on December 2 dedicated to the Listvyazhnaya coal mine accident on November 25. During the meeting, Putin promised to prosecute all persons who put miners' lives in jeopardy.

“It is unacceptable to abuse, to exploit the courage of people who go down into the mines,” Putin said. “Their lives and health must be pro-

tected. This is the personal responsibility of everyone involved in organizing production.”

Putin also instructed authorities to ensure safety standards are being adhered to at coal mines where accidents similar to Listvyazhnaya happened in the past, including the Raspadskaya coal mine where two methane explosions and a fire killed 91 people in 2010.

From February 1, Russian coal companies must end all bonus payments directly or indirectly related to the output, Putin stipulated. This measure will prevent coal companies from encouraging miners to increase coal production through violating safety standards.

In 2022, the government also will adopt new regulations to increase penalties on coal mining companies for not matching safety standards and raise compensation to miners and their families in case of accidents.

Speaking on December 29, Russian Deputy Prime Minister Alexan-

der Novak disclosed the government plans to stop issuing licenses to launch underground mines with high methane concentrations.

Novak said: “We need to embark on a policy aimed at decreasing the number of coal mines with hazardous conditions. In the past few years, the number of particularly dangerous coal mines in Russia decreased from 53 to 23, while the share of open-pit mines with the safe working conditions increased.”

However, Novak promised the government had no plans to close the mines recognized as dangerous altogether to keep jobs in the coal mining region.

In a separate statement on December 29, Russian Energy Minister Nikolay Schulginov said the government could design a comprehensive program of closing dangerous coal mines in Russia. Schulginov explained that the government took some measures to improve safety at underground coal mines after the Listvyazhnaya accident, and the program would be needed in case these measures do not bring about the desired result.

## China Coal Output Hits Record in 2021

China's coal output hit record highs in December and in 2021 as the government continued to encourage miners to ramp up production to ensure sufficient energy supplies in the winter heating season.

China, the world's biggest coal miner and consumer, produced 384.67-million metric tons of coal last month, up 7.2% year-on-year, according to the National Bureau of Statistics. This compared with a previous record of 370.8 million mt set in November.

— *Worldwide News Continued on Page 13* —





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## DATELINE WASHINGTON

## LOSS OF DISPATCHABLE FUEL DIVERSITY REVERBERATES IN EUROPE

BY CONOR BERNSTEIN



U.S. coal generation came roaring back last year, rebounding 17% from 2020 and grabbing market share from higher priced natural gas. The U.S. coal fleet is proving to be an invaluable price shock absorber amid energy-driven inflation here at home and coal is also an equally important missing price shock absorber in Europe.

The U.S. hasn't been immune to higher energy prices — with the U.S. Energy Information Administration pointing to rising natural gas prices as driving higher wholesale rates — but the pain for U.S. consumers hasn't come close to the shock now facing European households.

The European energy crisis — driven largely by soaring natural gas prices and the unfortunate unavailability of renewable power at key moments — has seen wholesale electricity prices jump 300% since last winter. Households are set to pay an average of 54% more for energy than they did two years ago, according to Bank of America. The average European residential consumer will spend 1,850 euros (\$2,095) on energy this year, up from 1,200 euros in 2020, an eye-watering increase despite government assistance. And that's the average — price increases in some nations, such as the U.K., will be far higher.

So painful are soaring bills in Britain that some utilities (unbelievably) are recommending cuddling the cat to stay warm since many consumers won't be able to afford turning up the thermostat. Eat porridge and other complex carbohydrates one note suggests because they take longer to digest and create more body heat in the process. This may all seem surreal in 2022, but the sobering reality is that millions are having to choose between soaring energy bills and other necessities, and they're doing so because of glaring policy missteps.

### 'Undiversifying' Baseload Power Supply

As columnist Holman Jenkins recently observed in *The Wall Street Journal*, "Europe's mess has been framed as a story of many influences—the proverbial perfect storm. But it's really a story of one thing, coal, plus hypocrisy." He continues, "by undiversifying its base-load power supply... Europe has invited all the consequences you read about: ill-advised reliance on Russian natural gas, frantic bidding wars with China for liquefied-gas shipments, fear of rolling blackouts whenever a French nuclear plant needs maintenance or the wind dies down or the sun goes behind a cloud."

What Jenkins correctly identifies is that Europe's crisis is a failure of policy, of a particularly poor approach to the energy transition that has limited supply of essential fuels and generating capacity while failing to provide anything close to adequate alternatives. He warns, "a lot more of this may be on the way if the developed world keeps playing Russian roulette with its energy supply, a vital underpinning of a modern society and foundation of every voter's well-being." Absent a policy course correction, a lot more is on the way here in the U.S.

Europe's energy crisis should be an unmistakable wakeup call to reprioritize the affordability and reliability of the nation's electricity supply during the energy transition. If the nation hit snooze after the catastrophe in Texas last February and rolling blackouts in California, dismissing them as regional anomalies, Europe's ongoing crisis is too painful and prescient to ignore. Dispatchable fuel diversity and fuel security are the bedrock of electricity reliability and affordability. Energy policy must reinforce, not dismantle, them.

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

— U.S. News Continued from Page 7 —

tiative is to determine the suitability of the underground geological formations for commercial-scale carbon dioxide storage.

Phase 2 of the project investigated the storage complex feasibility with the drilling of a test well at the site and a 3D geophysical survey. The well was completed at a total depth of 9,873 ft, and 625 ft of core samples from nine different geological formations were collected for analysis, which has now been concluded.

"Results to date have shown that the geology located below the Dry Fork Station is suitable for commercial-scale geologic storage," said Scott Quillinan, SER senior director of research.

The current project activities of Phase 3 are focused on finalizing the site characterization, well permitting and carbon dioxide capture assessment.

"There has been a tremendous amount of work that has brought us to this point," Quillinan said. "There are a lot of pieces that had to fall into place that have been built off the complex analysis of data by SER scientists and our project team. As we continue to advance the project, we are grateful for the expertise and support found here in Wyoming."

Adjacent to a first well that was completed in 2019, the new well allows researchers to gain data and fully characterize the geologic layers of the sub-surface site, including the target storage reservoirs and the cap rock seals.

According to McLaughlin, the interim director of SER's Center for Economic Geology Research (CEGR), the second well will allow the team to design a testing program to measure the response of injection — using water — within the formations. Additionally, the team will address some of the research questions that previous field activities presented.

"We are so fortunate to be able to drill a second well at the study site," McLaughlin said. "For the long term, we propose that this is the best way



to optimize the injection of carbon dioxide (CO<sub>2</sub>) in the three deep geologic formations that our technical team has characterized at the site. All of this will help us address remaining challenges for future commercial activities.”

To provide a full analysis of the site, other major ongoing activities include wide-scale baseline monitoring of soil gas, seismic activity and water samples.

“The detailed baseline analysis will allow us to differentiate between natural and anthropogenic CO<sub>2</sub>, monitor the migration of the CO<sub>2</sub> plume and pressure front, and verify containment effectiveness,” said Charles Nye, CEGR associate research scientist.

A unique attribute of both wells is that they have been drilled and will be completed to meet Class 6 well construction standards and will likely become Wyoming’s first Class 6 CO<sub>2</sub> injection wells for geologic storage.

Wyoming’s Department of Environmental Quality recently completed the permitting guidelines for Class 6 wells in the state, including both drilling a well and operating one. Additionally, this project will provide an open-book analysis of the Class 6 permitting process for all Wyoming stakeholders. The technical and regulatory team will publish the findings and results of drafting the Class 6 permits.

### **Graves, Rouzer Call for Biden Administration to Halt WOTUS Rulemaking While Supreme Court Considers Case**

Recently, the Supreme Court announced it will consider *Sackett v. EPA*, a case that will decide the scope of the Waters of the United States (WOTUS). The question was whether landowners have a right to challenge a Clean Water Act of the Environmental Protection Agency (EPA).

In response to this, Transportation and Infrastructure Committee Ranking Member Sam Graves (R-MO) and Water Resources and Environment

Subcommittee Ranking Member David Rouzer (R-NC) called for the President Joe Biden administration to halt the WOTUS rulemaking while the Supreme Court considers the case.

A joint statement said, “We welcome the Supreme Court’s decision to hear this case involving the scope of ‘waters of the United States’ and the opportunity it presents to provide certainty to the communities and stakeholders who have to live and work under this rule. Given this significant development, the Biden administration should immediately cease its efforts to issue a new WOTUS definition rule that will greatly broaden the federal government’s jurisdiction over privately owned land and add layers of red tape for farmers, builders, small businesses, local governments, and many Americans.”

Graves and Rouzer also recently wrote to the heads of the U.S. Environmental Protection Agency and the U.S. Army Corps of Engineers to request an extension of at least 90 days to the current public comment period for the administration’s rulemaking.

### **Nucor Selects West Virginia as Location for New Sheet Mill**

Nucor Corp. will build its new state-of-the-art sheet mill in Mason County, West Virginia. The West Virginia location on the Ohio River provides Nucor with important transportation and logistics advantages, and a strengthened ability to serve customers in the Midwest and Northeast, the two largest sheet consuming regions in the U.S. When fully operational, the new mill will employ approximately 800 full-time teammates.

“Following a thorough process to determine the right location for our state-of-the-art, greenfield sheet mill, we are thrilled to make this significant investment in West Virginia and enhance our presence in this important region,” President and CEO Leon Topalian said. “Our new sheet mill in Mason County will have unmatched

capabilities that will enable the continued expansion of high-quality, low carbon steels, building on our industry-leading offerings.”

As previously announced, the new sheet mill is expected to cost approximately \$2.7 billion and have the capacity to produce 3 million tons of steel annually. The new mill will be equipped to produce 84-in. sheet products, and among other features, will include a 76-in. tandem cold mill and two galvanizing lines.

Construction is expected to take two years pending permit and regulatory approvals. Additional sites in Northern West Virginia are also under consideration for a transload and processing facility.

### **Labor Department Creates Program to Encourage COVID-19 Vaccination**

The U.S. Department of Labor announced a new program designed to encourage American miners to get COVID-19 vaccinations. Mine Safety and Health Administration (MSHA) will pilot the Mine Vaccine Outreach Program to deliver free vaccinations in mining communities and provide educational outreach to mining communities in Kentucky and Arizona on the safety and efficacy of COVID-19 vaccines. The Centers for Disease Control and Prevention report that vaccination rates are below 60% in two states where a substantial number of mining operations exist.

Participation in MSHA’s Mine Vaccine Outreach Program is voluntary and free for mine operators in Kentucky and Arizona. Program representatives will collaborate with the states’ mine operators to identify convenient locations, coordinate with health professionals to administer vaccine services, and develop communication programs to address the community’s questions and concerns.

MSHA has selected Jazz Solutions Inc., an Ashburn, Virginia, IT solutions provider for federal, state and local governments, to administer the program.

## AWARDS

### ALABAMA MINING ASSOCIATION ANNOUNCES INAUGURAL SAFETY & SUSTAINABILITY AWARDS

The Alabama Mining Association (AMA) announced the winners of the organization's inaugural Safety & Sustainability Awards. AMA held its annual awards presentation on November 16 in Birmingham. According to AMA, the association's goal with the awards was to highlight the mining industry's safety and sustainability initiatives and publicly recognize companies and professionals that made such efforts possible.

#### Champion of Safety Award:

- James Christian, 43 years without a lost time accident
- James Lay, 43 years without a lost time accident
- Billy Millwood, 42 years without a lost time accident
- Randy Sellers, 29 years without a lost time accident
- Richard Dodd, 28 years without a lost time accident
- Billy Dorrough, 28 years without a lost time accident
- Randall Jenkins, 25 years without a lost time accident

Exceptional Reclamation Award went to Drummond Co. for the development of wetlands and endangered turtle habitat on pre-law mined land.

The Exceptional Safety & Training Initiative Award went to Beville State Community College's Longwall Mining Training Center.

The Land Stewardship Award went to Warrior Met Coal's Mine No. 4 Wetland Conversion Project.

The Lifetime Commitment to Stewardship Award went to Dwight Hicks, (retired) director of reclamation and environmental compliance at Drummond Co.

The Lifetime Dedication to Safety & Training Award went to Jeffery Minor, safety and compliance engineer at Nelson Brothers.

The Mitigation Excellence Award went to Southland Resources for the Mud Creek mitigation bank for Swann's Crossing Mine.

The Outstanding Safety & Training Leadership Award was given to Edward Boylen, vice president of safety at Warrior Met Coal.

The Water Quality Stewardship Award went to McWane for excellent compliance with Alabama's water quality standards.

The Wildlife Conservation Award was given to Drummond Co.'s Wild Quail Restoration Project in Walker County.

President's Community Safety Award was given to Argos Roberta Cement Plant: Argos Emergency Response Training Partnership with the Calera Fire Department.

President's Commitment to Community Award went to Vulcan Materials Co.'s Annual Quarry Crusher Run at the Dolcito Quarry in Tarrant.

AMA president Patrick Cagle outlined the association's efforts to recognize those who had worked to implement safety and sustainability practices in their respected capacities.

"These awards rightfully recognize the excellence of Alabama mining professionals, who work tirelessly to ensure

the well-being of their colleagues and the communities in which they operate," Cagle said. "Alabama's modern mining industry places the health and safety of our people and local communities first, and this new award series highlights individuals and companies who go above-and-beyond to reflect the core values of sustainable, 21st century mining. On behalf of AMA, I'd like to congratulate this year's winners. We are already looking forward to honoring a new class of projects and people in 2022."



Lifetime Commitment to Stewardship Award



Exceptional Reclamation Award



Mitigation Excellence Award



Exceptional Safety & Training Initiative Award



Outstanding Safety & Training Leadership Award



Land Stewardship Award



Wildlife Conservation Award



## Worldwide News Continued from Page 8

For 2021, output touched a record 4.07 billion mt, up 4.7% on the previous year.

Since October, authorities have ordered coal miners to run at maximum capacity.

Coal inventory at Chinese utilities exceeded 162 million mt on January 21, or 21 days usage, about 40 million mt higher than the same period last year, the state planner National Development and Reform Commission said.

Meanwhile, China's 2021 power consumption rose 10.3% year-on-year to 8.31 trillion kilowatt hours (kWh), the National Energy Administration said.

### Carmichael Coal Mine's First Export Ready to Sail

The first shipment of high-quality coal from the Carmichael mine has been assembled at the North Queensland Export Terminal (NQXT) in Bowen ready for export as planned. Bravus Mining & Resources CEO David

Boshoff said the project had successfully delivered coal for the first coal shipment to NQXT during the testing and commissioning of Bowen Rail Company's new trains.

The coal will now be loaded and dispatched according to NQXT's normal operations and subject to the port's shipping schedule.

"This is a big moment for everyone who has worked so diligently and passionately to build this mine and its world-class supporting civil and commercial infrastructure," Boshoff said. "From day one, the objectives of the Carmichael Project were to supply high-quality Queensland coal to nations determined to lift millions of their citizens out of energy poverty, and to create local jobs and economic prosperity in Queensland communities in the process."

Boshoff said the Carmichael Project had provided more than 2,600 direct jobs and paid more than \$1 billion to regional Queensland con-

tractors and businesses since construction began.

"High-quality Australian coal will have a role to play, alongside renewables, for decades to come as part of an energy mix that delivers reliable and affordable power with reduced emissions intensity," he said. "That's why Carmichael makes sense, and why, as a group, Adani is also heavily investing in renewables."

Bravus has secured the market for the 10 million metric tons per year of coal that will be produced at the Carmichael Mine.

The coal will be sold to customers in the Asia-Pacific region at index adjusted pricing, which means all taxes and royalties will be paid here in Australia.

Carmichael coal is high-quality 5,000 kcal/kg coal with low sulphur, low trace elements and low ash, which will meet the import requirements of key developing markets in the Asia-Pacific region.

## PEOPLE IN THE NEWS



Parker Phipps

**Signal Peak** announced that *Parker Phipps* will become president and CEO. Phipps has been vice president of underground operations at the mine since February 2020. He replaced *Joseph Farinelli* as president.

### The Navajo Transition Energy

**Co.**, which operates mines in New Mexico and Wyoming, will be under new leadership following the retirement of NTEC CEO *Clark Moseley*, who has led the Navajo Nation-created energy company and coal producer since 2014.



Clark Moseley



Dr. Tim Gerhardt

**Liebherr** appointed *Dr. Tim Gerhardt* as new managing director of Liebherr USA Co. Gerhardt joined the Liebherr USA executive management team alongside *Kai Friedrich*, managing director and divisional director of construction equipment. Gerhardt most recently served as managing director at Liebherr-Ettlingen GmbH remanufacturing center. Gerhardt assumes this role from *Dr. Torben Reher* who served Liebherr USA Co. since its inception in 2016. After six years of leading the newly formed organization, Reher plans to return to Germany.



Dan Horn

**Alpha Metallurgical Resources** promoted *Dan Horn* to executive vice president and chief commercial officer. Since December 2020, Horn has served as president of Alpha Metallurgical Coal Sales and as executive vice president of sales for Alpha Metallurgical Resources. Previously, he served in senior leadership roles within the sales departments of Contura Energy and Alpha Natural Resources.

**Whitmore Manufacturing** announced that *Chad Spretz* joined the company as vice president of sales. Spretz brings 18 years of experience in industrial sales and 13 years in sales management to the Whitmore leadership team. Most recently, he was vice president of business development and partnerships for Streamline Polymers.

*Joseph "Joe" S. Spivey*, 81, of St. Petersburg, Florida, passed away on Sunday, December 19, 2021. He was born September 24, 1940, in Loris, South Carolina. He earned his bachelor's degree at MacMurray College. He was the president of the **Illinois Coal Association**. He joined the ICA in 1976 as vice president and became president in 1978, serving in the role for 20 years.



Joseph "Joe" Spivey

## EU Will Subtract Millions From Funds to Poland Over Coal Mine

The European Union is starting the process to deduct millions of euros from payments to Poland in order to cover fines imposed on Warsaw for ignoring a court injunction to close down a coal mine, according to officials.

The European Court of Justice ruled last year that Poland should close the open-pit brown coal mine in Turow, near the border with the Czech Republic. In its injunction, it ruled in favor of the Czech government, which complained that the open-pit mine drains groundwater from villages on the Czech side of their border, while also causing dust and noise pollution.

The court ordered Poland to pay a daily fine of 500,000 euros (\$567,000) as long as it continues to operate the mine.

Poland's government, however, has refused to shut down the mine, saying it's crucial for providing jobs and energy to the country. It has argued that the EU court had no authority to impose the fine.

European Commission spokesperson Balazs Ujvari said the deadline expired for Poland's first payment, and the commission is now beginning its "offsetting procedure."

The first payment amounts to 15 million euros (\$17 million) plus 30,000 euros in interest.

The Polish and Czech governments have been holding talks in search of a solution to the problem but have still failed to reach a settlement.

Poland is expected by the European Commission to close its hard coal mines earlier than in 2049, but plans to defend its stance, Deputy State Assets Minister Piotr Pyzik said.

"The ministry has no such a plan, I would like to univocally dismiss it," Pyzik said, when asked about plans to shut down mines ahead of the 2049 deadline agreed on with the unions. "However, when it comes to the European Commission... we were told that 2049...from the point of view of the EC is unacceptable."

The ministry is now focusing on preparing a notification to the European Commission concerning state aid for the mining sector and hopes to convene the commission to the 2049 date.

## Turkey's Coal Power Down for Third Year

Carbon intensity has not declined in line with the drop in Turkish electricity generation over the last three years from high hard coal import costs, as natural gas power has ramped up to compensate for the shortfall in hydropower, according to a sectoral report recently released.

Turkey's electricity generation fell in 2021 for the third successive year, marking an 8% drop between 2018 and 2021, the London-based think tank Ember said in the report.

In 2018, coal generation peaked at 113.2 terawatt-hours (TWh) and was followed by a decrease of 0.3 TWh in 2019.

Coal generation fell by 7.1 TWh in 2020 when five lignite plants were forced to close operations for six months due to their noncompliance with new air pollution limits.

Ember calculated that Turkey saw another drop of 1.7 TWh in coal generation last year due to skyrocketing hard coal prices while also marking

a third consecutive annual decline in coal power.

The share of coal in total electricity generation was 37% in 2018 but dropped to 32% in 2021.

## Bukit Asam Will Construct Coal Gasification Plant to Reduce LPG Import

PT Bukit Asam Tbk launched the construction of a coal gasification plant on Monday, January 24, which is in line with the Indonesian government's efforts to reduce dependence on imports of liquid petroleum gas (LPG). Through this project, low-calorie coal will be converted into syngas and processed into methanol to produce dimethyl ether (DME) as an alternative to LPG.

A groundbreaking ceremony for the project, which is a collaboration with PT Pertamina (Persero) and Air Products and Chemicals Inc., was held in the Tanjung Enim Industrial Estate, Muara Enim, South Sumatra. Attended by the President of the Republic of Indonesia Joko Widodo, the project, which was designated as a national strategic project through presidential decree in 2020, was officially started.

President Director of Bukit Asam Arsal Ismail said that the groundbreaking was a historic moment in the development of project collaboration.

Arsal added that the downstream coal project into DME is in line with Bukit Asam's transformation and focus on developing the downstream industry to provide optimal added value for coal. The plant is designed to use 6 million metric tons (mt) of low rank coal to produce 1.4 mt of dimethyl ether (DME) annually, which can reduce Indonesia's LPG import by 1 million mt per year, he added.

The project is expected to take 30 months to complete and will be carried out in Tanjung Enim for 20 years with a total investment of US\$2.1 billion.

President Widodo said LPG imports accounted for 80.5% of last year's consumption of around 7.95 million tons.

## CALENDAR OF EVENTS

**February 27-March 2, 2022:** *Society for Mining, Metallurgy and Exploration (SME)*, Salt Lake City, Utah. Contact: Web: [www.smenet.org](http://www.smenet.org).

**April 25-27, 2022:** *CoalProTec*, Lexington, Kentucky. Contact: Web: [www.coalprepsociety.org](http://www.coalprepsociety.org).

**September 14-16, 2022:** *Bluefield Coal Show*, Bluefield, West Virginia. Contact: Web: [www.coctwovirginias.com/2019-bluefield-coal-show](http://www.coctwovirginias.com/2019-bluefield-coal-show).



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# PRODUCTION REBOUNDS WITH FEWER FACES PRODUCING MORE TONS

*OEMs adapt service to meet increasing demand*

BY STEVE FISCOR, EDITOR-IN-CHIEF



U.S. longwall production grew by more than 21 million tons in 2021.

In a year where total U.S. coal production climbed nearly 8%, it seems only natural that production from America's most productive underground coal mines would grow too, and it did indeed. More than half of the additional 40 million tons produced in 2021 came from the largest underground coal operators. Total U.S. longwall production grew by 17.3% to 142.7 million tons from 121.7 million tons in 2020.

Not all of the U.S. longwalls reported production increases and two of them closed. The total number of faces shrank to 37 from 40 and the total number of longwall mines declined from 35 to 33. Those figures include two trona mines in Wyoming and five mines that operated two longwall faces. Bridger Coal Co. in Wyoming closed its longwall mine and Panther Creek Mining is no longer operating a longwall at the American Eagle mine in West Virginia. American Consolidat-

ed Natural Resources (ACNR) closed the Monongolia County mine in West Virginia. Longtime *Coal Age* readers would remember it as the Blacksville mine. Murray Energy Corp. purchased it from CONSOL Energy in 2013.

According to the latest statistics from the U.S. Mine Safety and Health Administration, two of the major longwall complexes, CONSOL Energy's Baily Complex and ACNR's Marshall County mine, achieved more than 11 million tons per year (tpy) during 2021. Both operate two faces in the Pittsburgh No. 8 seam. A dozen longwall mines produced more than 5 million tpy in 2021, compared to seven in 2020 (see Table 2). In 2019, 13 longwall installations produced at a capacity of 5 million tpy or greater.

A couple of new names appear in this year's longwall census. ACNR's Century mine in Ohio is now known as the Belmont County mine and

the company's Lila Canyon mine in Utah is also now known as the Emery County mine.

Arch Resources started the longwall at its new Leer mine in West Virginia during September. It is expected to produce up to 4 million tpy of high-vol A coking coal. It will operate in tandem with Arch's flagship Leer mine for the next 20 years or more.

## Industry Demographics

Longwall ownership in the U.S. remained relatively unchanged. ACNR and the companies it controls (Foresight Energy and Hatfield Metallurgical) operate 12 longwall faces spread across Alabama (1), Illinois (4), Ohio (1), 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 nine 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 4.20 million tpy in 2021 compared to 3.75 million tpy in 2020. On average, it has a cutting height of 96.3 in., a panel width (or face length) of 1,236.9 ft, and a panel length of 13,091.6 ft. Last year, those numbers were 95.6 in., 1,210.1 ft and 12,341.3 ft, respectively. A total of seven longwall faces have face lengths of 1,500 ft or greater. A total of 13 longwalls operate in the Pittsburgh No. 8 seam. The maximum overburden on average reaches 1,107.6 ft. Except for a few mines in Utah, most are developed with three entry gates. Using an



1,883-hp double-drum, ranging-arm shearer, they take a 40.4-in. cut. The average yield setting on the shields is 1,058.3 tons. All of 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 in Virginia and ACNR's Emery County mine are the deepest at 2,000 ft. At 26,000 ft, Foresight Energy's Mach No. 1 mine has the longest panel.

## Longwall Associates Turns Rebuilds Quickly

The world of longwall mining has changed dramatically in the past few years. The global pandemic, supply chain disruptions, labor shortages, rebounding coal prices and demand has created quite a challenge for the mines and the suppliers.

Longwall Associates said its shop is extremely busy right now. "We're very fortunate," said Dennis Heninger, engineering manager for Longwall Associates. "We are very thankful for the current, very busy situation, even though it can be challenging."

Much of Longwall Associates' work is rebuilds. "We're running about 60:40 rebuilds to new equipment, primarily servicing the mines in the Appalachian Basin and Alabama," Heninger said. "However, we can provide service for any longwall mine and we have recently supplied new equipment to Signal Peak in Montana.

When it comes to rebuilding armored face conveyors (AFCs), replacing and rebuilding the deck plate is standard procedure for the equipment that arrives on site, but there's been quite a bit of upgrade work, Heninger explained. "There has definitely been an increase in coal demand and there are a lot of people wanting to increase production," he said. "In the past 12 to 24 months, we have upgraded equipment to improve production and capacity, as well as just the normal repair work."

With longer faces and higher production rates, customers are looking for larger chain sizes, larger sprockets and larger sigma sections to accommodate that gear, Heninger explained.

"Our focus right now really is supply chain management and keeping the workforce healthy," Heninger said. "We have to have raw materials on site and we have to be able to process that and that equipment has to get to the mines without affecting their production. Most of our resources are going toward that effort right now." Everyone is familiar with supply disruption, but the workforce issue is twofold with health issues related to the virus as well as general labor shortages, Heninger explained. "While I would like to say we've implemented some fantastic innovations at the shop, the reality is that we have to focus on those two areas to keep our customers supplied with equipment on time and ready to run coal," Heninger said.

As far as steel supplies, Longwall Associates uses Hardox for the deck plate and they have several sources for mild steel. "Mild steel has not been a problem," Heninger said. "Specialty steels, however, are a different story as far as plate, castings and forgings. We are spending a lot of time working with

our customers to ensure that orders are placed with enough lead time.

"The average longwall rebuild for Longwall Associates, from the time we bring it from the yard into the shop until we start delivery, is about three months," Heninger said. "That three months is from the time we bring it in the door. It all depends on the level of advance planning to secure a spot in the schedule. If the mines don't plan ahead and they don't secure a spot, then of course that affects when we can start. With new equipment, however, the lead time is about a year."

"It all depends upon the customer and how proactive they are," Heninger said. "Compared to five years ago, when it was a just-in-time mentality, a lot has changed and most of our customers are making arrangements and scheduling with sufficient time to accommodate everyone's needs. Sometimes production timelines deviate from the plan and all of our customers do a good job of working with us to make sure that we know in advance to plan properly," Heninger said. "What we are doing right now is trying to be very flexible, as much as possible to accommodate all of our customers, so that when things change, we can try to adapt to that change to meet our customer's needs.

**Table 1—Longwall Installations by Parent Company (2021-2022)**

Company	Ala.	Colo.	Ill.	Mont.	N.M.	Ohio	Pa.	Utah	Va.	W.Va.	Wyo.	Total
Alliance Resource Partners			1							2		3
ACNR						1		1		5		7
Arch Resources		1								2		3
Blue Mountain Energy		1										1
CONSOL Energy							5					5
Iron Senergy							1					1
Coronado Coal									1			1
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
Westmoreland Mining					1							1
Wolverine Fuels								2				2
<b>Total</b>	<b>5</b>	<b>3</b>	<b>5</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>6</b>	<b>3</b>	<b>1</b>	<b>9</b>	<b>2</b>	<b>37</b>

## Joy Pursues Systems Approach

Komatsu is focusing on the next level of automation for its Joy brand of longwall mining machinery. The objective is to fully integrate technologies, such as the Landmark technology for shearers, proximity protection and enhanced geometry control.

The Landmark system, which looks after the operational side of the longwall, has proven itself, according to Shawn Franklin, shearer product manager for Komatsu, who explained

why it has really taken in the last few years. “Its adoption level among U.S. longwall mines is approaching 20% and some now consider it an industry standard,” Franklin said.

Even though it's described as a shearer technology, the system works with the powered roof supports and does much more. The shearer's inertial navigation system collects data as it traverses from the main gate to the tail-gate and vice versa and steers the longwall. “The intelligence and the correc-

tions are carried out by the power roof support's control system,” said Allan Black, roof support production manager, Komatsu. “Using data from linear transducers inside the double-acting, advancing rams, the roof supports make the necessary adjustments to bring everything back in line.”

Proximity detection protects longwall operators, which is especially important as mines shift more toward automated operations. Automation has reduced the amount of eyes and ears on the longwall face.

“Proximity protection is a nice feature,” Black said. “Operators wear a tag. All the hardware is built into the Joy RS20s control system. That tag is detected as the miner walks up and down the longwall. If an automated prime sees a miner in the way, it will pause operations. If someone has had a medical emergency, for example, it would prevent a roof support from being pulled over them causing more problems.”

Enhanced geometry control is another safety feature Komatsu is currently developing for longwalls. It relies on three tilt transducers installed within the powered roof support — one in the canopy, one on the base and one on the linkage. “Taking the data from those transducers and applying it to the known geometry of the shearer and the roof supports, we can determine potential collision hazards using algorithms,” Black said. “We see the pick marks on the canopies. Enhanced geometry is a very nice feature that stops the shearer from progressing if it sees a potential collision hazard.”

Beyond those three main areas of improvement, Komatsu is also improving the use of peripheral items such as cameras, which allow people in remote locations to continuously monitor the operation. “If there's something that the transducer or the algorithm hasn't detected, the camera serves as a fall back measure,” Black said. “They also provide a comfort factor. Operators can see that the system is operating the way it was expected to.”

**Table 2—Active US Longwall Mines (February 2022)**

Company	Mine	Prod. 2021	Prod. 2020	% Change
CONSOL Energy	Bailey*	11,753,022	8,668,477	35.6
ACNR	Marshall County*	11,022,904	8,854,604	24.5
Foresight Energy (ACNR)	Sugar Camp*	7,860,150	7,196,444	9.2
Signal Peak Energy	Bull Mountains	7,246,554	6,022,919	20.3
Alliance Resource Partners	Tunnel Ridge	7,212,501	6,756,696	6.7
CONSOL Energy	Enlow Fork*	6,808,789	5,691,381	19.6
Foresight Energy (ACNR)	Mach Mining	6,713,341	3,841,668	74.8
ACNR	Marion County	6,182,761	3,874,919	59.6
ACNR	Harrison County	6,149,291	4,880,471	26.0
Iron Senergy	Cumberland	5,978,123	5,621,165	6.4
ACNR	Ohio County	5,974,355	4,998,672	19.5
CONSOL Energy	Harvey	5,299,867	4,410,039	20.2
Alliance Resource Partners	Hamilton County	4,938,788	2,623,205	127.9
Coronado Coal	Buchanan	4,852,300	3,766,386	28.8
Warrior Met Coal	Blue Creek No. 7	4,793,699	4,463,736	7.4
Arch Coal	Leer	4,370,790	4,185,123	4.4
Wolverine Fuels	Skyline	3,534,791	3,687,574	-4.1
ACNR	Lila Canyon	3,380,817	3,301,880	2.4
Wolverine Fuels	Sufco No. 1	3,310,292	4,458,836	-25.8
Arch Coal	West Elk	3,272,864	2,538,091	28.9
Foresight Energy (ACNR)	Deer Run	3,197,895	2,886,225	17.1
Pacific Minerals	Bridger	3,194,899	2,424,369	31.8
Hatfield Metallurgical (ACNR)	Oak Grove	2,020,277	1,608,068	25.6
ACNR	Monongalia County	1,992,063	2,294,715	-13.2
Peabody Energy	Twentymile	1,739,081	1,192,936	45.8
Westmoreland Coal Co.	San Juan South	1,572,266	1,246,825	26.1
Blue Mountain Energy	Deserado	1,541,218	1,885,034	-18.2
Alliance Resource Partners	Mountain View	1,539,656	1,834,142	-16.1
American Energy Corp.	Century Mine	1,271,897	1,689,296	-24.7
Arch Coal	Mountain Laurel	1,055,871	891,573	18.4
Wolf Mining (Arch Coal)	Leer South	905,261	756,071	19.7
Warrior Met Coal	Blue Creek No. 4	810,883	1,638,174	-50.5
Panther Creek Mining	American Eagle	759,230	750,953	1.1
Peabody Energy	Shoal Creek	427,134	714,831	-40.2
<b>Total U.S. Longwall Production</b>		<b>142,683,630</b>	<b>121,655,498</b>	<b>17.3</b>

Note: ACNR - American Consolidated Natural Resources. Source: Mine Safety and Health Administration.

\*Each of these mines operate two longwall faces.



Mine Company (parent)	Seam	Seam height (inches)	Cutting height (inches)	Panel width (ft)	Panel length (ft)	Overburden (ft)	No. of gate entries	Depth of cut (inches)	Shearer Total hp	Haulage system	Roof support yield (tons)	Face conveyor type (strand, motors)	Face conveyor width (mm)/ speed (fpm)	Stageloader type width, speed	Crusher	Electrical controls	Voltage to face
<b>ALABAMA (5)</b>																	
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 1,813	Ultratrac 2000	Joy 1,300	JWR/Cat CSTs 42 TIB 3x1,200	1,000/305	JWR 1,300 mm, 420 fpm	JWR	Line Power	4,160
Blue Creek No. 7 North Blue Creek/ Warrior Met Coal	Blue Creek/ Mary Lee	53	69	1,060	7,000-8,000	1,600	4	36	Joy 7LS-1D DDR 1,813	Ultratrac 2000	Joy 1,150	JWR/Cat CSTs 42 TIB 3x1,000	1,000/305	JWR 1,300 mm, 420 fpm	JWR	Line Power	4,160
Blue Creek No. 7 East Blue Creek/ Warrior Met Coal	Blue Creek/ Mary Lee	53	80	1,040	4,000-13,000	1,600	4	36	Joy 7LS-1D DDR 1,813	Ultratrac 2000	Joy 1,150	JWR/Cat CSTs 42 TIB 3x1,200	1,000/305	JWR 1,300 mm, 420 fpm	JWR	Line Power	4,160
Oak Grove Hatfield Metallurgical (ACNR)	Blue Creek	55	80	1,195	5,097	680	4	36	Joy 7LS-1D DDR 1,880	Ultratrac 2000	ZMI 1,020	CEMI 48 TIB 3x1,000	1,000/384	CEMI 1,200 mm, 420 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 2000	Joy 955	Cat/Cat CSTs 48 TIB 3x1,000	1,342/320	Caterpillar 1,424 mm, 385 fpm	Cat	Service Machine	4,160
<b>COLORADO (3)</b>																	
Deserado Blue Mountain Energy	B	84-168	132	800	14,000	400-900	3	30	Joy 7LS2 DDR 1,458	Ultratrac 2000	Joy 910	Joy 38 TIB 2x1,072	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 2000	Cat 1,327	Trimming/Cat CSTs 48 TIB 3x1,900	1,188/371	Caterpillar 1,588 mm, 520 fpm	Cat	Service Machine	4,160
West Elk Arch Resources	E	84-216	96-156	1,080	10,250-16,000	600-1,200	3	42	Cat EL-3,000 DDR 2,360	Jumbotrac 2000	Cat 1,271	Cat 48 TIB 3x1,650	1,188/371	Caterpillar 1,388 mm, 464 fpm	Cat	Service Machine	4,160
<b>ILLINOIS (5)</b>																	
Deer Run Foresight Energy (ACNR)	Herrin No. 6	96	96	1,400	15,000	600	3	42	7LS2A DDR 2,360	Jumbotrac 2000	Cat 1,200	Cat/Cat CSTs 48 TIB 3x1,900	1,000/371	Caterpillar 1,388 mm, VFD	Cat	Intermountain Electrical	4,160
Mach No. 1 Foresight Energy (ACNR)	Herrin No. 6	68	84	1,400	25,000	400	3	42	Joy 7LS2A DDR 2,054	Jumbotrac 2000	Cat 1,200	Cat/Cat CSTs 48 TIB 3x2,200	1,000/383	Caterpillar 1,376 mm, VFD	Cat	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 2000	Cat 1,200	CEMI/Cat CSTs 48 TIB 3x2,200	1,000/383	CEMI/Cat 1,376 mm, VFD	Cat	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 2000	Cat 1,200	CEMI/Cat CSTs 48 TIB 3x2,200	1,000/383	CEMI/Cat 1,376 mm, VFD	Cat	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 50 TIB 3x1,650	1,000/370	Joy 1,350 mm, 480 fpm	Joy	Service Machine	4,160

Legend: ACNR—American Consolidated Natural Resources; 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: CEMI = Centria Equipment and Machine, Inc.; PSS = PSSystems, Inc.; and ZMI = Zhengzhou Coal Mining Machinery.

Komatsu is now offering Rest API for shearers. “We have had it available on roof supports for a while, and we have just started to offer it for shearers,” Franklin said. “Rest API allows high level control of the equipment using software from a webpage so you can manage the equipment from a PC or a tablet or even a smart phone remotely. We have Rest API on one powered roof-support installation right now in the U.S., and we are starting to roll it out as option for shearers.”

Komatsu is also investing in shearer projects aimed at increasing productivity and reliability the old-fashioned way. One example is the J7500 ranging arm currently in final design that is aimed at increasing both power and life. “It will offer an arm, similar in size to the Joy J525 model, but with a 30% increase in power,” Franklin said. “It will also be longer in length to keep up with wider panels with larger drives to improve gate-end cut-outs. It will be our next generation arm to better serve the industry now and well into the future.”

### Supporting Roof Supports, But No Longer Making Them

Komatsu made the announcement last year it would no longer manufacture powered roof supports. “However significant that move looked, the industry needs to know that we haven’t walked away from the powered roof support business,” Black said. “We have redefined our business model, whereby we no longer physically manufacture the support, however, we are still retaining the design and engineering capabilities, so we can still design roof supports for any customer’s requirements.”

As an example, Black cited project management as a service Komatsu offers. “We have in-house testing capabilities for original equipment support or aftermarket rebuild support,” Black said. “We have final element analysis (FEA), which detects high stress areas, and flow studies to determine the lower, advance and set cycle time for

a roof support, or the flow characteristics for the entire longwall to determine the pumping requirements.”

Komatsu still provides key components, such as hydraulic leg seals, blipper valves, leg pocket castings, etc. “The valve gear is still manufactured in-house, as is the control system,” Black said. “We are still advancing work with electrohydraulic controls. We have a new development, the RS20n, which is a replacement for our RS20s control system.”

With its 1 Gb/s high-speed data backbone, the RS20n control system represents another significant change for longwall mining. “1000Base T1 two-wire system using a four core cable with two dedicated power lines,” Black said. “It’s physically robust and offers 10 times the speed of what is currently available on the market.”

With the other modules that will come with that system, the longwall operator will be able to tailor the longwall to suit the company’s automation as well as transmitting data very quickly from one support to the next to the gate end, Black explained. “It can interface cameras and other devices through media converters, so it provides the best communications infrastructure for a modern, automated longwall system,” Black said.

Black said Komatsu is also developing a new global dual solenoid with serial connectivity. “The Joy longwall control system was traditionally a three-component system, with mimic and micro-computing ‘the brains’ and the solenoid driver board,” Black said. “The serial connection removes the need for the solenoid driver board, making it a two-component system. It’s a lot simpler in the fact that the cable is just daisy-chained between the solenoids. The cable runs are tighter and shorter and it lends itself to easier fault finding.” Komatsu currently has a system running on larger roof supports in Australia and there are probably one or two applications where it could be used in the U.S.

Komatsu is also developing a “cost-competitive” tier 1 hydraulic valve control system, which replaces its traditional Compac system. “It’s got all the hydraulic benefits of a high flow unit,” Black said. “It’s designed to provide really quick response times and can be driven through the new RS20n control system.”

“Yes, we’ve moved away from the actual manufacture of roof supports, but we’re still designing them, supplying key components for them, and developing the next generation of controls,” Black said. “The goal is to offer better control mechanisms and improve cycle times as we advance toward a more remotely operated, automated longwall.”

Komatsu will assist mine operators in the manufacturer selection process. “We haven’t manufactured structures in-house since 2000,” Black said. “We’ve reacted very much toward the way the market was driving us. The highest cost items for a longwall system are the powered roof supports. It represents 80% of the cost of the longwall. We have retained the key components and the electrohydraulic controls. If you take the emotions out of the decision and look at what we’ve done, the mines will see this as a positive move.”

### Longer Faces Require More Robust AFCs

For its line of AFCs, Komatsu is taking a more holistic approach. “We are looking at where our customers expect to be in five to 10 years and designing the AFCs that will meet those needs, while continuing to support today’s systems,” said Daniel Sharpe, AFC product manager for Komatsu. “We are positioning ourselves to make sure that we can provide the automation benefits that the customers want, which could be high-level automation with something like OptiDrive or simply meeting the geotechnical requirements of the equipment.”

The average face length among U.S. longwalls continues to grow. “To



Mine Company (parent)	Seam	Seam height (inches)	Cutting height (inches)	Panel width (ft)	Panel length (ft)	Overburden (ft)	No. of gate entries	Depth of cut (inches)	Shearer Total hp	Haulage system	Roof support yield (tons)	Face conveyor type (strand, motors)	Face conveyor width (mm)/ speed (fpm)	Stageloader type width, speed	Crusher	Electrical controls	Voltage to face
<b>MONTANA (1)</b>																	
Bull Mountains		180	120-144	1,250	22,500	450	3	42	Joy 7LS5 DDR 2,360	Super GearRack	Joy 1,130	Longwall Assoc./Cat CSTs 48 TIB 3x1,650	1,088/376	Caterpillar 1,388 mm, 464 fpm	Cat	Intermountain Electrical	4,160
<b>NEW MEXICO (1)</b>																	
San Juan Mine No. 1 Westmoreland Mining	Fruitland No. 8	136-200	120-156	1,000	11,000	400-1000	3	39	Joy 7LS5 DDR 2,092	Ultratrac 2000	Joy 1,160	Joy 50 TIB 3x1,150	1,100/350	Joy 1,350 mm, 500 fpm	Joy	Service Machine	4,160
<b>OHIO (1)</b>																	
Belmont County ACNR	Pittsburgh No. 8	58	70	1,500	5,000	480	3	36	Joy 7LS1D DDR 1,880	Ultratrac 2000	CEMI 700	CEMI 48 TIB 3x1,000	1,000/378	CEMI 1,200 mm, 531 fpm	CEMI	MCI	4,160
<b>PENNSYLVANIA (6)</b>																	
Bailey - Dry Ridge CONSOL Energy	Pittsburgh No. 8	62-72	92	1,576	11,950	400-1,000	3	42	Joy 7LS2A DDR 1,692	Super GearRack	Cat 969	Longwall Assoc./Cat CSTs 48 TIB 3x1,900	988/378	Caterpillar 1,188 mm, 528 fpm	Cat	Line Power	4,160
Bailey - Crabapple CONSOL Energy	Pittsburgh No. 8	62-72	93	1,501	12,240	500-1,400	3	42	Joy 7LS2A DDR 1,692	Super GearRack	Joy 1,005	Longwall Assoc./Cat CSTs 48 TIB 3x1,900	988/378	Caterpillar 1,188 mm, 528 fpm	Cat	Line Power	4,160
Harvey CONSOL Energy	Pittsburgh No. 8	62-72	86	1,575	14,730	800-1,200	3	42	Joy 7LS2A DDR 1,692	Super GearRack	Cat 969	Longwall Assoc./Cat CSTs 48 TIB 3x1,900	988/378	Caterpillar 1,188 mm, 528 fpm	Cat	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 2000	Cat 1,096	Cat 48 TIB 3x1,900	988/371	Caterpillar 1,388 mm, 420 fpm	Cat	Line Power	4,160
Enlow Fork - H Side CONSOL Energy	Pittsburgh No. 8	66	88	1,521	15,262	600-1,200	3	42	Joy 7LS2A DDR 1,692	Super GearRack	Joy 1,005	Longwall Assoc./Cat CSTs 48 TIB 3x1,900	988/371	Caterpillar 1,188 mm, 525 fpm	Cat	Line Power	4,160
Enlow Fork - G Side CONSOL Energy	Pittsburgh No. 8	65	88	1,484	14,227	600-1,200	3	42	Joy 7LS2A DDR 1,692	Super GearRack	Cat 983	Longwall Assoc./Cat CSTs 48 TIB 3x1,900	988/371	Caterpillar 1,188 mm, 525 fpm	Cat	Line Power	4,160
<b>UTAH (3)</b>																	
SUFCO No. 1 Wolverine Fuels	Upper Hawatha	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 48 TIB 3x1,650	1,000/374	Caterpillar 1,388 mm, 464 fpm	Cat	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	Jumbotrak 2000	Cat 1,007	Cat/Cat CSTs 42 TIB 2x1,200	888/340	Caterpillar 1,388 mm, 450 fpm	Cat	Line Power	4,160
Uta Canyon (Emery County) ACNR	Lower Sunnyside	168	144	847	4,500-5,000	1,500-2,000	2	42	Cat EL2000 DDR 2,004	Ultratrac 2000	ZMJ 1,250	CEMI 48 TIB 3x1,000	1,000/312	CEMI 1,200 mm, 531 fpm	CEMI	Intermountain Electrical	2,300

Legend: ACNR—American Consolidated Natural Resources; 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: CEMI = Centralia Equipment and Machine, Inc.; PSS = PSSystems, Inc.; and ZMJ = Zhengzhou Coal Mining Machinery.

meet that need, we may need to increase the size of chains, and adapt our line pan designs,” Sharpe said. “We are also looking at shearer haulage as part of a larger system.”

As an example, Sharpe said engineers need to consider the seam height and the face length. “When you start specifying the system, in addition to the amount of coal loading on to the AFC, you also need to consider chain strength, chain size and the installed power on the face,” Sharpe said. “Going back to the systems side of things, the line pan has to be adapted to the size of the shearer to balance its center of gravity. We’ve seen a transition toward the upper end of our current capabilities and moving forward, we are positioning ourselves to meet the future needs of the industry.”

To add 300 ft of line pan to a longwall, there is more to consider than stronger chain and increased horsepower. “You’ve got to find that

sweet spot where the system is robust enough to manage that, but there’s also the softer side around the automation and the things that we could put in place to make sure the system doesn’t get itself into trouble,” Black said. “You don’t want to bog the AFC down. The system needs to be intelligent enough to realize it’s approaching an overload condition and slow the shearer until the AFC clears.”

Chain management has become much more important with longer systems, Sharpe explained. “The system needs to be more sensitive to anomalous situations that could create a chain event,” Sharpe said. “Putting these technologies in place, we can assure that the longwall can handle it. We now have three fully developed chain management offerings that range from a relatively simple system to one directly measuring tension in the chain.”

Komatsu is currently looking at the interaction with the shearer and

controlling the speed of the chain on the AFC. “It’s something that’s still being developed, but initial indication is showing a tangible reduction in chain travel, which is obviously beneficial to controlling the production and the load on the AFC, and other impacts in terms of equipment life and wear,” Sharpe said.

To back all of this up, Komatsu offers Joy Smart Solutions. “All the information gathered through the transducers and the equipment itself feeds into the control mechanisms that also is recorded remotely,” Black said. “Joy Smart Solutions allows people to interrogate the data either live or historically to look at trends.”

With Smart Solutions, Franklin explained, adoption levels among U.S. longwall operators are approaching the 40% level. That feedback is vital to mine management, as far as making decisions regarding performance and productivity.

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Mine Company (parent)	Seam	Seam height (inches)	Cutting height (inches)	Panel width (ft)	Panel length (ft)	Overburden (ft)	No. of gate entries	Depth of cut (inches)	Shearer Total hp	Haulage system	Roof support yield (tons)	Face conveyor type (strand, motors)	Face conveyor width (mm)/ speed (fpm)	Stageloader type width, speed	Crusher	Electrical controls	Voltage to face
<b>VIRGINIA (1)</b>																	
Buchanan	Pocahontas No. 3	60-76	70	700	11,500	1,400-2,000	4	42	Joy 7LS1D DDR 1,290	Super GearRack 2000	Joy 1,024	Joy/Longwall Associates 42 TIB 3x800	1,000/357	Longwall Associates 1,294 mm, 485 fpm	Joy	Line Power	4,160
<b>WEST VIRGINIA (9)</b>																	
Harrison County ACNR	Pittsburgh No. 8	79	94	1,518	13,300	1,100	3	39	Joy 7LS1D DDR 1,880	Ultratrak 2000	Cat 862	CEM/Cat CSTs 48 TIB 3x1,900	1,000/378	CEM/Cat 1,200 mm, 531 fpm	Cat	Line Power	4,160
Leer	Lower Kittanning	54-96	72-96	5,000-1,200	10,000	280-750	3	42	Joy 7LS1D DDR 1,840	Ultratrak 2000	Joy 1,040	Joy 42 TIB 3x1,340	1,000/337	Joy 1,294 mm, 443 fpm	Joy	Inter Mountain	4,160
Marion County ACNR	Pittsburgh No. 8	88	88	1,438	14,376	1,150	3	42	Joy 7LS1D DDR 1,880	Ultratrak 2000	Cat 890	CEM/Cat CSTs 48 TIB 3x1,900	1,000/378	CEM/Cat 1,200 mm, 531 fpm	Cat	Line Power	4,160
Marshall County West ACNR	Pittsburgh No. 8	96	95	1,181	16,132	850	3	42	Cat EL1000 DDR 1,926	Ultratrak 2000	Cat 890	CEM/Cat CSTs 48 TIB 3x1,900	1,000/378	CEM/Cat 1,200 mm, 531 fpm	Cat	Line Power	4,160
Marshall County East ACNR	Pittsburgh No. 8	96	98	1,474	11,391	900	3	42	Joy 7LS1A DDR 1,880	Ultratrak 2000	Cat 1,020	CEM/Cat CSTs 48 TIB 3x1,900	1,000/378	CEM/Cat 1,200 mm, 531 fpm	Cat	Line Power	4,160
Mountain View Alliance Resource Partners	Upper Freeport	88-108	78-108	4,000-850	6,000	600	3	42	Joy 7LS1A DDR 1,330	Ultratrak 2000	Joy 815	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	1,448	15,000	680	3	42	Joy 7LS1A DDR 1,880	Ultratrak 2000	Cat 862	CEM/Cat CSTs 48 TIB 3x1,900	1,000/365	CEM/Cat 1,300 mm, 531 fpm	Cat/CEMI	Line Power	4,160
Tunnel Ridge Alliance Resource Partners	Pittsburgh No. 8	62-72	80-84	17,000-20,000	400-725	400-725	3	42	Joy 7LS1D DDR 1,840	Ultratrak 2000	PSS 1,020	Joy 48 TIB 3x1,200	1,000/360	Joy 1,294 mm, 443 fpm	Joy	Line Power	4,160
Wolf Run (Leer South) Arch Resources	Lower Kittanning	54-78	72-84	4,000-1,200	10,500	450-1,300	3	42	Joy 7LS1D DDR 1,840	Ultratrak 2000	Joy 1,040	Joy 42 TIB 3x1,350	1,000/337	Joy 1,294 mm, 443 fpm	Joy	SMC	4,160
<b>WYOMING (2)</b>																	
Green River Solvay Chemicals	Bed 17	132	120-132	625	8,750	1,600	3	34	Joy 7LS5 DDR 2,360	Super GearRack 2000	Famur 800	Longwall Associates 42 TIB 2x1,000	1,100/330	Caterpillar 1,388 mm, 477 fpm	Cat	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	Ultratrak 2000	Joy 870	Joy 42 TIB 2x1,072	1,100/268	Joy 1,294 mm, 385 fpm	Joy	Service Machine	4,160

Legend: ACNR—American Consolidated Natural Resources; 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: CEMI = Centralia Equipment and Machine, Inc.; PSS = PSSystems, Inc.; and ZMI = Zhengzhou Coal Mining Machinery.

# EXPERIMENTS TO SAFELY BOOST RECOVERY

*Three crucial studies experimented with chemicals and pH, and found possible ways to improve recovery, meet some sustainability goals, and cut costs*

BY JESSE MORTON, TECHNICAL WRITER

Three critical coal flotation studies from 2021 show that the scientific establishment in countries that still prioritize coal power is finding ways to safely improve recovery.

Of the three studies, one concluded a coconut oil-based surfactant could be used with traditional collectors to increase recovery. A second concluded a compound historically used as a preservative in cosmetics outperformed traditional collectors. Both the experimental surfactant and collector are relatively safe and environmentally friendly, and their use in flotation might help operations attain some ES&G goals.

Two of the three studies found lower pH gives better recovery. One found a pH of 4 and the other found a pH of roughly 3 to deliver the best results. The latter found pH determines both the float rate and recovery rate. It concluded pH determines the so-called isoelectric point, which is when particles and bubbles join.

With prices for hydrocarbons rising, all three studies contain information

that could possibly help an operation save money and recover more coal.

## Coconut oil-based Surfactant Improves Recovery

A study<sup>1</sup> out of China demonstrated that Sodium Cocoyl Glycinate (SCG), an amino acid surfactant, when used with kerosene, as a flotation collector, and sec-octyl alcohols, as a frother, produced a significantly higher yield of clean coal than flotation with only kerosene and frother.

Coconut oil-based SCG, with a molecular formula of R-CO-NH-CH<sub>2</sub>-COONa, has low biological toxicity, can be degraded by microorganisms, and “is the best performing natural amino acid surfactant,” the study said.

The study involved several lab-scale experiments that used aerated flotation system for processing low-grade coal with the kerosene and alcohols, the control group; and low-grade coal with SCG, kerosene, and the alcohols, the experimental group.

For the control group, “the dosages of kerosene were 1,000, 3,000, 5,000 and 7,000 (grams [g] per metric ton [mt]), and meanwhile sec-octyl alcohols usage was 500 g/mt through all the tests,” the study said. For the experimental, “the dosages of collector and frother were fixed at 5,000 g/mt and 500 g/t with SCG concentrations of 20, 50, 100 and 1,000 g/mt.”

The flotation cell was aerated at 0.35 m<sup>3</sup>/h. “The speed of impeller was 1,900 rpm and the pulp density was 60 g/liter.”

First, some baselines were established by running the process on gangue only, and then on raw coal only.

For the control group, roughly 90 g of raw, low-grade coal was pre-wet-

ted in the cell for a minute. Kerosene was then injected. Two minutes later, the alcohol frother was added. Thirty seconds later, the aeration was activated. “The concentrate and tailings were collected, dried and weighted,” the study said.

For the SCG group, “there was an extra step of SCG addition between the pre-treatment and kerosene injection and this process lasted for 1 min.”

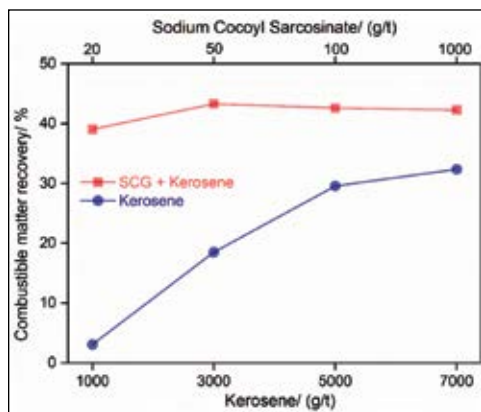
The metrics obtained for comparing the two groups were bubble attachment time, hydrophobicity estimates, surface tension effect estimates, emulsification effect estimates, froth layer size, and bubble size and distribution.

To measure bubble attachment time, an Induction 2015E tester designed by the University of Alberta was used.

The experimental group had a half-of-success adhesion time of 100 ms. The control group had a time of 270 ms. (Raw coal alone had a time of 613 ms.) “The presence of SCG cut down the attachment time largely by making coal particle surfaces more hydrophobic,” the study said.

Infrared spectroscopy found “both hydrophobic and hydrophilic functional groups were found in the molecular structure of SCG.” When SCG is mixed with kerosene, however, the result is increased hydrophobicity.

“Hydrophilic functional groups of SCG adsorbed with the hydrophilic sites on the coal surface through hydrogen bonds, leaving the hydrophobic ends exposed to the bubbles,” the study said. “This made a great differ-



Combustible matter recovery using coconut oil-based amino acid surfactant Sodium Cocoyl Glycinate and kerosene as a flotation collector verses using only kerosene. (Image: Niu, et al.)

<sup>1</sup> Nui, Chenkai; et al. (2021) Insight into the low-rank coal flotation using amino acid surfactant as a promoter. DOI: <https://doi.org/10.1016/j.fuel.2021.121810>.



ence at the content of hydrophobic functional groups on the coal surface, and shorten the attachment time, which enhanced the hydrophobicity of the coal surface.”

A surface tensiometer was used to measure surface tension for the control and SCG groups. A 19.69-mm platinum ring “was vertically inserted into the solution and then lifted to determine the air-liquid interface tension.”

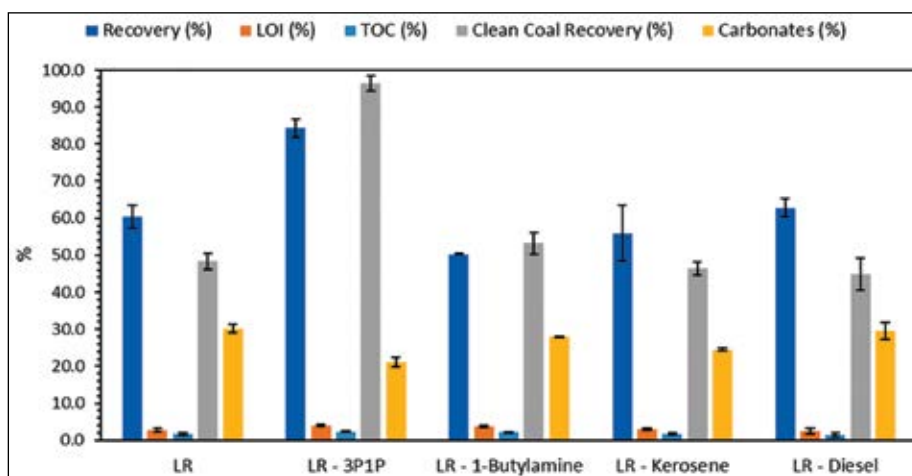
The results suggested surfactant SCG adsorbed at the gas-liquid interface, decreasing the surface tension. “SCG could reduce the surface tension of the solution efficiently, which might be beneficial to bubbles generation when a large dosage of oily collectors is applied,” the study said. “Moreover, the reduction of the surface tension may have an effect on the emulsification of the collector.”

To determine the effects of SCG on emulsion of kerosene and water, turbidity was measured in the control and experimental groups using a ZDK turbidimeter. “Droplet size distribution was determined using an Occhio nano 500 XY.”

The results showed the “surfactant would also work on the oil-water interface. Its polar end would insert into the water phase, and meanwhile the non-polar group enters the oil phase to form a directional absorption,” the study said. “The reduction of interfacial tension between water and oil cuts down the energy required to form the emulsion making the emulsification easier.”

To determine the height of the froth layer, a setup was used consisting of a “30 cm-height column, solution zone, quartz sand core and a float flowmeter.” The setup was aerated at a fixed flow of 0.35 m<sup>3</sup>/h.

“For each test, the same amount of water was added into the column,” the study said. “After that, kerosene, sec-octyl alcohols and SCG were injected, and then” the air valve was turned on and the maximum height of froth layer, after 40 s of aeration, was measured.



As a collector for low-rank (LR) coal, 3-phenyl-1-propanol (3P1P) outperforms ‘natural flotation,’ butylamine, kerosene, and diesel. (Image: Blanco-Flores, et al.)

The results showed “the maximum height of froth layer without SCG was relatively low, at 7 cm, and its half-life was about 2 s,” the study said. “However, the maximum height increased to around 16 cm when SCG was added and its half-life slightly prolonged to around 3 s, conveying that the addition of SCG contributed to the generation and maintenance of bubbles.”

To determine the distribution and the size of the bubbles, “photos of the froth layer during low-rank coal flotation were prepared, and then analytical software, Image-J, was used to extract the shape information from the images.”

The results showed “the maximum and minimum diameters of bubble were 5.3 and 0.4 mm in presence of SCG, as well as 6.7 and 1.25 mm without the surfactant,” the study said.

Roughly “80% bubbles fell into the size range of 0.82 to 2.51 mm for the SCG curve,” and without SCG “the bubbles with diameters of 3.30 to 5.41 mm took up 80%,” it said. The average diameter of bubble was “4.32 mm for SCG-absent group, which was about two times larger than SCG-addition group’s (1.21 mm).”

This means “smaller bubbles dominated after SCG was applied.”

The study concluded “a small amount of SCG (50 g/mt) could improve recovery in low-rank coal flo-

tation, and increase the concentrate yield by about 12% with its ash content roughly unchanged.” There is a point of diminishing returns. “The concentrate yields plateaued at 35% when more SCG was employed, and though a light upswing was found on the corresponding ash contents of concentrate, they were never greater than 10%.”

## Preservative Beats Hydrocarbon Reagents

A study<sup>2</sup> out of Mexico found that 3-phenyl-1-propanol outperformed butylamine, kerosene and diesel as a reagent in flotation of a low-rank coal.

“The volume of collector for optimal Recovery was 84.5  $\mu$ L” per 0.5 g of coal, the study said. “The maximum Clean Coal Recovery was achieved at pH 4; 2.5 min. of flotation time, and 87.9  $\mu$ L of 3-phenyl-1-propanol.”

In the study, “Recovery” refers to any coal-bearing mineral concentrate, and “Clean Coal” recovery references the more-desirable grades of concentrate.

Described as a non-ionic amphiphile, meaning it can be both hydrophilic and lipophilic, 3-phenyl-1-propanol can be found in nature and has historically been used as a preservative in cosmetics due to its antibiotic prop-

<sup>2</sup> Blanco-Flores, Alien, et al. (2021) Coal flotation in a low-rank carbonaceous mineral using 3-phenyl-1-propanol as a collector reagent. DOI: <https://doi.org/10.1016/j.fuel.2021.121363>.

erties. As a reagent in coal flotation, it interacts with both hydrophobic and hydrophilic parts of the coal particle.

It improves recovery by, among other things, modifying the zeta potential, or the ionic characteristics, of the coal particle surface, which helps with bubble attachment.

The study looked at floating “a low-rank carbonaceous mineral obtained from the Sabinas basin in Coahuila, Mexico.” The reagents used “were of ACS grade and were obtained from Sigma ldrich.”

The mineral was thoroughly assessed to determine its characteristics.

X-ray diffraction analysis used a 30-kV D8-Advance X-ray diffractometer. It found that “in general, silicates are predominant, whereas pyrite and sphalerite exhibit low concentrations; the predominant phase is quartz (59.2%), followed by calcite (20.4%) and orthoclase (17.9%),” the study said.

The pH was determined by potentiometry, using a Thermo Scientific electrode. It found “the pH value is slightly basic, which is consistent with the presence of carbonates,” the study said.

The loss on ignition (LOI) was determined by the gravimetric method. The mineral was washed, dried and then heated at high temps for set times. “The LOI was determined at 1,100° C for 4 h.”

A Bernand calcimeter determined the carbonate content of samples.

The mineral was treated with chemicals and then subjected to Fourier Transform Infrared Spectroscopy. “A Thermo Scientific Nicolet iS20 FT-IR spectrometer with an ATR and a spectral resolution of 0.4 cm to 1 was used.” The surface groups were studied. The signals obtained “are commonly identified in low-rank or oxidized coal.”

Zeta potential measurements were taken using a Zetasizer Nano ZS90. A separation process was performed beforehand to remove large particles.

The contact angle of 3-phenyl-1-propanol to graphite, as a hydro-

phobic surface model, was estimated. Water was used as a reference. A Ramé-Hart contact angle instrument was used to compare photographs and measurements. Findings suggested 3-phenyl-1-propanol has “a much lower contact angle, showing a tendency to interact with hydrophobic material.” Yet the angle was “different from zero,” suggesting “the molecule presents a little grade of hydrophilicity.”

The tests to compare the floatability performance of the reagents were performed in a Hallimond tube. A mineral sample was added to the flotation cell and wetted, followed by 100 µL of collector. “The dosage of kerosene and diesel was the same as 3-phenyl-1-propanol,” the study said. “The amine dosage was 10-3 mol/L.”

“The pulp was conditioned for 3 min. at 800 rpm, the cell was then filled with water, and the concentrate was collected during 2 min.; then it was dried and weighed,” the study said. “Experiments were conducted using nitrogen flow rates of 8-20 mL/min. and constant agitation (400 rpm).”

The floatability performance results for the different reagents was compared.

The microflotation tests found that “1-butylamine, kerosene and diesel were not effective for the flotation of coal because the Clean Coal Recovery of each one (53.2%, 46.4% and 44.8%, respectively) is not significantly superior to the value obtained in the natural flotation (48.3%),” the study said.

“However, 3-phenyl-1-propanol allows to recover the 96.4% of the coal in the mineral,” it said.

The molecular structure of 3-phenyl-1-propanol “allows a better interaction with aliphatic carbon chains and aromatic rings on the coal surface,” the study said. “At the same time, the alcoholic hydroxyl group provides hydrophilicity to the molecule, which allows it to interact with the oxidized coal.”

The tests found 3-phenyl-1-propanol modified zeta potential at pH

2, 3, 12 and 13. That “suggests that there is a modification of the mineral surface due to its interaction with the collector.” The suggestion was supported by FT-IR spectra analysis.

Coal flotation parameters were optimized using the Box-Behnken methodology.

It showed “only the flotation time and the dosed volume of collector have a statistically significant effect on Recovery,” the study said. For Clean Coal Recovery, pH and dosed volume had “a statistically significant effect.” Clean Coal Recovery decreased when pH increased.

Thus, while “pH does not exhibit a significant influence on the mineral Recovery,” it “influences significantly the carbon content,” the study said. “The optimal pH for Clean Coal Recovery is an acid value whereas, for the Recovery, it is a basic value.”

The results suggested a point of diminishing returns on float time. “Carbon content in the mineral can be recovered in a certain time, after which no more coal floats and only gangue keeps floating,” the study said. “For this reason, a difference is observed between the optimal times.”

Ultimately, 3-phenyl-1-propanol outperformed the traditional hydrocarbon reagents. “For this type of coals, the use of non-ionic amphiphilic molecules as collectors are more likely to be effective,” the study said.

The low-grade coal originally had negative zeta potential, which was modified by 3-phenyl-1-propanol. General mineral recovery was not significantly affected by pH, but was enhanced by float time and the size of the dose of reagent. Optimal clean coal recovery, however, required a pH of 4, 2.5 minutes flotation, and a slightly bigger dose of 3-phenyl-1-propanol.

One of the study’s authors said the study showed 3-phenyl-1-propanol is a potential collector. “Dosage tests and optimization study in real flotation cells are necessary for practical conclusions, but due to the non-ionic



amphiphilic molecular structure and the frother properties, it is likely that good results in this kind will be obtained,” said Dr. Alien Blanco Flores, professor, mechanical engineering, Tecnológico de Estudios Superiores de Tianguistenco.

The reagent is relatively safe compared to others, making it possibly more attractive to miners targeting sustainable development goals, she

said. “This reagent is less toxic and dangerous than commonly used hydrophobics such as kerosene or diesel,” Blanco Flores said.

“The common use of this substance is as a preservative in cosmetics, so, it is not toxic under a normal exposition; however, for industrial manipulation, we advise to use mask and gloves,” she said. “It is not expensive in comparison with advanced col-

lector reagents for coal that have not performed better than this alcohol.”

Since the study was published, Blanco Flores has explored the viability of other possible advanced reagents, but said she has yet to find one truly competitive with 3-phenyl-1-propanol.

## pH Regulates Float Rate, Recovery

A study<sup>3</sup> by researchers from Turkey and Poland found that the flotation

## COMPACT, TWO-STAGE FLOTATION SOLUTION GIVES RECOVERY RATE OF 75%

By **JESSE MORTON, TECHNICAL WRITER**

In field testing, a pilot-scale StackCell circuit averaged a recovery rate of roughly 75% with less than 7% ash at a residence time of roughly 2 min., Eriez Flotation reported. The results led to the installation of a full circuit with rows of units.

The field testing came after Eriez was tapped to upgrade a customer's flotation circuit. The coal particle size targeted was minus-150 microns, considered a coal slime.

Eriez first launched bench tests, which proved the potential viability of the solution. The solution averaged a 70% combustible recovery with less than 7% ash at a residence time of roughly 90 seconds.

Pilot-scale tests followed, validating the results. Three units in a series were trialed. Testing found that the circuit averaged combustible recovery in the range of 75% at less-than-7% product ash at less than 2 min. residence time, Eriez reported.

The results prompted the installation of two rows of three model SC-70 units, which are predicted to produce the same results.

Eriez said the StackCell is “the key technology” for treating often-rejected fraction, or for by-zero flotation without cyclone classification. “It is designed to handle exceedingly high volumetric flow rates and expedite the rate at which fine coal particles are floated,” said Drew Hobert, director of operations, flotation, Eriez. “The StackCell was created for by-zero coal flotation.”

The two-stage flotation solution “features a tank inside a tank with a one-way isolation of fluid between the tanks,” Hobert said.

“The new bubble-particle contact canister has high-energy dissipation for collection,” he said. “The external tank has low-energy quiescent conditions for froth recovery.”

The solution “increases air bubble concentration using maximum air flow and focused air introduction,” Hobert said. Since it “maximizes particle concentration, maximum hydrophobic species present,” he said. It “increases specific energy input by concentrating energy input, eliminating recirculating pumping, and using energy only for shearing and contacting.”

It offers “column-like performance, plug-flow behavior when in a series, and small cell volume,” Hobert said. It has a

“low profile, but with high surface area, low energy demand, and low capital and operational costs.”

Compared to conventional flotation equipment used for by-zero feedstocks, “the smaller footprint, lower initial capital investment and projected water and energy savings make StackCell a smart business decision,” Hobert said. “StackCell offers several major advantages.”

At the top of the list is the “substantial reduction in total installed cost, including reduced building envelope as well as foundation loads and structural requirements,” he said. “Users also experience both reduced operational expenses and increased brownfield expansion opportunities.”

The solution features a smaller footprint. “Lift-out height is 42% less, diameter is 25% less, row length is 40% less, total envelope and footprint is 52% and 54% less,” Hobert said. “Train mass is 73% less,” he said. “Installed power is 38% less.”

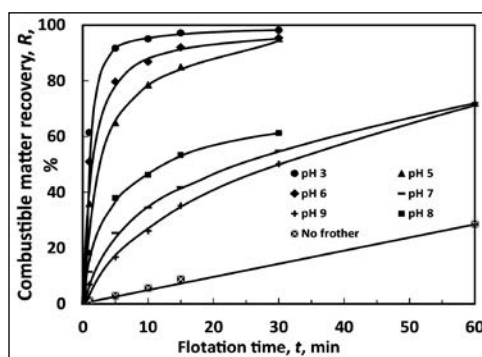
Improving technologies and the potential for rising coal prices prompted the initial development of the solution more than 15 years ago.

“As a result of significant improvements in dewatering technologies, such as solid bowl centrifuges and filter presses, traditionally rejected slimes fractions that possess potentially high economic values,” Hobert said.

The StackCell was originally introduced in 2007. “Based on a complete understanding of flotation fundamentals and field experience, a new flotation cell was developed for fine and ultra-fine material to overcome the inherent limitations of existing technologies,” Hobert said.



StackCell design features a tank within a tank, giving one-way isolation of fluid between tanks and increasing air bubble concentration. (Image: Eriez)



The lower the pH, the greater the recovery, the less float time required. (Image: Ömer Caniren, et al.)

and recovery rate of coal can be regulated by changing the pH in the flotation cell. The study said “pH influences the surface electrical potential of the coal particles, measured as zeta potential, and also coal hydrophobicity, measured as contact angle.”

Flotation rate “is a complex function” of, for the most part, zeta potential and the “flotation equilibrium constant.” Those two parameters and the “reverse process rate constant,” or the rate at which particle-bubbles disintegrate, “can be used for comparison of different flotation systems.”

The study looked at a “naturally hydrophobic coal” from the Zonguldak mine in Turkey. “This coal can be specified as a low-volatile bituminous coal,” the study said. The ash content was 12%.

For the study, numerous sample batches were floated. Each batch, weighing 100 g and made up of “–106 + 38  $\mu\text{m}$  size fraction,” was put in a lab-scale, 1-dm<sup>3</sup> Denver flotation cell with tap water and mixed for 5 min. Acid or sodium hydroxide was added to adjust the pH.

An “Aerofroth 65 (AF65) polyglycol-based frother was added and stirred for 1 min.”

Froth products and tailings were filtered, dried, weighed and then sampled for analysis.

The froth products were analyzed for ash content. From each batch, 10 g of dried sample was ground and burned for hours. The resulting ash was weighed to determine the ash content. “The recovery, as combustible matter, was calculated using the weight of the froth product and feed as well as the ash content of the froth product and feed.”

To determine zeta potential, a sample of each batch was ground in a lab ball mill, and screened through a sieve. The undersize was suspended in “both pure water and frother solutions separately.” The coarse particles settled.

“Then, a small amount of sample was taken from the top of the suspension and transferred to the measurement cell,” the study said. A Zetasizer Nano-ZS gave the zeta potential. “Three measurements for each coal suspension were performed and the average value of the measurements was calculated.”

Contact angles for each sample batch “were measured by the sessile drop method using a Contact Angle Meter,” a CAM-100, the study said. “Measurements were carried out at the different pHs,” but at a constant 80-g/Mg dose of frother.

The findings basically showed how pH significantly influenced the other factors and drove the flotation rate and recovery. That suggests that in equations for determining flotation rate and maximum recovery, the other factors can be lesser variables, the study said.

For example, “the investigated coal was naturally hydrophobic with maximum interpolated contact angle equal to about 72° at pH 4,” the study said. “The contact angle was sensitive to pH and varied between 60° and 72° in the presence of applied frother,” it said. “Frother-only flotation of the investigated coal was pH-dependent.”

When slightly acidic or slightly basic, the float “environment” became

“very unstable,” and recoveries had to be entered as averages, the study said.

The findings showed “the frother does not influence much the values of zeta potential.”

Instead, “the zeta potential data, as a function of pH, can be approximated with an empirical equation” that has been previously published, the study said.

“Much more useful is application of the measured and calculated physical parameters for theoretical kinetic-thermodynamic considerations,” it said. And the applicability is broad, it said.

Previous literature proves the kinetics, equilibrium, and maximum recovery rate of both thermodynamic and fractionated flotation processes are “practically identical” so long as “fractionated flotation is not performed exceptionally long.” Thus, the findings apply to both types of flotation, the study said.

The study found that when pH is the driving parameter, “the equilibrium constant of each test is different” and the Gibbs potential, or standard chemical potential, “is not constant.” The Gibbs potential changes “resulting from changes of pH of the flotation environment.”

Further, in the tests, the recoveries were “regulated with pH leading to changes of hydrophobicities in the air/bubble/particle water system,” it said.

Previous literature suggested “the hydrophobicity of a three-phase system is measured as contact angle.” Contrarily, the study found “hydrophobicity change can be characterized with other parameters; for instance: surface potential, which is the more influential factor in flotations regulated with pH.”

The study said that “it is obvious that the standard state of the particle-bubble aggregates occurs ... at the pH of the solution when the particle/aqueous solution reaches the so-called isoelectric point,” which for the study was 2.75. Reaching the isoelectric point is dependent on pH.

<sup>3</sup> Ömer Caniren, et al. (2021) Evaluation of kinetics and thermodynamics of a naturally hydrophobic coal flotation in the presence of frother and regulated with pH. DOI: <https://doi.org/10.1080/19392699.2021.1964490>.





**New Venue  
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**April 25-27**

**Lexington, KY**



The Coal Preparation Society of America (CPSA) is bringing back the Coal Processing Technology Conference and Exhibition to Lexington, Kentucky. A new venue, the Central Bank Center adjacent to Rupp Arena will house the event. Also new, it will be a joint conference with the Society of Mining Engineers, Central Appalachian Section with parallel technical sessions and more choices.

The majority of our exhibitors along with some new ones will be back on the floor which is nearly 80% booked. Check out the latest floor plan at [www.coalprepsociety.org](http://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 25** is exhibitor setup and features two workshops as part of our technical program (total of 7 Professional Development Hours):

- Pumps 101 - Topics include the fundamentals, selection, what affects performance, wear modes, and the best maintenance practices of slurry pumps.
- Coal Prep 101 - Topics include a review of coal properties important to utilization, coal sizing, cleaning and dewatering operations.

- **Three days of workshops, keynote and technical sessions**
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**Tuesday, April 26**, the conference begins with a keynote address by Joe Craft, President of Alliance Coal. The exhibit hall opens after the keynote and following a quick tour of the exhibit hall, join us for 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. A detailed technical program can also be found at [www.coalprepsociety.org](http://www.coalprepsociety.org)



Our Members Night Out also returns Tuesday evening to the Buffalo Trace Distillery. It will be held in their newly renovated Giants Hall and will feature distillery tours, bourbon tasting, hors d'oeuvres, dinner and Byron Trimble, a very funny comedian to close out the night. Sponsored by Conn-Weld Industries, it is a great networking opportunity so reserve a seat or an entire table but do so soon because this event always sells out and space is limited.



**Wednesday, April 27** there are morning and afternoon technical sessions with a lunch program that will include a few surprises. Our presenters in the technical sessions will talk about advances in coal preparation, slurry impoundments and new technologies in mining and processing among other topics.

Detailed information can be found at [www.coalprepsociety.org](http://www.coalprepsociety.org). You can also register for the conference and exhibition (\$50 which includes lunches and refreshments), book your seat(s) at Members Night Out, sign up to exhibit and/or advertise in our quarterly journal. Should you have any questions, please contact Mel Laurila ([qcinc@aol.com](mailto:qcinc@aol.com)) or Kathryn Dew ([coalprepsociety@gmail.com](mailto:coalprepsociety@gmail.com)).



## **April 25 - Full day of workshops will feature morning and afternoon sessions on:**

Pumps 101 - Topics include the fundamentals, selection, what affects p performance, wear modes, and the best maintenance practices of slurry pumps. Presented by Kenny Don, FLSmidth

Coal Prep 101 - Topics include a review of coal properties important to utilization, coal sizing, cleaning and dewatering operations. Presented by Barb Arnold, Penn State University

## **Advanced Coal Preparation Practices and Technologies (Tuesday, April 26, 2-4 p.m.)**

Title: Omnis Regenerative Energy - Producing High-Value Carbon and Mineral Products and Eliminating the Need for Coal Waste Impoundments

Presenter: Greg Smith, Omnis Global, Dan Yanchak, Consol Energy

Title: Arq Energy Unbound

Presenter: C. K. Lane (Arq)

Title: The Hydrophobic-Hydrophilic Separation (HHS) Process for Ultrafine Coal Recovery

Presenters: C. Sechrist, S. Keles, N. Youmans, K. Huang, A. Noble, and R. H. Yoon, Virginia Tech, J. Reyher and A. Jones, Minerals Refining Company

Title: Manage Moisture to Increase Plant Yield Moisture Benchmarks

Presenters: T. Anthony Toney and Mike Barish, Somerset International Incorporated

## **Design & Operating Practices for Slurry Impoundments (Wednesday, April 27, 9-11a.m.)**

Title: Merits of the Continued Use of Upstream Construction for Slurry Impoundments

Presenters: Andrew Kolbert, Schnabel Engineering

Title: Automation Delivers Safety Benefits for Tailings Facilities

Presenters: Landon Lounsbury and Mike Judd, RCT-Global

Title: Vertical Wick Drains to Accelerate Consolidation of Problem Soils Coal Refuse Disposal Impoundments

Presenters: Mitchell S. Halsey, Schnabel Engineering

Title: Reclaiming Impoundments Using Reinforcing Geosynthetics

Presenters: Santino Piccoli, TenCate Geosynthetics Americas

## **Processing Plant Modifications & Operations (Wednesday, April 27, 2-4 p.m.)**

Title: Fine Coal Cleaning with a Particular Emphasis on Low-Density Separations

Presenters: Peter Bethell and Steve Keim, Marshall Miller & Associates, Gerald Luttrell, Virginia Tech

Title: Expansion of the Leer South Preparation Plant from 600 to 1600 tph

Presenters: John Nielson, Arch Resources

Title: A Case Study for Jet Type Flotation Cells Application in a Coking Coal Preparation Plant Upgrade

Presenters: Zhigang Wang, The Daniels Company, Franklin Addison, Alpha Metallurgical Resources, Jan Wright, Dickenson-Russell Contura LLC

Title: Going Smart: Practices & Perspectives in China's Coal Prep Industry

Presenters: Chao Zhao and Guofeng "Fred" Yang, DADI



## **With the addition of the Society of Mining Engineers, The Technical Program covers topics from Mine to Market**

Abstracts for the technical papers can be found on our web site at:  
[www.coalprepsociety.org](http://www.coalprepsociety.org)



### **EVOLVE- Central Appalachia (Evolve CAPP) Tuesday, April 26, 2022, 2:00 – 4:00 PM**

- Title: Introduction to EVOLVE-Central Appalachia (Evolve-CAPP)  
Presenter: U.S. Department of Energy
- Title: EVOLVE-Central Appalachia (Evolve-CAPP) - Basinal Resource Assessment  
Presenter: Richard Bishop, Professor of Practice, Virginia Center for Coal and Energy Research (VCCER), Virginia Tech
- Title: Extraction and Purification Technologies for Rare Earth Element and Recovery from Coal-Based Sources  
Presenters: Rick Honaker, Department of Mining Engineering, University of Kentucky, Lexington, KY
- Title: Carbon-Based Products  
Presenters: Pending

### **Underground Mine Stability and Dust Control Wednesday, April 27, 2022, 9:00 – 11:00 AM**

- Title: Remote Underground Investigation and Stability Analysis of Historic Underground Limestone Mines  
Presenters: Al Campoli, PhD, PE, Principal Consultant, RESPEC
- Title: Underground Mine Stability/ Blast Analysis and Damage Control  
Presenters: Dave Newman, PhD, PE, President, Appalachian Mining & Engineering, Inc.
- Title: Observed Trends in Geotechnical and Hydrogeological Data for Appalachian Underground Coal Mines  
Presenters: Kevin Andrews, CPG, Vice President/Principal Geologist, Marshall Miller & Associates
- Title: Autonomous Drones for Mapping Inaccessible Underground Mine Areas  
Presenters: Richard Bishop, Professor of Practice, Virginia Tech Mining & Minerals Engineering
- Title: Respirable Coal Mine Dust Source Appointments Based on Thermogravimetric Analysis  
Presenters: Setareh Ghaychi Afrouz, Maria Lizeth Jaramillo Taborda, Cigdem Keles, Emily Sarver  
Virginia Tech Mining & Minerals Engineering

### **Mine Automation and General Topics in Mining Wednesday, April 27, 2022, 2:00 – 4:00 PM**

- Title: Autonomous Roof Bolter Operations Using Robotic Operations  
Presenters: Steve Schafrik, PhD, PE, Associate Professor, University of Kentucky Department of Mining Engineering
- Title: Underground Shuttle Car Automation  
Presenters: Z. Agioutantis, S. Schafrik, J. Sottile, and V. Androulakis, University of Kentucky
- Title: Automated Shuttle Car Docking  
Presenters: Joseph Sottile, PhD, Professor, University of Kentucky
- Title: Mining Litigation  
Presenters: Dana Howard, Member, Stoll Keenon Ogden, PLLC
- Title: Kentucky's Coal Heritage Trail  
Presenters: Steve Gardner, PE, Senior Consultant, Pittman Green, LLC
- Title: Recent Trends in United States Coal Mining Activity  
Presenters: Steve Keim, PhD, PE, President, Marshall Miller & Associates



# Exhibit Hall Floor Plan as of January 24, 2022 80% Sold

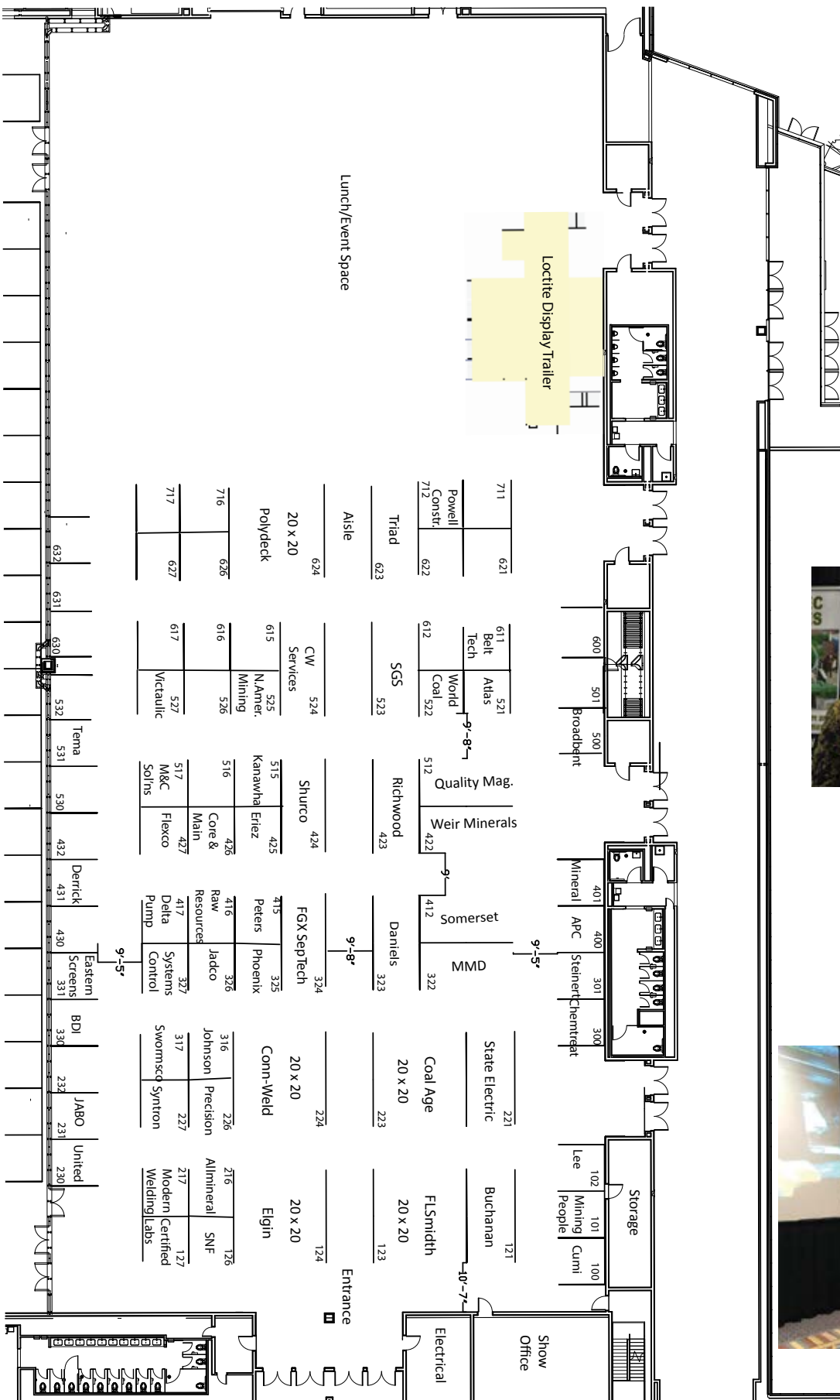


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# COALFIELD TRANSITIONS: CHARAH TO REDEVELOP CHESWICK POWER PLANT

Charah Solutions will acquire the Cheswick Generating Station, the Lefever Ash Landfill and the Monarch Wastewater Treatment Facility from GenOn. It said it will begin environmental remediation and sustainable redevelopment of the Pennsylvania properties upon closing.

The asset purchase agreement with GenOn was signed in December and the full transfer will take place in early April after the Cheswick Generating Station ceases electrical generation operation.

Charah has commenced the redevelopment and remediation planning efforts and will begin physical work after closing. GenOn will continue to maintain responsibility for the plant and operate the plant, the landfill and the wastewater treatment facility in the normal course of business through closing.

The Cheswick Generating Station, a 565-megawatt (MW) coal-fired plant operated by GenOn, located in Springdale, Pennsylvania, near Pittsburgh and along the Allegheny River, is expected to be deactivated on March 31. The 56-acre primary generating station site, along with an adjacent 27-acre parcel, consists of an operating rail line, a coal yard, bottom ash emergency and recycle ponds, waste ponds and a coal pile runoff pond, coal delivery equipment, and an ash handling parcel. Charah will be responsible for the shutdown and decommissioning of the coal power plant, the remediation of the two ash ponds and performing all environmental remediation and redevelopment work at the site.

The 182-acre Lefever Ash Landfill located three miles northwest of the Cheswick power plant is currently operating and provides disposal of coal combustion residuals (CCR) and residual waste from Cheswick under an

active solid waste permit. Charah will be responsible for the closure design, remediation closure work and post closure monitoring of the landfill.

Charah will also be responsible for day-to-day management and operations of the Monarch Wastewater Treatment Facility and for compliance with all applicable environmental regulations.

The company has retained Avison Young to provide real estate advisory, development, and brokerage services to oversee the redevelopment of the property and future sales of the remediated properties.

The existing power plant will be demolished, and potential redevelopment uses for the properties include renewable energy and battery storage options that utilize the existing transmission system, reuse of the switchyard, transportation and logistics that use the river shipping assets, and other potential industrial uses.

This is Charah's fifth major Environmental Risk Transfer (ERT) project and the second major project with GenOn. In July 2021, the company acquired GenOn's Avon Lake Generating Station and adjacent property, with the full transfer expected to occur in the first half of 2022. Charah said its ERT services model delivers compelling value to utility partners, shareholders, local communities and the environment.

"Our ERT services are innovative and sustainable solutions designed to meet the evolving and increasingly complex needs of our utility partners to lower their costs and meet their environmental commitments," Charah Solutions President and CEO Scott Sewell said. "Many utilities are experiencing an increased need to retire and decommission older or less economically viable generating assets while minimizing costs and maximizing the



Charah Solutions will acquire and decommission the Cheswick power plant, located near Pittsburgh, Pennsylvania.

value of the assets and improving the environment. The Cheswick project is another example of Charah Solutions providing a custom approach for these complex projects while sustainably remediating the site and redeveloping the properties in an environmentally responsible manner designed to create economic and environmental benefits for the entire community."

In related news, Charah recently sold 80% of the real property acreage at the former Gibbons Creek power plant in Texas and expects to sell the remaining 20% in 2022.

A local investor group has purchased and closed on 4,860 acres of the 6,166-acre area, including the 3,500-acre reservoir, dam and spillway with the intent of future residential development. Terms of the transaction were not disclosed.

Charah sold the property in 10 months. In October 2021, the company completed the implosion of the retired coal-fired power plant as part of the shutdown and decommissioning process. Environmental remediation work for the existing ash ponds and landfills is under way and ahead of schedule and is expected to continue through 2023.

# CAT TO OFFER COMPONENTS AND WEAR PART LIFECYCLE AGREEMENTS THROUGH DEALERS

In 2019, Caterpillar announced customer value agreements or CVAs, a portfolio of innovative, flexible solutions that help maximize the value of a Caterpillar equipment investment. Through partnerships with its worldwide dealer network, Caterpillar Resource Industries said it is now expanding these service offerings to “deliver convenience, assurance and expertise while sustaining an exceptional customer experience throughout the equipment lifecycle.” CVAs represent a shift in focus to outcome-based value-added services, where customers can engage in multiyear agreements with their Cat dealer, manage their risk, and run a more optimized operation.

Cat CVAs for mining are dealer-to-customer service agreements on new or running equipment, guided by a common framework and value promises. They offer a range of support, performed by the dealer or customer, such as Vendor Managed Inventory, Cost-Per-Hour (CPH) and Cost-Per-Ton type payment structure options.

The CVA frameworks are developed to address customer interest in solutions beyond the iron that reduce risk, increase convenience on site, streamline operations, maximize uptime and reduce effort in ordering parts. CVAs can be tailored to accommodate many operations, geographical challenges and customer segments.

CVA frameworks successfully introduced in 2020-2021 are:

- Maintenance for Mining CVA (global) – deliver the right parts at the right time, kitted for each maintenance interval, lowering total cost of ownership by optimizing drain intervals;
- Hydraulic Hose and Coupling CVA (global) – for Cat or Mixed fleets – inventory management, trained

dealer expertise, controlled costs with pay-per-use option;

- Powertrain Guarantee CVA (launched in Australia, Europe, Indonesia and North America) – protection and assurance on load and haul machines, beyond the standard warranty and pay-per-use option;
- Undercarriage CVA (global) – zero upfront costs, CPH options and scalable coverage from parts up to repairs and rebuilds on large track-type tractors;
- Ground Engaging Tools (GET)/ Buckets CVA – complete coverage of GET needs, best match for customer operation, on-site delivery, inventory management and assurance programs.

Cat said customers globally are already benefiting from the CVAs on their equipment by using Cat parts (up to 50% longer component life with Cat filters), risk sharing guarantees (pay for the life achieved by the major components), flexible payment structures (allowing conversion of CapX to OpX), and predictive analytics through condition monitoring services.

“With more than 34,000 active CVAs registered (and growing) on Resource Industries equipment, we believe customers are finding significant value from these solutions,” said Marc Cameron, vice president of Resource Industries Sales, Services and Technology division. “A Cat CVA allows the customer to sign up for one or more of a holistic suite of value-added services in a way never seen or experienced before. Components are lasting longer, consumption of wear parts is lower, repairs and rebuilds are more predictable.”

Commercially available through Cat dealers today, Cat CVAs will continue to expand and evolve to be compelling service agreements po-

sitioned to meet customer needs throughout the machine lifecycle.

## Hy-Tech Acquires Jackson Gear

Hy-Tech Engineered Solutions and Power Transmission Group (PTG) recently acquired the Jackson Gear Co., which specializes in the engineering, manufacture and sales of larger gears and shafts. Hy-Tech expects this addition will more than double PTG’s capacity in overall production, as it broadens existing product lines, deepens engineering expertise and improves lead times.

“The ability to provide gears and spur gears up to 72-in. maximum pitch diameter will be a huge benefit,” Hy-Tech President Doug Ciabotti said. “Aside from the advantages this brings to new and existing customers in terms of larger gear product availability and additional gear and shaft design engineering know-how, customers can expect it to help address issues of cost and supply chain problems across the board.

From gear rating assistance to comprehensive CAD and CAM programs for engineering new or modifying existing products, Jackson Gear brings more than 80 years of manufacturing experience to the Hy-Tech family of companies. Specifically, in product lines including worm gears, sprockets, bevel gears, internal gears, spur gears, heli-



With the acquisition of Jackson Gear, Hy-Tech now has the ability to supply mines with larger gear products.



cal gears, worm shafts, pinion shafts, helical shafts and spline shafts. Using KISSsoft gear design software, PTG has become a leader in both reverse engineering existing gears and in the design and development of complex new gear and transmission systems.

"We have expanded our abilities to address complex gearing challenges, which have traditionally been difficult to design and manufacture," said Patrick Curry, vice president and general manager of PTG. "Combined with even larger, dedicated production capacity for rush and breakdown requirements, as well as 'one-off' special orders, the Jackson acquisition further cements our reputation as the go-to provider of complete gear solutions."

### Olympus Provides Hands-on NDT Instruction to Engineering Students

Olympus recently donated OmniScan flaw detection equipment to LeTourneau University to support the next

generation of nondestructive testing (NDT) inspectors. Olympus phased array ultrasonic testing (PAUT) specialists Curtis Dickinson and Rob Frashefski traveled to the campus in Longview, Texas, to offer students in-person instruction.

The class they visited, Nondestructive Evaluation and Testing, is a senior level course that teaches engineering students the theory and practice of NDT methods. Using the OmniScan equipment to demonstrate, the Olympus experts discussed PAUT theory and practice with the students in the welding/materials joining engineering program. "It was a great experience getting to learn about ultrasonic phased array and how to maximize the use of the equipment in our studies," said Amber Van Duyn, welding engineering junior.

LeTourneau University teaches rigorous engineering through an immersive, hands-on learning approach.



Olympus application specialist Curtis Dickinson (center) instructs students Miguel Gonzalez (left) and Amber Van Duyn (right) on proper inspection methods with phased array ultrasonic inspection technology.

The Department of Welding/Materials Joining Engineering is part of the ABET-accredited bachelor of science in engineering and bachelor of science in engineering technology degree programs and offers concentrations in materials joining engineering.



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# BATTERY-POWERED SCOOPS OFFER LONGER TIME BETWEEN CHARGES



Scoops are true utility workhorses for underground coal operations. They handle multiple tasks, including maintenance, resupply, cleanup and rock dusting. To help get the job done, the redesigned battery-powered Joy 02ESV scoops offer excellent operator comfort and robust time between charges.

OptiDrive technology was developed specifically for these next-generation 240-volt machines, and Komatsu said it expects it to improve reliability, boost operator productivity, improve motor performance and help reduce maintenance costs. OptiDrive is easier to maintain and troubleshoot because it has fewer cable runs.

Designed to help minimize downtime, these scoops have new electronics that eliminate switches, and the color display provides real-time operational and fault information to keep operators informed. Additional drive input modules allow the OptiDrive control system to interface with third-party proximity detection systems.

The Model 02ESV36 has a recommended seam height of 36 in. to 63 in. (91 to 160 cm), a 120-ft<sup>3</sup> (3 m<sup>3</sup>) bucket, and a maximum payload of 20 tons (18 metric tons). The Model 02ESV56 has a recommended seam height of 56 in. to 83 in. (142 to 211 cm) a 140-ft<sup>3</sup> (4 m<sup>3</sup>) bucket and a 30.4-ton (27.5 mt) maximum payload. The Model 02ESV60 has a recommended seam height of 56 to 83 in. (142 to 211 cm), a 165-ft<sup>3</sup> (5 m<sup>3</sup>) bucket and a 31.5-ton (28.7 mt) maximum payload.

With less heat and noise compared to diesel power, the 240-volt battery power contributes to improved working conditions. These three Joy scoops also have improved motor efficiency for increased motor life and enhanced tramming, while improved ergonomics help keep operators more comfortable.

To provide increased power and reduced downtime in the most demanding applications, the scoops are equipped with robust Dana drive axles configured specifically for the application.

For durability and longevity, the center section has been redesigned and includes heavy-duty pivot bearings and pins. The frame is rigorously engineered for reliability and transporting heavy payloads.

[komatsu.com](http://komatsu.com)

## Environmentally Friendly Hydraulic Fluid

Bio-Ultimax 1000 is a readily biodegradable biosynthetic formula, which performs like mineral oil-based hydraulic fluids, but are environmentally friendly. With oxidation performance comparable to full synthetics, this is one of the safest hydraulic fluids for the environment, according to the manufacturer, Renewable Lubricants. Ideal for stationary or mobile environments, Bio-Ultimax super high Viscosity Index (VI) fluids are proven in systems up to 10,000 psi and in systems with ultra-fine filtration.

To ensure performance and long life, Renewable Lubricants developed the stringent IsoGreen filtration standard, which meets or exceeds the Rexroth pump guidelines for hydraulic fluids. Non-toxic, zinc-free formulations contain no heavy metals. In addition to enhancing performance, Bio-Ultimax helps companies achieve their sustainability goals. They are ideal for use in all types of hydraulic systems including trash compactors, waste and recycling collection vehicles, hydraulic pumps, pile driving equipment and more.

With a higher VI than synthetics, Bio-Ultimax 1000 has improved thermal shear stability and increased load capacity. Their extremely low volatility increases the flash and fire safety features, making them safer to use. A direct replacement for mineral oil-based hydraulic fluids, Bio-Ultimax is ideal for hydraulic systems where low toxicity, biodegradability, and non-bioaccumulation properties are required.

These patented bio-based hydraulic fluids are formulated to perform in high- and low-pressure hydraulic systems that require Anti-Wear (AW), anti-rust, anti-oxidation, anti-foam and demulsibility properties. With patented antioxidants, these biosynthetics provide improved performance in oxidation stability over standard plant/vegetable/HETG and unsaturat-



ed HEES type fluids. They are highly inhibited against moisture and rusting in both fresh and sea water, and pass A and B sequences of the ASTM D-665 Turbine Oil Rust Test. Formulated to provide a longer seal life with reduced oil leakage, this environmentally friendly, zinc-free product meets or exceeds high-pressure pump requirements.

Very little wear was encountered in field studies and in accelerated pump tests using bio-based formulations pump stand tests and pressures and temperatures ranging from 2,000 to 3,000 psi and from 150°F to 210°F.

[www.RenewableLube.com](http://www.RenewableLube.com)

### Industrial Controls

c3controls recently launched an upgraded line of IEC Pilot Devices, with the new Series GT directly replacing the 22-mm IEC Pilot Devices-Series B products. The IEC pilot device line features pilot lights, push buttons, selector switches and E-Stops, with a wide range of variations and options available within each product group. All new Series GT products are completely cross-compatible with the discontinued Series B products, all while keeping the same mounting and assembly dimensions and specifications, as well as part numbers and list prices.

The design enhancements include a more robust operator bracket, a new 4X chrome-plated bezel option, modernized aesthetics, increased color vibrancy on push button caps, and reinforced internal components on all selector switches. These pilot devices are used in a wide range of industrial application for equipment or machinery that is controlled electrically.

"The new IEC pilot devices provide premium performance without the premium price," said Aaron Venness, c3 product engineer. "We listened to feedback from customers, and made both aesthetic and performance enhancements that provide machine builders and end users world-class products built with the ultimate in craftsmanship."







The one-piece bracket design offers a more secure contact-block-to-operator connection, simplifying installation and providing end users fur-

ther confidence that the devices are built to last. As an option to the standard polyester bezel, the chrome-plated bezel provides the durability and corrosive resistance needed for Type 4X applications, including those outdoors and in harsh environments. The modernized aesthetics and increased color vibrancy match the appearance of today's modern equipment, and a smoothened profile increases space to more flexibly customize product markings on the push button operators.

[www.c3controls.com/samples](http://www.c3controls.com/samples)

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## Battery-powered HVAC System for Haul Trucks

The iON-DRIVE is a roof-mounted DC HVAC system with a built-in lithium-ion battery bank. The battery-powered HVAC system allows the trucks main engine to shut off at idle while keeping the cab cool, reducing unnecessary idle time. With its purpose built, mine spec steel assembly coupled with the highly efficient large face evaporator, the iON-DRIVE sets the standard for rooftop air conditioning systems in tough work environments.

The iON-DRIVE has the capacity to run the HVAC system continuously for up to 30 minutes. The iON-DRIVE's built-in lithium-ion battery is charged by the haul truck's main battery bank, via DC-to-DC charging interface.

Installation of the system on the cabin roof is simple. Connecting only two cables to the truck's battery bank



enables straightforward installation with minimal impact on the asset. The iON-DRIVE is most suited to haulage cycles with short idle times, allowing for sufficient battery charging from the truck's main engine.

"The iON-DRIVE provides a simple and unique anti-idle solution for haul truck fleets with lower idle times," Remote Energy Director Chris Baumann said. "With the continued

push to find ways to operate more efficiently and reduce emissions, the iON-DRIVE is one solution that is available today, to reduce unnecessary fuel burn at idle. With the addition of the iON-DRIVE to our range of anti-idle solutions, we now have a solution for each unique application and can provide idle reduction for various haul cycle scenarios."

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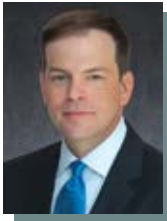
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# OIG's Audit of MSHA Enforcement Is a Mess

BY BRIAN HENDRIX



Audits aren't fun for anyone. Most of the time, the Mine Safety and Health Administration (MSHA) is basically the auditor. Last year, the Department of Labor's Office of Inspector General (OIG) audited MSHA to determine if MSHA properly managed the "process [MSHA] used to issue, terminate, modify and vacate violations." Everyone would benefit from an audit aimed at objectively answering that question and executed by individuals who understand the agency and the industry. Unfortunately, that's not how I'd describe this audit, and it's not how MSHA described it.

The OIG "analyzed more than 736,000 violations" issued between January 1, 2013, and September 30, 2019," reviewed inspection reports, and reviewed supervisory reports from six districts that [OIG] judgmentally selected." It also "interviewed MSHA headquarters, district, and field office personnel to learn the violations process" and "interviewed a representative from the United Steel Workers, United Mine Workers of America Union, and the Solicitor's Office within the Department of Labor."

According to the OIG, MSHA did not properly manage the violation process it used to issue, terminate, modify and vacate violations because of significant weaknesses in MSHA's violations process. The process weaknesses included untimely verifications that operators corrected hazards by due dates, due dates set longer than necessary and unjustified extensions of those due dates, violations with errors, unclear justifications for vacating violations, and supervisory reports that were incomplete or inaccurate. These issues were mainly due to MSHA's insufficient

oversight and missing or improperly designed system controls.

The OIG found that nearly a third were not terminated by the "required due date." According to the OIG, "[violation abatement due dates were longer than necessary and varied widely, and extensions were unjustified." The OIG also said MSHA did not issue "104(b) orders in a consistent or timely manner."

The OIG also faulted MSHA for its failure to properly explain why it vacated citations. The OIG reviewed 12,278 "vacated violations" among the 736,000 "violations" studied and found that "more than 20% had either vague reasons listed or no reasons listed at all. Examples included: 'issued in error,' 'after further review, this citation is vacated,' 'after further review it was determined that a citation was not justified,' and 'upon further review it has been determined that this is not a violation.'"

The OIG also found that "[t]housands of violations written by MSHA inspectors did not comply with the Mine Act and MSHA Handbook requirements."

MSHA didn't exactly agree with the OIG's findings. The OIG noted that "MSHA expressed concerns about the balance and tone of the report and the fact that we did not give it credit for improvements resulting from organizational changes it made toward the end of our scope period."

MSHA did agree with some of the recommendations, and acknowledged that its inspectors may benefit from additional training and more effective supervision. However, MSHA said OIG failed to understand a couple of basic, but critical concepts.

Mine operators must abate (correct or fix) every alleged violation cited by MSHA within a reasonable time, and the issuing inspector decides what's reasonable. If the alleged vio-

lation isn't abated within the time set by the issuing inspector, the inspector must issue an "order of withdrawal." When an operator abates an alleged violation, MSHA terminates it. That's all "MSHA 101" or "basic MSHA."

Unfortunately, it seems the OIG did not understand the difference between abatement and termination.

MSHA explained that "once a hazard has been identified, it is the operator's responsibility to abate the hazard, and if this cannot be done immediately, the operator will danger off the hazardous areas. . . [I]t may take additional time for MSHA inspectors to physically return to the mine and terminate the citation. In such a circumstance, the mine operator would danger off the area to assure miners are not exposed. The OIG's conclusion that citations that have 'overdue' (extended) due dates means the hazards have been unabated, thereby exposing miners to hazards longer than necessary, or putting the safety of miners in jeopardy is incorrect."

In short, "MSHA disagree[d] with the OIG's use of 'abate' and 'terminate' as synonyms in this report and disagrees with the OIG's conclusions."

Why does this matter? Even though MSHA rightfully disagreed with a lot of what the OIG said, MSHA has and will continue to listen to the OIG. MSHA has and will pay closer attention to the time set by inspectors for abatement, to abatement deadlines and to terminations. Inspector may be quicker to issue 104(b) orders. To avoid that, operators should continue to engage with inspectors about the time needed to abate alleged violations, keep a close eye on abatement deadlines, and request extensions before those deadlines pass.

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