

Coal Age[®]

The Magazine for Coal Mining and Processing Professionals

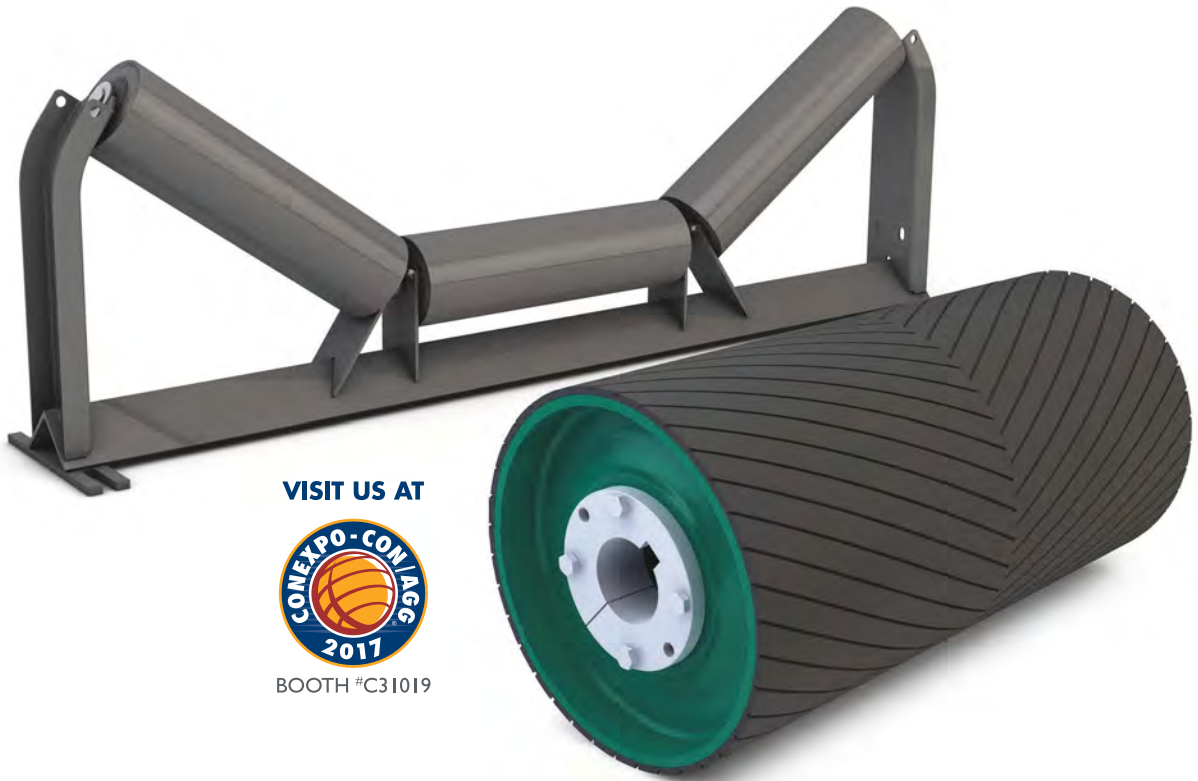
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Coal Age

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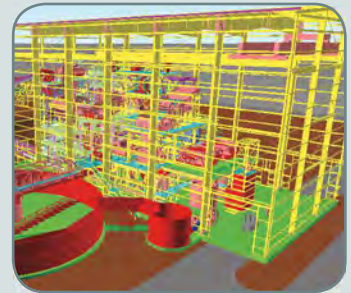
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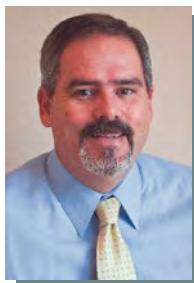
THIS ISSUE

This month, Coal Age takes an in-depth look at advances in coal power generation. On the cover, Mississippi Power's 582-MW Kemper County Energy Facility, America's newest coal power plant, champions both an integrated gasifier system that converts coal into syngas and a marketable slag, and carbon capture technology that traps CO₂ for enhanced oil recovery. Sited next to a coal mine, it is at once the largest of its kind in the world, an undeniable engineering coup to advocates, and a fountainhead of ire to critics. (Photo courtesy of Mississippi Power)

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RELIABLE POWER FROM COAL



BY STEVE FISCOR
PUBLISHER &
EDITOR-IN-CHIEF

The first question that I get from people who know my proud affiliation with coal is: Do you really think Trump can save the coal miners? Until recently, my answer was the same as it was prior to the election: "No. Trump alone can't save the coal business, but the opposing party said it would kill it." After seeing what's happening with job growth, however, my feelings have changed.

Obviously, with large quantities of low-cost gas, the gas and coal markets will remain soft for the next few years. If Trump follows through on plans to grow domestic production to make America energy self-sufficient, bringing more gas onto the market will not help the situation. In all likelihood, coal and gas will hold onto their one-third size slices of the electricity generating pie. But, what if the pie grew? The Energy Information Administration (EIA) reported that net power generation in the United States during December (the latest numbers available) increased 6.4% from the previous December. This occurred while the entire country experienced average temperatures. December 2015 was the warmest December on record, so a return to normal shows improvement.

The other surprising stat from the EIA is that electricity generation from coal increased in all regions of the country compared to the previous year, while natural gas generation decreased in all parts of the country, except for the Northeast. This increase in coal generation with a subsequent decrease in natural gas generation is mainly attributed to an increase in natural gas prices that occurred in December 2016. A slight increase in gas prices had a significant impact on the coal burned during December.

The U.S. Bureau of Labor Statistics reported that nonfarm payroll employment increased by 235,000 in February. The employment gains occurred in construction, private educational services, manufacturing, health care and mining. Yes, you read that correctly, "mining." Manufacturing added 28,000 jobs in February. Over the past three months, manufacturing has added 57,000 jobs. Employment in mining increased by 8,000 in February, with most of the gain occurring in support activities for mining (+6,000). Mining employment has risen by 20,000 since reaching a recent low in October 2016.

While we are all excited to see the increase in mining-related jobs, it's the increases in manufacturing jobs that we need to watch. As we have demonstrated many times in *Coal Age*, the weather has a marginal impact on base-load electricity demand compared to the demand from industrial and manufacturing facilities running around the clock. Those factories in Indiana and Michigan run on electricity. If the Trump administration could double or triple the jobs in the manufacturing sector by luring business back to the U.S., with tax incentives or shaming Tweets, the size of the energy pie will grow.

A growing energy pie bodes well for coal. Electrical power from coal is clean and reliable. The coal industry will not need to take land for pipelines to satisfy increasing demand. The transportation and distribution network is already in place. Restarting it creates more jobs, too. So, yes, the Trump administration could save the coal businesses and a lot of other businesses by repatriating jobs to the U.S.

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EIA: COAL PRODUCTION TO INCREASE IN 2017

Coal production in the United States is expected to increase slightly in both 2017 and 2018, reversing recent declines, primarily because of rising natural gas prices, according to a new report by the U.S. Energy Information Administration (EIA).

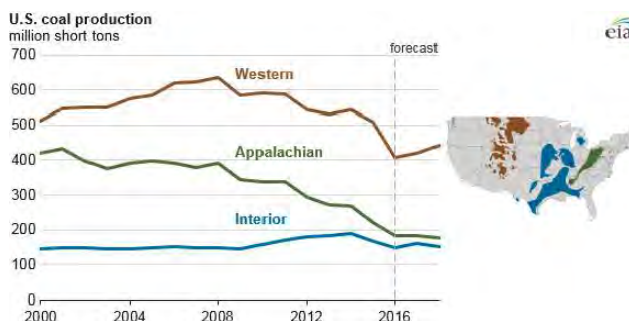
The federal agency's short-term energy outlook, issued in early February, said coal output in the nation totaled 739 million tons in 2016, an 18% decline from 2015 and the lowest level of coal production since 1978. Nowhere was this decrease more pronounced than in Kentucky, once the leading coal producer in the U.S. Kentucky's coalfields are located in both the high-sulfur Illinois Basin (ILB) in western Kentucky and Central Appalachia in eastern Kentucky. The 42.6 million tons of coal mined in the commonwealth last year was its lowest yearly total since 1939.

As the EIA noted, the vast majority of coal produced in the U.S. is used to generate electricity, with smaller amounts of metallurgical coal marketed domestically and overseas for steel production. As a result, coal production and coal-fired electricity generation are closely connected. In recent years, coal production has been hurt by utilities switching from coal to gas to take advantage of historically low natural gas prices. But with average gas prices forecast to climb well past \$3/MMBtu over the next two years, "coal is expected to regain some of the electricity generation mix, and coal production is expected to increase slightly," said the EIA.

Largely because of the anticipated increase in gas prices, "the use of natural gas-fired generators is expected to decline slightly in 2017," the EIA said. "However, new natural gas power plants are currently being built, and by 2018, the availability of these units may lead to increases in natural gas-fired generation."

As many as 12 new gas plants are under development or construction in Ohio, a state that traditionally has relied heavily on coal-fired generation. Any gains in national coal production are not expected to be uniform by region. For instance, the EIA said coal production should increase in the western U.S., going from 407 million short tons (st) in 2016 to 443 million st in 2018, but remain relatively flat in Central and Northern Appalachia and the nation's interior, consisting mainly of the ILB.

In the Appalachian region, where 183 million st was produced in 2016, this year's output is expected to fall slightly to 177 mil-



The EIA sees western U.S. coal production growing by 36 million tons by 2018.

lion st. Interior coal production, meanwhile, is forecast to increase from 150 million st in 2016 to 152 million st in 2018.

The EIA added that although the relative prices of coal and natural gas are important in determining fuel use, generation trends for these fuels also are affected by changes in generation from other sources, including renewable resources such as wind, solar and hydro, as well as by total electricity demand, which can be significantly affected by both weather and economic factors.

Some early signs already are pointing to a potential increase in electricity demand and production in 2017. Ohio-based American Electric Power Co., one of the nation's largest electric utilities, said its regulated coal-burning power plants are expected to consume about 33 million tons in 2017, up from 30 million tons last year.

CNX Coal Resources said in a February regulatory filing that it expects to produce a bit more steam coal this year and in 2018, approximately 26 million tons, higher than the 24.7 million tons its three longwall mines in Pennsylvania — Bailey, Enlow Fork and Harvey — turned out in 2016.

Alliance Resource Partners, the largest steam coal producer in the ILB, is targeting about 3 million tons of additional production in 2017 over the 35.2 million tons it produced in 2016.

Peabody Energy Announces Closing of \$1B Offering

In mid-February, Peabody Energy closed its previously announced private offering of \$1 billion aggregate principal amount of senior



BREAKING NEWS

American Resources Commences Production at Carnegie Mine

American Resources Corp., through its wholly owned subsidiary Quest Energy Inc., has commenced production at its Carnegie mine in Pike County, Kentucky. The Carnegie mine will extract coal from the Alma seam, which is ranked as a high-volatile A/B metallurgical coal.

The Carnegie mine is the first of the company's series of mines in the Alma seam that it anticipates bringing into production during 2017. The company forecasts its production costs at the mine to be below \$56/ton and will be shipped by rail from the company's McCoy Elkhorn Bevins Branch complex.

"We are excited to begin production at the first in a series of Alma seam mines in the area," said Tom Sauve, president of American Resources Corp. "I applaud our team for coming in under budget on the development of the mine and achieving a very expedited timeframe to get on production. This mine offers us the ability to create blends with our other metallurgical production at our McCoy Elkhorn facility and offer our customers a very attractive high vol metallurgical product at a time when high vol coal is in demand." American Resources is engaged in diversified energy services including mining, processing and logistics.

TOP 10 COAL-PRODUCING STATES

(in Thousand Short Tons)
Week Ending (2/25/17)

	YTD '17	YTD '16	% Change
Wyoming	48,600	41,709	16.5
West Virginia	14,629	12,282	19.1
Texas	8,734	6,324	38.1
Pennsylvania	8,239	6,589	25.0
Illinois	8,097	7,220	12.1
Kentucky	7,337	7,235	1.4
North Dakota	5,820	4,579	26.6
Indiana	5,325	4,607	15.6
Montana	5,089	4,737	7.4
Utah	2,809	2,144	31.0
U.S. Total	128,306	110,338	16.3

secured notes, consisting of \$500 million of 6% senior secured notes due in 2022 and \$500 million of 6.375% senior secured notes due in 2025. The net proceeds of the offering have been funded into an escrow account pending Peabody's emergence from bankruptcy.

The notes were issued by a special purpose wholly owned subsidiary of Peabody in connection with the restructuring of Peabody as part of its reorganization plan filed with the U.S. Bankruptcy Court for the Eastern District of Missouri on January 27. If Peabody's plan of reorganization is confirmed and certain other conditions are satisfied on or before August 1, the net proceeds from the offering will be released from escrow to fund a portion of the distributions to creditors provided for under the plan of reorganization, and Peabody will become the obligor under the notes. Following Peabody's emergence from bankruptcy, the notes will be jointly and severally, and fully and unconditionally, guaranteed on a senior secured basis by substantially all of Peabody's current and future direct or indirect U.S. subsidiaries (subject to certain exceptions).

North American Expects Improvements in 2017

In its most recent quarterly earnings statement, North American Coal said it expects to see a significant increase in tons sold in 2017. This improvement in coal sales stems from the start of production at Bisti Fuels in early January and to a full year of production at the Coyote Creek mine.

Bisti Fuels is expected to deliver approximately 5 to 6 million tons per year (tpy) of coal when the power plant is operating at anticipated levels. Coyote Creek expects to deliver between 2 million to 2.5 million tons of coal annually when its power plants are operating at anticipated levels.

In July 2016, Liberty Fuels began delivering coal to its customer for facility testing and commissioning. Production levels at Liberty Fuels are expected to increase gradually and to build to full production of approximately 4.5 million tpy of coal beginning in 2023, although the pace of future deliveries will be affected by the timing of the Kemper County Energy Facility reaching full operating capacity.

Income before income taxes is also expected to benefit moderately from fewer expenses related to the Otter Creek reserves and a lower, more moderate, operating loss at Centennial as the company manages ongoing mine reclamation obligations.

WORLD NEWS

Drummond Posts Record Year in Coal Exports

With a 10% increase in production and a 16% increase in exports as compared to 2015, reaching 28.4 million and 32.6 million tons, respectively, Drummond Ltd. ended 2016 with record numbers. The company cited its investment in state-of-the-art technology at its operations in Colombia, generating operational efficiencies at its mines and the port, and developing initiatives aimed at mitigating its environmental impact as well promoting "exemplary compensation projects."

"In a complex international market and with the challenges presented by the local economic environment, it is very gratifying for the company to show record numbers for its exports and to have Colombian coal reach 24 countries in 2016," said José Miguel Linares, president of Drummond Ltd. "This achievement reaffirms our commitment to sustainable, properly performed mining."

Other Drummond Ltd. milestones in 2016 include the signing of collective bargaining agreements with four union organizations: Sintramienergética, Sintradrummond, Agretritrenes and Sintramneros. These agreements included improvements in wage conditions and labor benefits for a three-year term.

"On social matters, we reaffirmed our commitment to supporting the peace process and, among other initiatives as part of our work to support our neighboring communities and promote human rights, we signed an agreement with the DPS to develop projects focused on the fight against extreme poverty," Linares said. "Drummond Ltd. will continue to work in 2017 to maintain its production ... and move forward in developing initiatives that are aligned with its corporate social responsibility policy, for the benefit of the country and its people."

Conuma to Restart Willow Creek in Canada

Encouraged by its early success in reopening two British Columbia metallurgical/PCI coal mines acquired from bankrupt Walter Canada last year, Conuma Coal Resources Ltd. is preparing to restart a third mine, Willow Creek, in July, a move that could boost the company's 2017 output to approximately 4 million tons in the western Canadian province. Conuma, a subsidiary of West Virginia-based ERP Compliant Fuels, resumed surface mining at the Brule mine in the Tumbler Ridge area of British Columbia soon after Brule, along with the Wolverine and Willow Creek surface mines, were acquired from Walter in September 2016.

Mark Bartkoski, Conuma's president, said in February that the company is pleased with results so far from Brule and Wolverine, which also resumed producing coal late last year. In particular, he praised the productivity at Brule and Wolverine. Brule and Wolverine are targeted to produce about 2.4 million and 1.3 million tons of coal, respectively, in 2017.

Conuma always had planned to restart Willow Creek, which has higher production costs, after Brule and Wolverine were back in operation. If Willow Creek resumes production in July as planned, it most likely would turn out about 300,000 tons in the latter half of this year, on its way to an annual run rate of approximately 700,000 tons starting in 2018.

Reopening the three former Walter mines has led to a welcomed resurgence in the local economy. Conuma expects to have about 460 full-time employees by early May and almost 700 once Willow Creek is up and running at capacity. Bartkoski said his company is not interested in reopening a mine for a short period of time, but is attempting to construct operations so they can withstand the traditional up-and-down nature of coal markets without having to

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lay off employees. The company is shipping coal through the Ridley Terminal in Prince Rupert, British Columbia, to Asian markets.

Chinese Miners Benefit From Improving Coal Prices

Some listed coal companies in Shanxi province, the country's largest coal production base, expect to see profits grow, thanks to rising coal prices resulting from the nationwide capacity reduction campaign, according to *China Daily*. Shanxi Lu'an Environmental Energy Development Co. Ltd. said in a public filing that it expected to make a net profit between 680 million yuan (\$99 million) and 950 million yuan last year, up from 103 million yuan in 2015. Lu'an said the earnings hike was due to sharply rising coal prices in the second half of last year.

Likewise, Shanxi Xishan Coal and Electricity Power Co. Ltd. estimated that its profit would hit 367 million-437 million yuan last year, up 160% to 210% on a year-on-year basis. Yang Quan Coal Industry (Group) Co. Ltd. estimated its profit would rise more than threefold year-on-year.

The National Energy Administration earlier set a goal to cut 50 million metric tons (mt) of coal capacity in 2017, down by 80% on the 2016 target of 250 million mt. According to the China National Coal Association, the combined profits of coal companies, with government subsidies, amounted to 32 billion yuan, up 363% year-on-year. China has set goals to cut 800 million mt of coal capacity by 2020. Last year, China's output of coal decreased by 11.2% year-on-year to 2.3 billion mt.

Cambodia Orders New Coal-fired Power Plant

Toshiba Plant Systems and Services Corp. (TPSC) landed a contract to construct a 150-megawatt coal-fired power plant in Preah Sihanouk province, which would be Cambodia's third coal-fired power plant. TPSC will build the turnkey power plant for Cambodian Energy II Co. Ltd. (CEL2). Construction should be completed by late 2019.

Poland to Reduce Coal Output

The Polish government wants to reduce coal output to 65 million metric tons (mt) from a little more than 70 million mt in 2016, the *Warsaw Voice* reported. The Polish Energy Ministry also said it is working on a program to improve the coal sector through 2030.

China Bans North Korean Coal Imports

In a bid to comply with the United Nations Security Council resolution that China participated in drafting in November last year, the country has now decided to ban all coal imports from North Korea, according to the *Malaysia Sun*. China's decision also comes in light of the recent missile test conducted by North Korea. The country announced the decision in a public notice that was issued by China's Ministry of Commerce, along with the country's customs agency.

Russia, Iran Begin Building Large Power Plant

Russia and Iran have begun the construction of a 1.4-gigawatt (GW) coal-fired power plant in Bandar Abbas in southern Iran, according to *Iran Daily*, citing Sputnik. The Russian company Technopromexport and an Iranian holding company signed an agreement on the construction of a thermal power plant in Iran with \$1.27 billion funded by Russia. The Russians will also improve the ef-

Continued on p. 7...

Centennial will continue to evaluate strategies to maximize cash flow, including through the sale of mineral reserves and equipment. The company is evaluating a range of strategies for its Alabama mineral reserves, including holding reserves with substantial unmined coal tons for sale or contract mining when conditions in Alabama and global coal markets improve. Cash expenditures related to mine reclamation will continue until reclamation is complete, or ownership of, or responsibility for, the mines is transferred.

North American Coal expects to continue its efforts to develop new mining projects and is pursuing opportunities for new or expanded coal mining projects, although they believe future opportunities are likely to be limited.

Analyst Questions DP&L Decision to Side With Sierra Club

Murray Energy Corp. is pushing back against a controversial plan by Dayton Power & Light Co. (DP&L), Ohio's smallest investor-owned electric utility, to close the coal-burning J.M. Stuart and Killen power plants in the state by mid-2018.

DP&L, an AES Corp. subsidiary, recently entered into a stipulation with several parties including the Sierra Club in support of a revised electric security plan that would provide the utility with \$125 million in revenue from customers annually for five years — a total of \$625 million, to strengthen its balance sheet.

Closing Stuart and Killen now is part of the plan, but it was not always so. DP&L previously floated a proposal with the Ohio Public Utilities Commission (PUC) that could have ensured the continued operation of both baseload plants for another 10 years.

Because DP&L shares ownership of Stuart and Killen with other electric utilities such as Dynegy Inc. and American Electric Power Co., it cannot shut either plant unilaterally. As a result, negotiations are under way to secure the approval of all co-owners.

Ohio-based Murray, the largest privately owned and underground mining company in the U.S., is intervening at the PUC against the DP&L stipulation to protect its business interests, as it sells steam coal to both plants.

In a March 1 filing with the commission, Energy Ventures Analysis Inc. principal Emily Medine, testifying on behalf of Murray, made a case for the sale of Stuart and Killen by DP&L, not the plants' retirements. She also questioned the decision by DP&L to enter into a stipulation with the Sierra Club, a national environmental group that opposes coal-fired generation and coal mining throughout the country.

"Given the information available, it appears committing to the closure of Killen and Stuart was the price for garnering Sierra Club support and that DP&L believes it has a better chance of obtaining approval for its ESP with Sierra Club support than without, and that the ESP with the closure of Killen and Stuart is a better outcome for DP&L than no ESP," Medine said.

But she disagrees. A sale of the plants "should generate positive value to DP&L both through a payment and a transfer of costs related to the ultimate closing of the plants, thereby reducing the revenue needed to support DPL's heavy debt load," she said. Also, while DP&L may own only about 1,100 megawatts (MW) at the two generating stations, which account for about 3,000 MW of generation combined.

"Historically and prospectively, this capacity has at most times been 'in the money,'" she said. "If the capacity is retired, the

supply curve contracts and other power prices would be higher.”

Medine noted there has been considerable interest in third-party acquisitions of existing coal plants. Earlier this year, for example, a joint venture of Blackstone and ArcLight Capital Partners LLC purchased the 2,600-MW Gavin coal plant in Ohio from AEP. Two years ago, Dynegy bought coal plants belonging to Duke Energy Ohio.

As a result, Medine said, DP&L should market both Stuart and Killen to potential joint ventures, merchant generators or even coal companies interested in vertically integrating their businesses. “Coal producers and transporters are increasingly flexible with respect to their pricing structure to improve the dispatch of coal plants,” she said. “In some markets, coal producers have been known to provide discounts and premiums to the coal price based upon real-time power pricing. Depending upon the discounts, this could reduce the fuel cost to very low levels during off-peak periods, allowing plants to dispatch ahead of gas.”

A Murray spokesman declined to comment on whether his company might be interested in buying Stuart or Killen.

Cloud Peak Energy Modifies Agreements With Westshore Terminals, BNSF Railway

On February 15, Cloud Peak Energy Inc., one of the largest U.S. coal producers and the only pure-play Powder River Basin (PRB) coal company, announced that Cloud Peak Energy Logistics LLC replaced its throughput agreement with Westshore Terminals Ltd. Partnership and its transportation agreement with BNSF Railway Co.

Under the new agreements, which were effective in January for the throughput agreement and April for the transportation agreement, Cloud Peak Energy made upfront payments and also committed to minimum payments through 2018. The outstanding undiscounted commitments are approximately \$51 million through the current two-year term of these agreements.

The agreements if elected, may be extended through the end of 2019 if elected. In addition, Westshore has certain priority rights on throughput capacity in respect of any export shipments by Cloud Peak Energy through 2024. The original throughput and transportation agreements and underlying take-or-pay commitments would have expired at the end of 2024.

“Westshore and BNSF are critical parts of our effort to maintain a viable long-term Asian export business,” said Colin Marshall, Cloud Peak Energy president and CEO. “We value our strong relationships with Westshore and BNSF and appreciate their willingness to work with us. We believe in the long-term opportunity for Asian exports of Powder River Basin coal.”

Alpha Completes Sale of Assets in Eastern Kentucky

Alpha Natural Resources Holdings Inc. and ANR Inc. announced the divestment of all of their affiliated mining assets in Harlan County, Kentucky, to JRL Coal LLC of Marietta, Georgia.

The Coalgood assets include a permitted surface mine operation that has been idle since 2012 and nearly 12 million tons of high-quality thermal coal reserves. JRL has indicated its plan to operate the assets.

“The divestiture of the Coalgood mining complex represents our ongoing dedication to our strategic plan regarding idled assets, which has been to identify non-strategic properties for di-

Continued from p. 6...

efficiency at the Ramin power plant in the Khuzestan Province to 50%-55% from the current 36%, a government official said.

India Pushes Coal Production Despite Weak Demand

The Indian government will continue to push for higher coal production in the 2017-2018 fiscal year despite sluggish demand, piling up of pithead stocks and missed targets. Indications available from the federal Ministry of Coal indicate that the latter will set a production target of 660 million metric tons (mt) during 2017-2018 for Coal India Ltd. (CIL), which accounts for more than 80% of domestic supply.

The production target for next year would be about 15% higher than CIL's expected coal production during 2016-2017. During the period April-December 2016, the miner produced 377.7 million mt of coal, compared to the 417 million mt target set by the Ministry of Coal, as per official data released. It is expected to close in the current fiscal year (at the end of March) with a production of 582 million mt against a government target of 598 million mt.

Persisting with setting a higher production target was significant when viewed against a slowdown in demand from key consuming sectors like thermal power production. The off-take of coal by thermal power producers during April-December 2016 was estimated by the government at 391 million mt, which was less than the 434 million mt consumption forecast from the thermal power generation companies, made at the start of 2016-2017, a ministry official said.

He said the government would continue to push for production growth despite sluggish demand because production growth was set keeping in view long-term demand of the fuel across industrial sectors and could not be a reflection of “short-term cyclical demand fluctuations.”

However, the slack demand for coal was expected to persist in the longer term, too, with the Central Electricity Authority (CEA), the statutory government authority for the electricity sector, forecasting that low demand for the fuel was likely to aggravate further with the authority claiming that the country does not need any more coal-based thermal power plants until 2027.

The forecast was based on the CEA's assumption that electricity demand for 2022 would be around 235 gigawatts or about 17% lower than the demand estimate made in 2012 when a large number of thermal power projects were planned for implementation.

Coal Truckers Protest Renewables in South Africa

Coal truck drivers in South Africa recently protested against the government's decision to invest in renewable energy from independent power producers. On March 1, traffic came to a standstill in Pretoria, South Africa, when contracted coal truck transporters were moving at a snail's pace in an effort to get a reaction from the government regarding Eskom's intention to use more renewable energy, *ESI Africa* reported. More than 100 coal truck drivers blocked several roads around the capital. In February, while delivering the State of the Nation address, South African President Jacob Zuma said his administration was now more committed to the Renewable Energy Independent Power Producer Procurement Program (REIPPPP). He emphasized a move toward renewables while explaining that the government continues to work toward ensuring national energy security.



DATELINE WASHINGTON

THE CLUB ON THE HEAD OF AMERICAN WORKERS

BY LUKE POPOVICH



By the time you read this, the Sierra Club will have twice been reminded of former President Barack Obama's boast that "elections have consequences." The Senate will have confirmed Scott Pruitt's nomination as Environmental Protection Agency (EPA) administrator following the committee's endorsement. To the climate lobby that owned the EPA for the last eight years, Caligula is about to capture the convent. The many more who have been punished by the EPA's regulations welcomed Pruitt as their savior.

Also, President Donald Trump signed the resolution of disapproval Congress passed last month, voiding the so-called Stream Protection Rule. An oxymoron right up there with airline cuisine and military music, the stream rule will soon be extinguished, under the arcane Congressional Review Act. The Sierra Club loved this rule; the National Mining Association (NMA) hated it. It was the first rule overturned by the Trump presidency.

How did all this happen? The Sierra Club itself provided one answer. It recently announced a new goal to destroy 65,000 jobs. Of course, that's not how the club announced it, but that was what some of us heard when the club boasted of its goal to shut down another 28 gigawatts (GW) of coal-based power.

To the red-carpet supporters, billionaire philanthropists and trust fund intellectuals who cheer the club's Beyond Coal campaign, the impact on jobs will be lost in translation. Cost is no consideration for this crowd because they never pay it. But the impact of closing so much plant capacity will not be lost on voters, especially not on the hundreds of thousands of men and women whose jobs are in the coal supply chain.

Here's what they will hear. The club's 28-GW target roughly equates to 90 million tons of lost coal production, the volume of coal required to supply these plants with power. That lost volume translates into job losses of 10,000 direct coal mine workers (U.S. Mine Safety and Health Administration data) and 9,000 direct coal plant workers (Department of Energy's "Energy and Employment Report").

Add to this toll the standard 3.6 multiplier for indirect job losses derived from MSHA data — conservative as it omits some cat-

egories — and the club's goal will kill another 46,000 jobs found in power plants, railroads, barge transport, ports and equipment vendors.

This brings the Sierra Club's total tribute to America workers to 65,000 lost jobs.

Bureau of Labor Statistics data show fossil energy jobs of the kind lost here paid an annual average of \$111,300 in 2015. Many voters across the country often ask one another: Where have all the good jobs gone? Why can't we create the kinds of jobs that once supported a family? Here is one answer. It isn't necessarily China or mechanization or lack of qualified applicants that is slowly eroding living standards for the once great American middle class. It's the rising influence of well-funded advocacy groups that are indifferent to the jobs they destroy while in pursuit of trivial environmental improvements.

The stream rule that Congress overturned for example would have delivered zero improvements because it merely duplicated oversight responsibilities of other state and federal regulators. The Clean Power Plan, Obama's contribution to the Paris climate accords now hamstrung in litigation, would destroy tens of thousands of jobs in the fossil energy sector just to deliver a global warming reduction so trivial that the EPA didn't bother to measure it.

This may explain why the Obama administration's single-minded devotion to the environmental left was costly for the president's supporters in November. Reducing carbon emissions and coal production reduced economic prospects for tens of thousands of men and women. Small wonder they turned on their tormentors and the candidates who had turned against them.

To woo them back, the governing class must end its romance with the green lobby. Their evangelical zeal for punitive energy regulations — from stopping pipelines to shuttering power plants — and their indifference to the welfare of working Americans, are incompatible with the economic growth and high-wage jobs voters want.

The Sierra Club can't read election results, but here's betting that Congress can.

Luke Popovich is a spokesman for the National Mining Association, the industry's trade group based in Washington, D.C.

“COST IS NO CONSIDERATION FOR THIS CROWD BECAUSE THEY NEVER PAY IT.”

vestiture, thereby allowing Alpha to reduce its footprint,” said Alpha CEO David Stetson. “In this case, we will transfer six permits, reduce bonding by \$6 million and also reduce our ARO in future years by a significant amount.”

Terms of the transaction were not released.

Alpha Natural Resources Holdings Inc. and ANR Inc. have affiliate mining operations in West Virginia and Kentucky, and supply metallurgical and thermal coal.

Dynergy Comes Out of Bankruptcy in Good Financial Standing

Dynergy Inc.’s Illinois Power Generating Co. subsidiary, operator of two coal-burning power plants in downstate Illinois, 915-megawatt (MW) Coffeen and 615-MW Newton, emerged from a brief voluntary stay in bankruptcy in early February in improved financial condition after their debt was restructured.

Houston-based Dynergy, one of the nation’s largest merchant generators, placed the two plants in a prepackaged Chapter 11 bankruptcy reorganization case in December in the U.S. Bankruptcy Court for the Southern District of Texas in Corpus Christi. At the time, the company said it already had secured sufficient votes in support of a proposed plan of reorganization.

During the abbreviated stay in bankruptcy, Dynergy was able to eliminate \$825 million of unsecured genco bonds and reduce consolidated annual cash interest expense by approximately \$45 million, as well as simplify the company’s capital and organizational structure.

Participating eligible genco bondholders were provided their share of approximately \$181.7 million of 8.034% new unsecured and senior notes due in 2024 and issued by Dynergy with covenants that are substantially similar to Dynergy’s existing 5.875% senior notes due in 2023; 8.6 million seven-year warrants issued by Dynergy can each be exercised into one share of Dynergy common stock for an exercise price of \$35 and \$87.1 million in cash.

Dynergy said the two plants now are in a “stronger competitive position.” They are located in the Midwest Independent System Op-

erator (MISO) market, which includes all or part of 15 states, including downstate Illinois, plus the Canadian province of Manitoba.

Dynergy has maintained the MISO market is less lucrative for competitive power plants like Coffeen and Newton than the rival PJM Interconnection market, which includes northern Illinois and the Chicago area.

In early February, Dynergy also closed on the \$3.3 billion purchase of 17 natural gas and coal-power plants in the U.S. from French-based Engie. The coal-power plants included 635-megawatt (MW) Coletto Creek in Texas and 52-MW Northeastern in Pennsylvania. Both plants are expected to continue operating.

Overall, Dynergy now owns 50 power plants totaling about 31,500 MW. Coal accounts for 36% of its generating capacity, compared to 64% gas. Last year, the company retired a 615-MW coal unit at Newton and a 630-MW unit at its Baldwin plant, also in Illinois. In October, however, the company reversed course and decided not to close an approximately 650-MW coal unit at Baldwin after it cleared an Illinois Power Agency auction. The unit now will remain in commercial operation at least through September 2018 instead of closing in March 2017.

Altogether, Dynergy owns about 8,000 MW of merchant generation in Illinois, most of it coal-fired.

On February 23, Dynergy reported a net loss for 2016 of \$1.24 billion, versus net income of \$50 million for 2015. The year-over-year decrease was primarily driven by asset-impairment charges related to Baldwin and Newton and its co-ownership of the 2,300-MW J.M. Stuart coal plant in Ohio in 2016, and a second-quarter 2015 deferred tax valuation allowance reversal that benefited the company in 2015 but did not reoccur in 2016.

New Owners of Gavin Power Plant Will Keep it in Operation

For more than four decades, the massive General James M. Gavin coal-burning power plant along the Ohio River near Cheshire, Ohio, was one of the major workhorses for American Electric

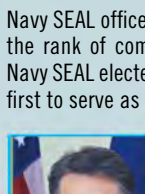


PEOPLE IN THE NEWS



Ryan Zinke

On March 1, Montana Rep. *Ryan Zinke* was confirmed as the 52nd **secretary of the interior**. Zinke is a fifth-generation Montanan who grew up near Glacier National Park. He has led efforts to renew the Land and Water Conservation Fund in Congress, and has also been a firm advocate for sportsmen and women to gain access to public lands. Zinke also co-authored the 2015 Resilient Federal Forest Act, which initiated reforms for revitalizing America’s timber areas and preventing wildfires by emphasizing local collaboration on responsible timber harvest projects. He has been in the U.S. House of Representatives since 2014, and before that served in the Montana State Senate from 2009 to 2011. He was also a U.S.



Rick Perry

Navy SEAL officer for 23 years. He retired with the rank of commander. Zinke was the first Navy SEAL elected to the U.S. House and is the first to serve as a cabinet secretary.

Former Texas Gov. *Rick Perry* was sworn in on March 2 as the 14th secretary of the United States **Department of Energy**. During Perry’s 14 years as governor, Texas created 2.2 million jobs and led the nation in energy production. Texas now produces more wind energy than all but six countries in the world. Under his leadership, Texas reduced its carbon footprint by 17%, reduced sulfur dioxide by 56%, and nitrogen oxide by 66%. Perry is a veteran of the United States Air Force.



Glenn Kellow

Peabody Energy announced its board of directors that would serve following emergence from Chapter 11: *Glenn Kellow*, president and CEO of Peabody Energy; *Nicholas Chirekos*, former North America head of mining for J.P. Morgan; *Stephen Gorman*, president and CEO of Borden Dairy Co.; *Joe Laymon*, vice president of human resources and corporate services for Chevron Corp.; *Teresa Madden*, former EVP and CFO of Xcel Energy Inc.; *Robert Malone*, former chairman of the board and president of BP America Inc.; *Kenneth Moore*, former managing director of First Reserve Corp.; *Michael Sutherlin*, former president and CEO of Joy Global Inc.; and *Shaun Usmar*, CEO of Triple Flag Mining Finance Ltd.



AWARDS

NASLR Hands Out Awards for Land Reclamation



The NASLR awards its 2016 scholarship to Florence Miller.

The National Association of State Land Reclamationists (NASLR) gave out awards at its annual conference held last fall in Bozeman, Montana.

NASLR awards a \$1,500 scholarship to a full-time student that focuses on the area of mined land reclamation or a closely related field. The 2016 scholarship was awarded to Florence Miller who just started her graduate work at Montana State University to pursue a master's degree in land resources and environmental sciences. She conducted her undergraduate studies at California Polytechnic State University and earned a bachelor's degree in Soil Science. For her thesis, she will be examining the potential sources of uranium that currently contaminate drinking water on the Crow Reservation in Montana.



Daniel Kestner receives the Dean Spindler reclamationist of the year award.

The 2016 Dean Spindler Reclamationist of the Year award winner was Daniel Kestner with the Virginia Department of Mines, Minerals, and Energy. He is the consummate professional in GIS and mapping applications related to mine land reclamation. The Dean Spindler Reclamationist of the Year award was established to recognize exemplary work done by state regulatory professionals in the field of mined land reclamation.

Paramont Coal Co.'s Smith Gap surface coal mine in Virginia was nominated for the Coal Reclamation Award for achieving excellent reclamation of abandoned mine lands through responsible re-mining techniques. The Smith Gap surface mine consists of multiple surface coal mining and reclamation operations including surface contour, area mining and highwall mining. The reclamation opera-

tions successfully eliminated and reclaimed more than 10,000 feet of previously existing highwalls that were created by the pre-SMCRA mining. Final grading and revegetation of the mined areas has complemented and enhanced the existing contours for a natural appearance that over time will ultimately blend with the original terrain. Also, three stream-channel reconstructions have been successfully implemented by Paramont.



The Smith Gap surface mine accepts the nomination for the NASLR Coal Reclamation Award.

Contura's Running Right Leadership Academy Receives Award at SME

Contura Energy Inc.'s Running Right Leadership Academy (RRLA), owned by Contura Energy Services LLC, has received the Health and Safety Operational Excellence Award from the Society for Mining, Metallurgy & Exploration (SME). The award recognizes exemplary occupational health and safety management performance and practices, and the honor was formally presented during the SME annual meeting in Denver this week.

According to the SME, eligibility for the award includes performance in accordance with certain health and safety metrics as well as documentation of the organization's approach to operational management in a number of safety- and health-related areas including emergency response, compliance practices, training and education.

The academy's director, Gary Frampton, accepted the Operational Excellence award on behalf of the company.

"With our available training options, an underground miner can be trained on site-specific issues while, just outside the door of the building, a surface miner is practicing fall rescue and recovery training," Frampton said. "With a hands-on approach, we retain much more of what we are taught. At the academy, our approach is unique to each group of miners — specific to their mine plans, seam conditions and day-to-day challenges."

Located in Julian, West Virginia, the academy is a regional center for advancing mine safety utilizing state-of-the-art simulation and training equipment to provide a safe and engaging learning environment for miners.

"The academy is an exceptional, safety-focused facility with a truly unique methodology," said Kevin Crutchfield, Contura's chief executive officer. "We're honored by this award, which underscores the importance of safety training in the mining industry and specifically showcases our innovative approach in taking training to a new level."

Power Co. (AEP), one of the largest electric utility companies in the United States. Starting in February, the twin-unit, 2,665-megawatt (MW) baseload generating station was under new ownership after Blackstone Group LP and ArcLight Capital Partners LLC acquired Gavin and three natural gas-burning plants in Ohio and Indiana from Columbus, Ohio-based AEP for approximately \$2.17 billion.

The new owners said they intend to continue operating Gavin, the largest power plant in Ohio and one of the biggest coal burners in the U.S. The plant, which has nearly 300 employees, consumes more than 7 million tons of steam coal annually from several suppliers, including Ohio-based Murray Energy Corp., the largest privately owned coal company and underground miner in the nation.

AEP built Gavin's two roughly 1,300-MW generating units in 1974 and 1975. The plant was named in honor of a World War II hero, commanding general of the 82nd Airborne Division and U.S. ambassador to France, who also served as an AEP director from 1961 to 1980. The plant established several AEP records for availability and total generation in its first few years of commercial operation.

In recent years, though, AEP has retired more than 6,000 MW of coal-fired generation in the region. So-called "competitive" coal plants like Gavin, whose output is sold into PJM Interconnection, a regional grid operator headquartered in Pennsylvania, have found it increasingly difficult to compete in an era of flat electricity load growth, lower natural gas prices and rising renewable energy resources such as wind and solar.

Along with Gavin, Blackstone and ArcLight purchased the 840-MW Waterford Energy Center in Waterford, Ohio; 507-MW Darby Generating Station in Mount Sterling, Ohio; and 1,186-MW Lawrenceburg Generating Station in Lawrenceburg, Indiana. AEP announced the sale on September 14 and the deal closed at the end of January.

AEP said it expected to net about \$1.2 billion in cash after taxes from the transaction. The company is investing proceeds from the sale in its regulated businesses, including transmission and contracted renewable projects.

"AEP's long-term strategy has been to become a fully regulated, premium energy company focused on investment in infrastructure and the energy innovations that our customers want and need," Nicholas Akins, AEP chairman, president and CEO, said in a statement. "This transaction advances that strategy and reduces some of the business risks associated with operating competitive generating assets."

AEP and Gavin made national news 15 years ago when the company spent about \$20 million to essentially buy the village of Cheshire, located in the shadow of the plant, over air pollution concerns. Most of the approximately 200 local residents relocated.

Before the end of 2017, AEP plans to complete a lengthy strategic review process that could result in the sale or closing of four other coal plants representing 2,671 MW of generating capacity. They are Cardinal, Conesville, Stuart and Zimmer, all located in Ohio. Some of the plants are co-owned with Dynegey Inc. and Dayton Power & Light Co., a subsidiary of AES Corp. of Arlington, Virginia.

Owners of Navajo Plant Vote for 2019 Lease Extension

Rather than close the plant later this year, the utility owners of Navajo Generating Station (NGS) voted on February 13 to extend

operations of the three-unit 2,250-megawatt (MW) facility near Page, Arizona, to December 2019 if an agreement can be reached with the Navajo Nation.

This measure would preserve continued employment at the plant and add additional revenue for the Navajo Nation and the Hopi Tribe. It also provides the nation or others with the potential to operate the plant beyond 2019 should they so choose.

The owners of NSG include the Salt River Project (SRP) at 42.9%, which is also the operator; U.S. Bureau of Reclamation at 24.3%; Arizona Public Service Co. at 14%; NV Energy at 11.3%; and Tucson Electric Power (TEP) at 7.5%.

"The utility owners do not make this decision lightly," said Mike Hummel, deputy general manager of SRP, the plant's operator. "NGS and its employees are one reason why this region, the state of Arizona and the Phoenix metropolitan area have been able to grow and thrive. However, SRP has an obligation to provide low-cost service to our more than 1 million customers and the higher cost of operating NGS would be borne by our customers."

According to a recent study by the National Renewable Energy Laboratory, "Electricity produced at NGS is currently more expensive than electricity purchased on the wholesale spot market," and "price trends examined suggest a turnaround might be years away, especially if natural gas prices remain low."

Hummel said the owners' focus now is to secure an agreement with the Navajo Nation that would allow the plant to continue to run through the end of its lease on December 22, and allow removal and restoration activities, which could take up to two years. Hummel said without an agreement between the owners and the Navajo Nation, the plant would be required to cease operations in 2017.

David Palumbo, deputy commissioner of operations for the Bureau of Reclamation, said the Department of the Interior is looking into ways the plant could operate after 2019 in a more cost-effective manner. "We recognize that NGS is an economic driver throughout the state of Arizona, both for local economic activity and Native American employment near the facility as well as for users of CAP water, including the tribes that rely on that water. Before discussing the possibility of a permanent shutdown, we would like to see if we can find a path forward that meets the needs of multiple NGS stakeholders."

NGS currently employs 400 full-time workers, 90% of whom are Navajo. Hummel said NGS employees will be considered for possible positions within SRP while career and financial planning services will also be available.

SRP President David Rousseau said, "The SRP board fully supports operating NGS through the current lease term of 2019 while working with the Navajo Nation on transition alternatives to the mutual benefit of their members and our customers."

TEP President and CEO David G. Hutchens agreed. He said, "We look forward to working toward a long-term solution for NGS that balances the needs of the plant's many stakeholders and serves the best interests of our customers and the community we serve."

American Coal Council and Coal Trading Association Combine

Members of the American Coal Council (ACC) and the Coal Trading Association (CTA) have approved the combination of the two organizations. The combined organization will operate under the

existing American Coal Council name and organizational structure and be managed by CEO Betsy Monseu and current ACC staff members.

Two CTA Board Directors have been added to the ACC Board of Directors: Steve Watson, director of trading and origination with Arch Energy Resources; and Ginny Farrow, portfolio director of coal with NRG Energy. Coal trading matters will be addressed by a new ACC Coal Trading Committee, which Watson will chair.

“The missions, activities, and programs of the ACC and CTA fit well together, and the two organizations have had a longstanding relationship to co-host the annual Coal Trading Conference,” ACC CEO Monseu said. “I thank the boards and members of both organizations for their support of this combination, and the recognition of the value proposition it provides. I appreciate the contributions of CTA Executive Director Bob McLean and wish him well as he retires.”

CTA programs and events to be continued under ACC include the reception at the Eastern Fuel Buyers Conference in Orlando on May 2; the Coal Trading Conference in New York on December 4-5; and the Fundamentals of Coal Trading class, which is being converted to an online education program.

Contura to Increase its Interest in DTA

Contura Energy has significantly increased its ownership stake in Dominion Terminal Associates (DTA), a world-class coal export facility located in Newport News, Virginia. Upon closing, Contura will hold a 65% majority ownership in the facility through its affiliate, Contura Terminal LLC.

“The coal blending capabilities and transportation flexibility provided by DTA serves as a strategic cornerstone of Contura’s Trading & Logistics business,” said Kevin Crutchfield, CEO, Contura Energy. “This investment supports our continued focus to deliver quality coal products with the reliable service our international customers expect from Contura Energy.”

The highly mechanized DTA facility provides 22 million tons per year (tpy) of overall capacity and 1.7 million tons of total coal ground storage. Currently, Contura owns approximately a 41% interest in the facility.

On January 12, Peabody Energy filed a motion with the U.S. Bankruptcy Court in the Eastern District of Missouri requesting approval of bidding procedures for the sale of its ownership stake in the DTA facility as part of its ongoing Chapter 11 restructur



Contura now owns a 41% interest in the Newport News export facility.

ing. That order was approved by the court on January 30, and an auction was held for the asset on March 6. Contura participated in the bidding process jointly with Arch Coal, a current partner at the DTA facility. The transaction is subject to U.S. Bankruptcy Court approval and closing. A hearing on the matter is currently scheduled for March 9.

EPA to Act on Waters of the United States Rule

President Donald Trump issued an executive order on February 28 directing the U.S. Environmental Protection Agency (EPA) and the U.S. Army Corps of Engineers to review and then rescind or revise the 2015 Clean Water Rule: Definition of “Waters of the United States.”

“EPA intends to immediately implement the executive order and submit a notice to the office of the Federal Register announcing our intent to review the 2015 rule, and then to propose a new rule that will rescind or revise that rule,” said EPA Administrator Scott Pruitt. “The president’s action today preserves a federal role in protecting water, but it also restores the states’ important role in the regulation of water.”

In his executive order, Trump said, “It is in the national interest to ensure that the nation’s navigable waters are kept free from pollution, while at the same time promoting economic growth, minimizing regulatory uncertainty, and showing due regard for the roles of the Congress and the states under the Constitution.”

1

CALENDAR OF EVENTS

April 10-13, 2017: *19th Annual Electric Power Conference & Exhibition*, McCormick Place West, Hall F1, Chicago, Illinois. Contact: <http://2017.electricpowerexpo.com>.

April 11-14, 2017: *25th International Mining Congress and Exhibition of Turkey-IMCET 2017*, Antalya, Turkey. Contact: UCTEA Chamber of Mining Engineers of Turkey; Tel: +90312 425 10 80; Email: imcet2017@gmail.com; Web: <http://imcet.org.tr/>.

April 30-May 3, 2017: *Canadian Institute of Mining (CIM)*, Montréal, Québec, Canada. Contact: Web: <http://convention.cim.org/en/Montreal/2017/Home.aspx>.

May 7-9, 2017: *Haulage & Loading*, Wigwam Resort, Phoenix, Arizona. Contact: Web: www.haulageandloading.com.

June 13-15, 2017: *Longwall USA*, David L. Lawrence Convention Center, Pittsburgh, Pennsylvania. Contact: Web: www.longwallusa.com.

August 29-31, 2017: *AIMEX*, Asia-Pacific’s International Mining Exhibition, Sydney, Australia; Contact: Web: www.aimex.com.au/home/.

September 13-15, 2017: *Bluefield Coal Show*, Brushfork Armory-Civic Center, Bluefield, West Virginia. Contact: Bluefield Chamber of Commerce; Tel: +1-304-327-7184; Web: www.bluefieldchamber.com.

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IGCC TECHNOLOGY COMING OF AGE

Eyeballed by Asia and Europe, tested in the U.S. at a cost, coal gasification power proves promising

BY JESSE MORTON, TECHNICAL WRITER



Tampa Electric Co.'s (TECO) integrated gasification combined cycle (IGCC) unit, Polk 1, celebrated its 20th anniversary last year. Knowledge gained from Polk 1 was used in designing and launching Duke Energy's Edwardspoint, Indiana, IGCC unit, which is meeting milestones after being at the center of scandals and controversy when its launch missed deadlines and broke budgets. (Photo: TECO)

Too old to be babied, yet still too young to be blamed, integrated gasification combined cycle (IGCC) technology is slowly emerging from adolescence.

While there are hundreds of pulverized coal-fired power plants in the U.S., there are only three operational IGCC power plants stateside. The eldest IGCC facility celebrated its 20th anniversary of operations last year, and it no longer uses coal due to costs. Its youngest sibling is double its size, more complex, and consistently garnered maudlin headlines over the last half decade as it exploded budget constraints and repeatedly missed deadlines while ramping up. The middle child, also double the size of the eldest, during ramp-up was such a locus of scandal an executive told the local daily it would "need an exorcist."¹ Their parents were prototype facilities, conceived in the public sector and academia, birthed in the private sector, coddled by government, and now either closed or converted. One is currently being repurposed to make

fertilizer. Abroad, IGCC has met perhaps more success and interest, specifically in countries with high coal and low natural gas reserves.

This snapshot perhaps lends to cynical conclusions unnecessarily. No doubt, cheap natural gas from north-central Appalachia is killing more than just the U.S. coal sector. Nuclear plants nationwide are getting the axe, and uranium miner Cameco recently vaporized jobs after shuttering a mine and attempting to placate stampeding investors. Indeed, IGCC is in good company as a viable technology that has been sidelined by the advent and deployment of innovative hydraulic fracturing drilling technology making Marcellus shale-bound gas accessible.

In this economic environment, all three IGCC plants face challenges and uncertainty, but ultimately will prove to be viable at generating low-emissions power from coal, advocates and experts say. They also say prospects for IGCC technology are promising, thanks in part to lessons

learned the hard way.

Hard lessons come quick when building a modern engineering marvel.

Engineering a Tourist Attraction

In layman's terms, an IGCC plant treats coal to release gases that are cooled and cleaned to create a fuel gas called syngas, comprised of carbon monoxide and hydrogen. Syngas is burned to turn a turbine. For the combined cycle part, heat generated in the process turns water to steam, which spins a turbine.

The U.S. Department of Energy (DOE) provides details. The coal "to be gasified is combined with steam and limited oxygen in a heated, pressurized vessel. The atmosphere inside the vessel is starved of oxygen, and the result is a complex series of reactions of the feedstocks to produce syngas," DOE, via the National Energy Technology Laboratory (NETL), reported. During that stage, much of what would have become airborne particulate matter were the coal burned remains in the slag.

The gas is cooled in a separate vessel before the next step.

The NETL continued, “The syngas can be cleaned relatively easily, given the much lower volume of raw syngas to be treated compared to the large volume of flue gases that need to be treated in conventional post-combustion cleaning processes.” This means most of the sulfur and carbon either remains in the slag or is removed in the wash, occurring in a third vessel.

The syngas flows to vessel four where, the NETL reported, “The clean syngas can be combusted in turbines or engines[.]” In the meantime, back up to step one where the heat from the syngas is captured in the form of steam, which then turns a turbine and garners the designation “combined cycle.”

Simple enough in theory, but in practice, five iterations of the IGCC plant launched stateside and three of those effectively failed as power plants before Mississippi Power’s Kemper County Energy Facility reportedly went online in January.

Two early prototype IGCC facilities ultimately closed and were relocated, but in hindsight and for research purposes were “quite successful,” said Thomas Sarkus, senior industrial partnerships manager, NETL. The Cool Water, California, plant featuring Texaco gasification technology came online in 1984 and was terminated in 1989. It reincarnated in Kansas as the Coffeyville Resource Nitrogen Fertilizer

Plant, where it gasifies petroleum coke in the production of fertilizer. The plant reportedly currently captures 650,000 metric tons per year (mtpy) of carbon dioxide (CO₂) for enhanced oil recovery (EOR), a process that uses the gas to extract some of the last remnants of oil from depleted wells. Similarly, a Dow Synfuels Corp.-subsidized IGCC plant located in Plaquemine, Louisiana, and featuring Louisiana Gasification Technology Inc. technology, ran for more than a decade starting in the mid-1980s. The subsidies expired, the plant closed, and then it effectively reincarnated as the Wabash River facility in West Terre Haute, Indiana.

Wabash, which started up in 1995 and gasified 2,500 tons per day of coal and pet coke, had the “hardest row to hoe,” Sarkus said. It was the first commercial, meaning producing more than 200 megawatts (MW) per day, IGCC plant in the United States (and the second in the world after Nuon Power’s Buggenum plant in the Netherlands).

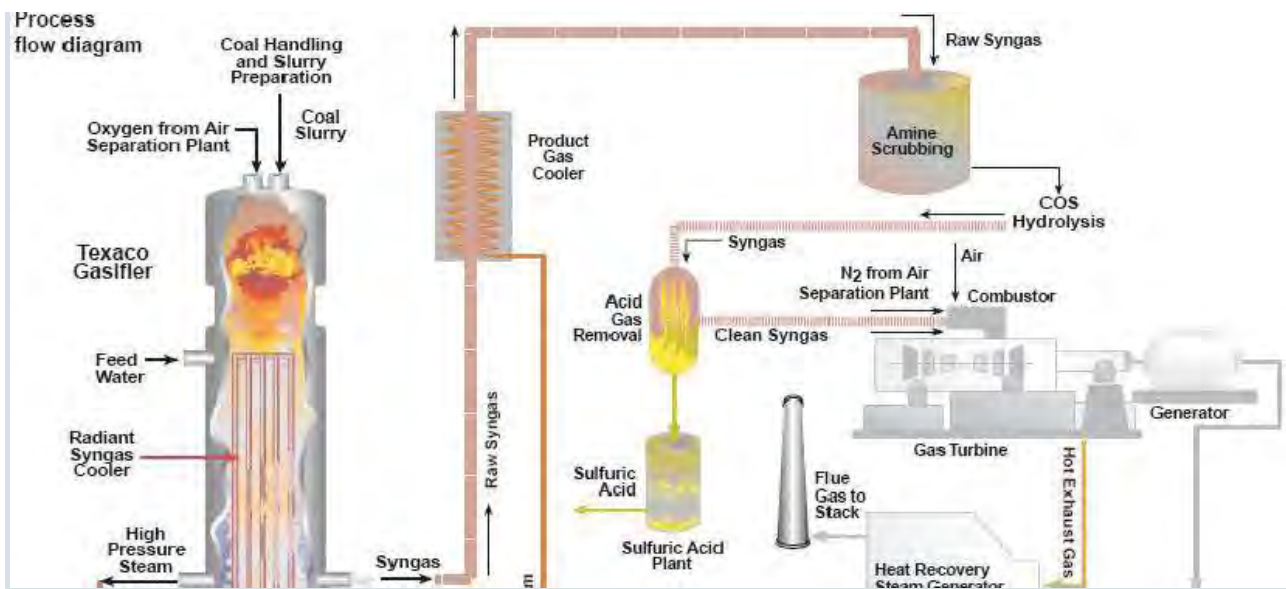
Last May, the Wabash River plant changed hands, no longer produces power, and is currently being retooled to produce fertilizer using pet coke, a transformation described by new owner Phillip Brothers Fertilizer as putting the technology to “a more productive economic use.” Within that quote lies the common denominator in the closure of the Cool Water, Plaquemine and Wabash plants. By most accounts, they were shuttered not due

to designs on the computation pad, but due to balances on the ledger. They were functional but expensive to operate, and ultimately successfully served as research facilities. Beyond those three, roughly a dozen more have been proposed but were axed by the government sometime before the ribbon-cutting. For example, last March, the California Energy Commission terminated the 300-MW Hydrogen Energy California IGCC plant in Kern County.

Worldwide, there have been only eight commercial-scale IGCC plants to successfully launch since Wabash in 1995: Polk Power Station (USA) in 1996; Vresova (Czech Republic) in 1996; Puertollano (Spain) in 1998; IGCC Nakoso (Japan) in 2007; GreenGen (China) in 2012; Edwardsport (USA) in 2013; Taeon (South Korea) in 2016; and Kemper (USA) in 2017.

That history perhaps explains why Tampa Electric Co.’s (TECO) Polk County trophy IGCC facility garnered thousands of tourists per year during its first decade of operation, Sarkus said. “It is quite a spectacle to see,” he said. “They are a crackerjack unit in terms of the chemistry and fine tuning that unit to run.”

There are other reasons the unit drew gawkers. The facility, referred to as Polk 1, was named by Energy Probe as the cleanest coal-burning power plant in North America in 2005. In 2015, it won the Edison Electric Institute (EEI) Edison Award, the institute’s foremost accolade, for its system of using reclaimed water in its op-



TECO’s 250-megawatt (MW) Polk 1 unit flow diagram, above, provides a hint of the challenges faced by engineers in designing a system that creates, then scrubs, then burns, then recaptures the heat from syngas. (Photo: NETL)

erations. Thus, power and fuel stock companies in coal-rich countries have sent emissaries to the plant to learn its secrets. “There’s been a lot of interest from other users, scientists, academia and around the world,” Mark Hornick, director of engineering and project management for TECO, said. “We’ve hosted groups from every continent, excluding Antarctica.”

Polk 1 is now the eldest IGCC facility in the world. Surrounded by natural gas-fired turbines, it stands as a testament to a previous era.

Polk Remembers

Built on reclaimed oak and slash pine barrens, Polk 1 started out as a gleam in the eye of the federal government. Dubbed the Tampa Clean Coal Technology Project, it “was selected by the U.S. Department of Energy (DOE) in December of 1989 as a Round III Demonstration Project for the Clean Coal Technology (CCT) Program,” the NETL reported. “Construction began in October of 1994, followed by operational startup in September of 1996.” For four years it was a demonstration. Coal was supplied by truck from TECO’s transloading facility in Apollo Beach.

The NETL provided operational specifications. “The plant uses General Electric Energy’s (formerly owned by Texaco) commercially available, entrained-flow, oxygen-blown gasifier to produce syngas

from coal, which feeds a combined-cycle turbine system to produce electricity. Each day, 2,200 tons of coal are first ground, combined with recycled and makeup process water to form a slurry, then partially oxidized in the gasifiers with 95% pure oxygen supplied by an air separation unit,” the NETL reported. “The gasifier produces a high temperature and pressure, medium-British thermal unit (Btu) synthesis gas, which has a heat content of 267 Btu per standard cubic foot. Most — 95% — of the carbon contained in the coal is converted on a mass basis. Molten ash collects in the bottom of the gasifier before solidifying in a water-filled sump. The non-leaching slag is sold for use as construction material.”

All-in costs for launch and presumably the demonstration hit \$303 million, the NETL reported, with \$152 million coming from TECO and \$151 million coming from the DOE. The NETL summarizes the early failures and snafus, clogs and corrosion, that caused outages or mandated repairs and represented unforeseen expenses. In 2000, TECO released an executive report to the government, summarizing the history of operations, compiling lessons learned, and providing predictions for the plant and the technology. It stated, “O&M costs have been much higher than expected. Several expensive capital improvements have been required, and more renovation is in progress and planned. Fortunately, there

have been no station reliability impacts.”

And reliable is now a term oft-used to describe Polk 1, Hornick said. The growing pains of the late 1990s are history. “Polk 1 is an integral part of our power-generation fleet,” he said. “It is very competitive.” It has an operating heat rate of 9,650 Btu per kilowatt-hour, “which is better than most conventional coal-fired plants,” the NETL reported. Having “put the nail in the coffin” of the challenges accompanying the demo, the plant now runs “as we would expect it to run. Our overall average onstream factor has been 78% and we’ve had years as high as 82%,” Hornick said. “It produced 27 million MW-hours through to the end of 2016. It has more cumulative generation than any other facility in the world.”

In 2000, TECO started adding natural gas-fired units to the facility. Eventually, the IGCC unit was accompanied by four natural gas units. In 2006, Polk 1 celebrated its 10th anniversary. By then established and reliable, it was “typically one of the lowest cost units in our system in terms of incremental costs,” Hornick said “So it dispatches very early in our fleet.” Which begs the question why the natural gas units?

Hornick said due consideration of a number of factors ensured Polk 1 was for a time an only child. “We look at the whole range of costs over the life cycle of the facility,” he said. “You have to use fuel price forecasts for coal and natural gas.” Perhaps equally importantly, constructing a syngas plant is almost prohibitively expensive, a recurring reality illustrated by Polk’s sister plants. “We did look at building one similar to Duke Edwardsport back in the mid-2000s,” Hornick said. “We actually changed our mind when we saw that the capital costs were getting higher. We decided to do a natural gas unit instead.”

All-in launch and demo costs were summarized in TECO’s 2000 report. “The direct cost for a new single train 250-MW IGCC plant on the Polk site in Polk’s current configuration incorporating all the lessons learned would be about \$1,650/kW.” The report added that fully implementing the lessons learned could shear off 20%. However, Hornick said, those numbers would now need to be adjusted for inflation, if not for the lessons gleaned in the 16 years since.

Nonetheless, both the NETL and TECO describe Polk 1, and IGCC in general, as



Duke Energy’s Edwardsport IGCC Project, above, with two gasifiers and engineered for eventual carbon capture for EOR, replaced a 160-MW pulverized coal-fired plant and came online in 2013. (Photo: Duke Energy)

“efficient” and cost-effective. Once built, debugged and perfected, Polk 1 proved the “technical viability of the technology if not the economic viability,” Sarkus said. “The plants are more expensive in terms of capital costs and operations and management costs.”

Inflated costs can be a demon difficult to exorcize.

Trials, Tribulations, Turnarounds

The cheapest lessons are those learned second hand. In that spirit, TECO shared experiences and ideas with Duke Energy, parent company of the Edwardsport, Indiana, IGCC project. “The learnings from Polk were transported into a lot of what Edwardsport has done and what GE did with that design. They added some things that were different and a little more complex,” Hornick said. “We help each other out. They’ve learned some stuff from us and we’ve learned some stuff from them.”

Edwardsport came online in June 2013 and on paper gasifies 1.7 million-1.9 million tons of coal per year in generating 618 MW of base load electricity, according to the NETL. “It is based on the GE Energy ‘Reference Plant’ design; main units consist of two GE gasifiers in parallel, two GE 7FB combustion turbines in parallel (232 MW each), and one GE steam turbine (320 MWe),” the NETL reported. “The IGCC plant replaces a now demolished 160-MW coal-fired power plant at the site. The new IGCC plant is cleaner than the old plant while providing more power; SO_x, NO_x, and particulate emissions are well under new source limits.” The plant was designed to later enable carbon capture. What it did in the beginning was enable controversy.

First there were cost overruns. The original price tag was set at \$1.9 billion but incrementally levitated to \$3.5 billion. Next the environmentalists circled, wanting to reveal the government’s hand in the game. Finally, there was scandal, as government officials were terminated over ethics charges and company personnel were fired over mismanagement and conflicts of interest. Most recently, the company settled in court to, among other things, refund customers \$87.8 million.

The first couple of years were plagued by technical difficulties, preventing the plant from operating at expected capacity for the majority of the time. However,

that appears to be history as the plant has achieved some goals that bode well for the future, spokeswoman Angeline Protogere said. “In August when it was hot and power was in demand, the plant’s gasifier had an availability level of about 90%,” she said. “Also during the cold weather of February 2016, the gasifier had an availability of 100%.” Further, the site “has completed a record run of 97.8 days on a single gasifier

(Train 1), and a record run of 63.8 days of dual gasifier operation,” Protogere said. Mississippi Power’s Kemper County Energy Facility, which was declared “operational” in early January, has trodden a similar path. It is the largest IGCC power plant in the world, making its debut a first. It is situated on a coal mine with estimated reserves at 4 billion tons, and “will convert 12,000 tons of local Mississippi low-rank



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coal per day to produce 582 MW (net) of electricity,” the NETL reported. The new plant will utilize Transport Gasifier (TRIG) technology developed jointly by Kellogg, Brown, & Root and Southern Co., and is suitable for the local lignite resources. The two gasifiers will operate in air-blown mode. The byproducts will be sold to offset costs. The CO₂ captured will be sold and used for EOR.

The plant is comprised of 2,500 miles of cable, 175 miles of pipe and 40,000 tons of structural steel, CEO Anthony Wilson said at Power-Gen International, where Kemper was awarded for its carbon capture operation.

Construction on the plant started in December 2010 and at times, according to headlines, appeared it would continue indefinitely. When it finally went live, it was more than a year behind schedule and over budget by more than 300%. The plant’s original 2006 price tag was \$1.8 billion; 10 years later the IGCC plant capex costs almost touched \$5.56 billion. Kemper had to pay back \$130 million in federal tax credits after missing a May 2014 deadline to start commercial production. The plant repeatedly had to rebuild sections of infrastructure and eventually lost the backing of the South Mississippi Electric Power Association. Throughout this, it maintained a high profile. Prior to taking the Whitehouse, President Donald Trump reportedly inspired Congress to consider expanding tax breaks to players in the

energy sector. Coverage specifically mentioned Kemper as a plant in need.

“We’ve had our challenges,” Wilson said. “Any time you do something that is the first of its kind at this scale, you are going to face adversity.” In line with the company’s history, Mississippi Power has turned things around, and the gasification plant is “competitive with any units on our fleet,” he said.

Like Polk, Kemper has the attention of energy companies worldwide for a couple of reasons. “Kemper will be the largest source of captured anthropogenic or manmade CO₂ from a generating plant anywhere in the world,” Wilson said. “It is massive.” Wilson said he is most proud of the plant’s worker health and safety record. “Over that six-year period, we have had zero recordable injuries.”

Asian and Eastern European energy companies in particular are tuning in to Kemper. “Our company has signed five MOUs and one letter of intent with foreign utilities who understand that the answer to coal’s future could very well be in this technology,” Wilson said. “Many of them, China, Eastern Europe, have very large deposits of lignite, and they see this technology as a possible way for them to become energy independent.”

Indeed, China and Poland are reportedly deeply interested in coal gasification technologies. The countries combined have more than 500,000 megatons of lignite reserves, which is less than half of

what the U.S. has. And, more importantly, they don’t have easy access to the glutted American natural gas markets. To state the obvious, almost anywhere outside the U.S., Canada and certain Eurozone countries, gasification technology is ascendant. Prior to fracking, it almost had a bright future here.

Back to the Future

IGCC harks back to a different era. For a society with huge coal reserves trying to prevent acid rain, it was the technology of the future. “It has a great environmental profile in terms of clean air emissions. It also produces a hard and vitreous slag that is relatively inert in terms of the solid products that come out of it,” Sarkus said. An IGCC plant also consumes one-third less water than a conventional coal-fired power plant. “Those things are all going to be more important going forward into the future,” he said.

However, he said, there is a point of diminishing returns for fuel costs, he said. “A lot of people think that IGCC can become a winner economically if natural gas prices were in the range of \$6-\$8 or more per million Btu.”

Hornick agreed. “If coal is less expensive than natural gas, you’ve got it made because you have a good efficient process,” he said. “If carbon capture is required and coal prices are relatively low with respect to natural gas, then IGCC would be something that would be competitive.”

And that’s in a ideal world, where ramp-up of an IGCC plant occurs on time and under budget, and where initial operations face few technical difficulties, they said. “Reality is, we’re over half way there,” Sarkus said.

“Many years ago, one of the former directors of NETL came and asked when is IGCC going to be purely commercial? How many of these are we going to have to build with government assistance until industry takes and runs with it. At that time my answer was at least 20,” he said. “Where are we today? We’re at about 12, compared to thousands of pulverized coal combustion units. I think you have to temper your expectations a bit.”



The biggest IGCC power plant in the world, Mississippi Power’s 582-MW Kemper County Energy Facility, above, features two gasifiers and captures CO₂ for enhanced oil recovery (EOR). It was reportedly operational in January. (Photo: Mississippi Power)

Russell, J. (2011, January 29). Contractor Says Duke Took Risks at Plant. The Indianapolis Star. Retrieved January 19, 2017, from www.ncwarn.org/2011/01/contractor-says-duke-took-risks-at-plant/.

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NEW INITIATIVES LAUNCHED TO IMPROVE COAL-FIRED POWER

Recognizing the benefits of coal-fired power, the industry takes advantage of technical attention coming from several different directions

BY STEVE FISCOR, EDITOR-IN-CHIEF



Dynegy's Coffeen plant was recently recognized as one of the nation's best coal-fired plants.

While much of the mainstream media has been distracted by renewable energy, the coal business has quietly continued to consistently provide low-cost power from a relatively small footprint. They do so more cleanly today than they ever have. Still, when a power provider opts for new coal technology, they are usually referred to as a group that is bucking the low-carbon trend. After being the target of environmental activism for more than 40 years now, the coal-fired power segment gets that, but they also deserve some respect.

Last year, a total of at least eight coal-fired plants were recognized as leaders in their respective fields. Sadly, the general public never received that news. Even long-time *Coal Age* readers might be surprised to learn about some of the recent activities taking place among coal-fired powerproviders. GE, for example, has launched a major campaign to reduce emissions from existing coal-fired power plants. Rather than closing them, they are suggesting that

they be retooled with the latest upgrades.

What follows is a collection of some of the more positive stories from the coal-fired sector that have been announced in the last six months or so.

America's Finest

During December, five U.S. coal-fired power plants were recognized for top environmental performance with the 2016 Peabody Energy Clean Coal Awards. Honors were determined based on data available from the Environmental Protection Agency (EPA) for the lowest sulfur dioxide (SO₂) and nitrogen oxides (NO_x) emissions rates in addition to the best efficiency (as measured by heat rate), which results in a lower carbon footprint. Starting this year, the company also presented awards to industry pioneers advancing modern, large-scale carbon capture, use and storage (CCUS) projects. Honoree selection for the new awards followed a comprehensive review process by an independent panel of CCUS

subject matter experts.

"Peabody has advocated clean coal technologies to reduce carbon and other emissions for nearly two decades, and we are pleased to shine a bright light on the quality work being done in the U.S. to advance high-efficiency, low-emissions generation and low-carbon systems," said Peabody Energy President and CEO Glenn Kellow. "Our 2016 winners showcase the tremendous environmental success achieved today and the progress toward large-scale carbon capture technologies we believe are essential for society's carbon goals." The honorees included:

Dynegy's Coffeen Plant — Honored for the best SO₂ emissions rate among U.S. coal plants, the Coffeen plant has a SO₂ emissions profile that is 99% better than the U.S. coal fleet average. The 915-megawatt (MW) power plant operates in central Illinois and is more than 50 years old. The Coffeen plant uses low-sulfur Powder River Basin coal and added a wet scrubber in 2009.

Southwestern Electric Power Co.'s John W. Turk Jr. Plant — Honored for the best NO_x emissions rate among U.S. coal plants, the Turk plant has a NO_x emissions profile that is 79% better than the U.S. coal fleet average. The 600-MW ultra-supercritical power plant was built in Fulton, Arkansas, by SWEPCO, a subsidiary of American Electric Power, and began commercial operation in 2012.

Longview Power's Longview Plant — Honored for the lowest heat rate among U.S. coal plants, the Longview plant operates at a level of efficiency 15% better than the U.S. coal fleet average. Longview's best-in-class heat rate of 9,003 Btu per kilowatt-hour in 2015 continues to improve, and the company's current efficiency performance is on track to be well below 8,900 Btu per kilowatt-hour. The 705-MW supercritical

power plant located in Madsville, West Virginia, was commissioned in 2011.

Mississippi Power's Kemper County Energy Facility—Honored as Carbon Capture, Use and Storage Pioneer, the 582-MW Kemper facility located in Kemper County, Mississippi, employs Transport Integrated Gasification technology that is expected to reduce CO₂ emissions by 65%. Judges applauded the facility's innovation in the areas of ash removal and CO₂ separation, noting “the technology holds great promise for future new electric power plants.”

NRG Energy and JX Nippon Oil & Gas Exploration's Petra Nova Carbon Capture Project—Honored as Carbon Capture, Use and Storage Pioneer, the Petra Nova project (see Carbon Capture, p.22) demonstrates commercial-scale deployment of post-combustion carbon capture and is designed to capture approximately 90% of CO₂ emissions from a 240-MW equivalent slipstream of flue gas from the W.A. Parish plant in Thompsons, Texas, southwest of Houston. Judges commended the project's innovative capture technology, observing that it “represents the first large-scale retrofit of an existing coal-fired power plant.”

Today's high-efficiency, low-emissions (HELE) coal-fueled generation includes multiple technologies capable of reducing the vast majority of SO₂, NO_x, particulate matter, mercury and other emissions. Advanced HELE technologies result in a smaller environmental footprint, achieving as much as a 25% reduction in a plant's CO₂ emissions rate. Longer-term investments in next-generation carbon capture technologies are widely recognized as essential to meet long-term global climate goals.

The Peabody Energy Clean Coal Awards program was established in 2014 to recognize leadership and improve awareness about the benefits of clean coal technologies. Peabody believes coal will continue to be an important part of the world's energy mix, and responsible use including further deployment of advanced coal technologies can help achieve energy security, economic growth and environmental solutions.

The World's Best

In 2016, *POWER* recognized three very different coal-fired power plants: Mátra power plant, Visonta, Hungary; National Capital Power Station Dadri, Gautam Budh Nagar, Uttar Pradesh, India; and Tanjung Bin Ener-

gy power plant, Johor, Malaysia. They were located in very different regions, climates, and political and economic environments, and they deploy diverse state-of-the-art technologies to address both unique and global challenges.

When one thinks about innovation at power plants, they may not immediately think of Hungary, but the country's largest coal-fired plant introduced several unique approaches and was among the first to employ a water-wise ash-handling system. The Mátra power plant's commitment to continual improvement is also seen in the addition of biomass fuel and a solar facility.

The noteworthy aspects of the Power Station Dadri, one of the largest in coal-dependent India, included consistent high-performance ratings, as well as newer improvements such as an innovative solar thermal system that supplies some of the site's energy needs.

Malaysia has been bucking the fuel transition trend as it adds coal-fired capacity, it is deploying the most efficient technology plus pollution controls. The Tanjung Bin ultrasupercritical project came with an extra-challenging site but still met its schedule and budget.

GE Launches Center of Excellence

During March, GE announced its new global Powering Efficiency Center of Excellence (COE), which brings together cross-business experts in its energy businesses to

apply a total plant hardware and software solution approach to boost the efficiency of the world's new and existing coal-fired power plants and significantly reduce their emissions. The global COE, headquartered in Baden, Switzerland, will create integrated solutions as well as provide vision and oversight around the world. Regional teams will focus on engineering capabilities and local execution.

“By bringing together the combined experience of a cross-business group of experts from GE's Power Services, Steam Power Systems, Global Research Center and Global Growth organizations, we are showing operators how they can achieve emissions compliance and increase efficiency with their new and existing coal-fired power plants” said Michael Rechsteiner, executive sponsor of the global COE and vice president of product lines for GE's Power Services.

The COE aligns with GE's recent study that found carbon dioxide (CO₂) emissions from the world's steam fleet can be reduced by 11% when existing hardware and software solutions are fully applied. Coal-fired power generation provides electricity for about 40% of the world. It also accounts for nearly 75% of the electricity sector's carbon emissions because many plants are older and inefficient.

“While GE supports the increased use of renewable energy sources, we also realize the need for flexible and efficient coal



Russell Ray, chief editor of *Power Engineering* magazine, presents David Greeson, NRG Energy's vice president of development, and Takeo Tanei, vice president of JX Nippon Oil & Gas, with a 2016 Peabody Energy Clean Coal Award for Carbon Capture, Use and Storage Pioneer.

solutions to help to reduce emissions and bring reliable energy supplies to power producers,” Rechsteiner said. “GE has a suite of steam upgrades and emission management technologies that, when combined with our digital technologies, can increase efficiency on average by 4%.”

The newest coal plants being built using GE’s ultra-supercritical technology can deliver up to 49% efficiency rates — significantly higher than the global average of

33%. Every point of efficiency reduces operating costs over the lifetime of the plant while also reducing CO₂ emissions by approximately 2%.

Modern coal-fired power plants rely on a complex network of sensors, digital controllers and supervisory computers to operate and coordinate plant subsystems. GE’s digital capabilities and portfolio of air quality control systems can help further lower atmospheric emissions to meet or exceed

the world’s strictest regulations.

In addition, the Powering Efficiency COE will provide a set of financing solutions to help customers develop transformative projects toward a lower carbon intensity power generation mix.

In addition to the global COE, regional organizations — starting in India — will help ensure real-time answers to meet coal power plants’ local needs.

“Our initial focus is in India due to the country’s explosive energy demand projections,” said Ashok Ganesan, leader of the Powering Efficiency COE and GE’s Power India Ltd. managing director. “The overall efficiency of the existing power plant fleets, particularly the country’s aging coal-fired plants, is still relatively low. Our regional team in India is ideally suited to demonstrate the full potential of the Powering Efficiency COE to help the country’s coal plants operate more efficiently and reduce emissions.”

The first project showcasing GE’s Powering Efficiency COE commitment in the country is with India’s largest utility, NTPC Ltd. The utility selected GE to help increase the efficiency of three, 200-MW Ansaldo steam turbines installed more than 30 years ago at the Ramagundam Super thermal power plant in the state of Telangana. GE will help NTPC improve the efficiency of each steam turbine by up to 1%, increase plant output by approximately 30 MW, as well as reduce its carbon footprint by approximately 5%.

The project includes the Enhanced Steam Path (ESP) upgrade solution to help NTPC boost the efficiency and output of its power plant. The ESP was the first upgrade solution introduced to customers that blended GE and Alstom thermal power generation service technologies following the integration of the two businesses.

Upgrades Could Cut Global CO₂ Emissions by 1 Billion Tons

During December, GE released an analysis of global power plants, which found that carbon dioxide (CO₂) emissions from the world’s fleet of coal and gas plants can be reduced by 10% — the equivalent of removing 95% of cars off U.S. roads — when existing hardware and software solutions are fully applied. The analysis is the first to quantify the emission reductions of using existing technologies to upgrade the global

CARBON CAPTURE SYSTEM GOES LIVE IN TEXAS

Partners NRG Energy and JX Nippon announced in early January the completion of Petra Nova, the world’s largest post-combustion carbon capture system, located in Bend County, southwest of Houston. The project, heavily subsidized by the federal government, was reportedly completed on time and on budget.

The system is expected to capture 90% of the CO₂ from the 240-megawatt (MW) slipstream of exhaust flue gas from a pre-existing coal-fueled electrical generating unit and pipe it 80 miles for use in extracting oil from West Ranch field wells. The patented process, with a scrubber made by Mitsubishi, “employs a proprietary ... high-performance solvent for the CO₂ absorption and desorption,” NRG reported.

The plant reportedly will capture more than 5,000 tons of CO₂ per day, which, NRG stated, “is the equivalent of taking more than 350,000 cars off the road.”

The West Ranch oil field, jointly owned by NRG, JX Nippon and operator Hilcorp, is anticipated to up production from 300 to 15,000 barrels per day using the plant’s CO₂. The process is dubbed enhanced oil recovery (EOR). During the testing period, which closed December 29, more than 100,000 tons of captured CO₂ was delivered to the oil field.

Previous reports stated Houston’s NRG and Tokyo’s JX Nippon each shelled out \$300 million for the project. The former received almost \$200 million from the government. Approximately \$167 came from the U.S. Department of Energy’s (DOE) Clean Coal Power Initiative. The DOE contributed another \$23 million under Section 313 of the Consolidated Appropriations Act of 2016. JX Nippon secured loans from Japan Bank for International Cooperation and Mizuho Bank to the tune of \$250 million.

Construction began in 2014. “At peak construction, more than 500 people were working on the project,” NRG reported.

Similar predecessor systems include the Boundary Dam Power Station in Saskatchewan, Canada, which went online in 2014. It had reportedly captured 1 million metric tons of CO₂ as of July 2016. Most of it was used for EOR.

Critics report the system is up against both

relatively inexpensive natural gas for power generation and relatively low oil prices. Advocates report the project’s success shows existing units can be modified to be competitive with natural gas units. “By being built on an existing coal unit, Petra Nova shows an economic path to make existing and new fossil fuel plants significantly more environmentally viable as we transition to more sustainable energy future,” NRG said.

The company is an independent power producer and operates in a competitive market. Prices and service can dictate whether customers will renew their contract. For calendar year 2016, the company reported raw earnings of \$3 billion, but a net loss of \$891 million.

To save money and cut greenhouse gas emissions, the company reportedly completed four coal-to-natural gas projects at four separate power stations in 2016. “The successful introduction of natural gas replacing coal as the primary fuel allows these units to continue meeting customer needs while complying with current environmental standards and supporting NRG’s wider decarbonization efforts,” NRG reported. “Collectively, the modified units can generate more than 2,780 MW, enough power to meet the demands of more than two million average homes.”

The four modified units were at the Big Cajun II Generating Station in Louisiana; the Joliet Generating Station near Chicago; the Shawville Generating Station and the New Castle Generating Station both in Pennsylvania.



Sixteen-foot diameter ductwork takes flue gas from the coal plant to the carbon capture facility where the CO₂ is removed from the flue gas. (Photo: NRG)

fleet of coal and gas-based power plants.

“The technology to make coal and gas more efficient is available now — countries and companies alike should be taking advantage of this to lower their carbon output,” said Deb Frodl, global executive director, Ecomagination, GE. “These actions should be taken as a complement to continued investment in renewable energy sources as we all strive to find carbon reductions across the energy mix.”

GE used a proprietary set of data for each coal and gas-fired plant in the world to uncover potential opportunities to improve plants’ heat rate and lower carbon emissions. The analysis comes as countries around the world are looking for climate saving solutions that will help them transition to a lower carbon energy future.

Potential for Coal Plant Upgrades

- Coal power plants could be made approximately 4% more efficient with 2.5% in efficiencies coming from turbine and boiler upgrades, and 1.5% coming from software improvements;
- The analysis also found that applying all potential upgrades to coal power plants can remove 900 million metric tons (mt) of CO₂ (11% of total coal power emissions); and
- China (296 million mt CO₂) and India (143 million mt CO₂) are two countries with big opportunities in the coal power sector.

Potential for Gas Power Plant Upgrades

- Similarly, GE’s analysis estimates that gas-fired power plants could be made approximately 3.3% more efficient with 1.8% coming from hardware upgrades and 1.5% coming from software improvements. These savings could reduce global gas power emissions by 203 million mt or 8.8%; and
- Russia (45 million mt) and the U.S. (34 million mt) are two countries with big opportunities in the gas power sector.

“Our goal is to provide technology solutions that best meet the needs of our customers and help reduce emissions,” said Paul McElhinney, president and CEO, GE Power Services. “Globally, carbon emissions from coal and gas-fired electricity generation can be reduced by 10% annually, and GE’s software and hardware upgrade solutions can help make this a reality with moderate investments in the installed base.”

According to the International Energy Agency (IEA), approximately 41% of glob-

al electricity generation comes from coal-fired power plants and 22% comes from gas-fired power plants. The IEA estimates that both fuels will see increased use over the next decade. For markets with significant energy needs and coal reliance, like China and India, upgrades to power plants can help provide cleaner energy options and help countries make progress toward their climate goals. With natural gas playing an increasingly important role in many

markets around the world, there is also great opportunity to ensure that it too is being utilized as efficiently as possible.

In response to the findings, GE has set up a dedicated team to provide customers with holistic software, hardware and financing solutions for coal plant upgrades. Additional findings from GE’s *Global Power Plant Analysis* include:

- Upgrades to the entire global coal fleet can save 494 million mt of fuel globally on



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an annual basis.

- In the European Union, where there is a goal to reduce emissions 40% by 2030, these solutions can help drive efficiencies from coal reliant countries like Poland where coal accounts for 80% of electricity generation.
- In Africa, South Africa has the biggest opportunity for fuel and carbon savings (23 million mt) coming from upgrades in the coal power sector.

To learn more about GE's *Global Power Plant Analysis*, visit www.gereports.com/ge-power-plant.

First Fully Commercial Plant Launches, Captures CO₂ at \$30/mt

During October 2016, Carbon Clean Solutions, a leader in CO₂ separation technology, launched a new project that will see more than 60,000 mt of CO₂ captured from a 10-MW coal-fired power station based near Chennai, India. Post-startup, the power station is set to become a zero-emission plant.

The ground-breaking project, believed to be the first of its kind, is privately financed and will capture CO₂ at just \$30 per/mt — much lower than the \$60/mt-\$90/mt capture costs typically observed in the global power sector.

The captured CO₂ will then be used by Indian firm, Tuticorin Alkali Chemicals & Fertilizers (TACFL), for soda ash production.

Aniruddha Sharma, CEO at CCSL, said, “This project is a game-changer. By capturing and crucially, reusing, CO₂ at just \$30 per/mt, we believe that there is an opportunity to dramatically accelerate uptake of CCU technology, with its many benefits, around the world. This is a project that doesn't rely on government funding or subsidies — it just makes great business sense. We are delighted to be partnering with TACFL to make this project a reality.”

This announcement comes following the successful completion of CCSL's pilot testing program at Technology Centre Mongstad, the world's largest and most advanced facility for testing and improving CO₂ capture, in May 2016.

The pilot yielded results that showed that use of CCSL's solvent dramatically reduced emission levels and lowered corrosion, while improving system reliability. In related news, CCSL appointed Will Shimer to run the firm's North American operations from Chicago.

GE Upgrades Polish Power Plant

Highlighting its growing portfolio of solutions to help support the long-term role of Poland's coal-fired power plants in Europe's energy mix, GE's Power Services business will modernize one of three Zamech-made turbine-generator sets at Veolia Energia Pozna ZEC SA, a 275-MW district-heating plant.

“We are pleased to select GE to help us

increase the efficiency and output of our steam turbines,” said Jan Pic, member of the board and operational director of Veolia Energia Pozna ZEC. “This project will help the station operate more efficiently, as we want to strengthen our position in a very competitive environment.”

The Veolia Energia Pozna station features one, 65-MW Zamech unit and two, 105-MW Zamech units. GE plans to increase Unit 3's output by up to 6 MW (the extra power will be sent to the local grid) and also improve turbine efficiency by up to 6%. Additionally, to improve the turbine's operational flexibility, during periods when there is no demand for electrical power, the operator will be able to disconnect the low-pressure (LP) part of the steam turbine while it is in full district-heating mode. This will allow the operator to use thermal power for the preheating of district-heating water only.

“When GE acquired Alstom Power's technology portfolio in 2015, it absorbed the ability to service generation equipment from other manufacturers, including the Zamech turbines installed at the Veolia Energia Pozna station,” said Pascal Schweitzer, general manager of GE's Power Services business in Europe. “Our coal business is well-positioned to respond to future energy needs. We have one of the highest-efficiency, lowest-emissions technologies coupled with our digital solutions, and we are excited to help position Veolia to remain competitive and ‘win’ with its existing fleet.”

Veolia in Poland, which is one of the leading providers of services in the areas of energy, water and wastewater as well as waste management, is present in 74 towns and cities including Warsaw, Łódź and Pozna. The company is the largest private operator of district heating networks across the country. It also is Poland's third-largest cogeneration plant operator.

For the past 15 years, GE has maintained and serviced Veolia's steam turbines to provide cost-effective performance improvements. During this time, GE has performed numerous major inspections and modernizations of the facility's generating equipment. The steam turbine modernization outage at the Veolia Energia Pozna station is expected to start in May, and the commissioning of the upgraded equipment is scheduled for August.



GE will upgrade one of three turbine-generator sets at Veolia Energia Pozna in Poland.

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Session I: Improving Operations Optimizing Slope Angles with Controlled Blasting, Slope Monitoring, and Good Communication

Keith Taylor, Sr. Geotechnical Engineer, Freeport-McMoRan

Is Bigger Still Better? Considerations for increasing size of haulage equipment

By M. Dotto, T.G. Joseph, M. Curley

Equipment selection is one of the most important decisions made in mine planning. This study analyzes hauler scale impacts on aspects not currently incorporated into conventional mine planning, including expansion of roads to accommodate larger equipment, road layer thickness variation depending on hauler size, and fuel consumption and emissions.

The Critical Link Between Loader Productivity, Operator Performance and Mining Costs

By Andrew Jessett, CEO, MineWare

This presentation explores the critical link between loader productivity, operator performance and the overall cost of mining as far as:

- Performance of material loading assets heavily influence the success of the downstream mining processes;
- Why inefficiencies on the front end have dramatic repercussions to the overall value stream; and
- Why the variation in performance between operators on loading equipment will continue to significantly affect the success factor for the whole load-and-haul process.

Improving Ingress/Egress Systems on Mobile Equipment

By William L Porter & Jonisha P Pollard; National Institute for Occupational Safety and Health (NIOSH), Pittsburgh Mining Research Division

Slips and falls from heavy mobile equipment commonly occurring during the ingress/egress process with root causes being largely unknown. The NIOSH Mining program conducted research to determine injury mechanism and equipment characteristics associated with front end loader ingress/egress injuries. This work included reviewing injuries reported to MSHA and identifying the elements of the system that equipment operators feel create difficulty while getting on or off of their equipment.

Use of Lighting Technology on Mobile Equipment

By Yazhi Fletcher, Chief Technical Officer, Phoenix Lighting

In an industry that continues to stress the importance of efficiency, LED lighting is opening up a whole new world of options. Companies are able to utilize their resources like never before while gaining productivity and cost benefits from technology. LEDs offer numerous benefits to the operation needs of the surface mining industry. They are more durable than traditional lighting, dramatically decrease energy expenses, and virtually eliminate maintenance.

Session II: Haulage Strategies Bringing New Life to DC Haul Trucks with an AC Retrofit Package

By Ben Balbech, Heavy Industry and Power Systems Manager, Flanders

With custom designed AC wheel motors built into the DC motor frames and a high performance liquid cooled IGBT drive package that drops into the existing DC drive footprint, old DC haul trucks can now meet or exceed the capability of modern AC haul trucks. An all new, open, flexible, industry-standard control package makes troubleshooting and diagnostic simple. Advanced traction control with a virtual limited slip rear differential greatly improves truck tracking in slippery conditions.

Mine Haulage Simulation: A Tool Towards Managing Uncertainty

By Hooman Askari-Nasab, Mohammad Tabesh, and Shiv Upadhyay

A mine and extraction simulation operational planning tool with Excel input/output interface and automated reporting has been developed, validated and used as part of the short-range planning of a large-scale oil sands open pit operation in Canada. The simulation tool takes the production schedule as an input and imitates the truck-shovel haulage-systems and its interaction with the extraction plant including crushers and downstream assets. The simulation tool accurately reported the major system's KPIs at 95% level of statistical confidence within 3% accuracy of the historical dispatch data for the project. This tool gives the planner capability to assess the impact of changing operational scenarios such as stockpiling, different sizes of mixed-fleet trucks, and introduction of new haul-roads into to the mine plan. Normalized results of the project will be presented.

Can 'Big Data' Answer the Big Question: How Do My Haul Roads Perform?

By Roger Thompson, Professor of Mining Engineering, Curtin University, Western Australia School of Mines

Much has been made about the potential of big data to transform mining and how to capture, evaluate and share this information with those decision makers that value the data. While the amount of data available from operations and equipment is increasing, only a fraction of its full value is currently being extracted.

Coordinated Operator Training

By Graham Upton, Director of Business Development, Doran Precision Systems

Simulator training reduces accidents and provides efficiency for mine operations. Typically, simulators train one operator at a time for particular operations, whether it be haul truck, shovel operator, or other equipment operator training. A new approach allows operators of two or more vehicles to be fully integrated, immersed, and coordinated within a training scenario. Using multiple simulators, one instructor can train several operators at a time.

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Session III: Fleet Management Innovative Information Mining: Fleet Optimization

By Lia Walker, Quality Leader, Freeport McMoRan

Advancements in technology have presented an opportunity to gain insights into business and drive efficiencies. Big Data solutions, characterized by large volumes of data that have a wide variety of data types and must be processed at a high velocity, cannot be processed by traditional means. Building on advanced BI and IoT capabilities, the Freeport McMoRan strategy includes developing and implementing a technical solution combined with integration with the business operations to achieve results.

How Big is Too Big?

By Craig Griffiths, Manager Customer Solutions, Volvo Construction Equipment
Mines and quarries around the world are limited by capital available and the deposit's potential. Quarterly reporting often loses sight of the objective: to sustainably extract the resources available. Operations chasing NPV, IRR while missing the fundamentals of economics can kill a company. Deferring capital expenditure (cash flow) is a fundamentally sound management program for operations. To lose potential cash flow while maintaining a sound bankbook, can be the most economical sound solution for an operation.

Analysis of New Truck Fleet and Improvements in the Load Times Supported by Simulation

By Maikol G. Vega, Mining Services, Modular Mining Systems

The use of real time data obtained from a fleet management system allows engineers to include representative input parameters in the simulation process. This paper presents the simulation of a large open pit coal mine, using a haulage simulation software. The study includes the impact analysis of improvement in loading times and the use of double-side loading, the decrease in the variability of the number and time for each pass.

Turning Erdenet's Data into Dollars

By Job Del Rosario, Business Solutions Manager, Micromine Americas

This presentation is based on a case study involving the Erdenet Mining Corp. (EMC). Finding ways to reduce mining costs and improve efficiency while working complex ore bodies has been a challenge for EMC, a large Asian copper miner. They decided to face challenges by introduction of technology and strengthening employees' technology skills.

Fleet Maintenance Solutions: Air Pre-cleaner Kits Reduce Costs and Increase Performance

By Jill Frederick, Centri Product Manager, DRM Diversafab

In a climate of volatile commodity prices, mining companies must proactively cut costs without slashing workforce and production. Centri Pre-cleaners recently introduced an air pre-cleaner kit for haul trucks to replace inefficient and exhausted OEM air cleaners. Use of the kits result in decreased air filter usage, reduced fuel consumption, increased production, decreased downtime and reduced recordable incidents.

Session IV: Loading Techniques Hydraulic Excavator vs. Rope Shovel Performance

By Rodion Andreev, Tim Joseph, John Sammut, and Mark Curley

An analysis of dig performance for a hydraulic excavator versus an electric rope shovel of similar size class was performed in terms of the energy required to excavate a unit quantity of the same material from a mining face. The outcome of the analysis was that the energy per unit excavation quantity of rope shovels and hydraulic excavators are in fact identical. But this does not represent the total picture driving the selection of one excavating tool over another. The total 'cost' of ownership including capital, sustaining capital, operating and maintenance costs, time, availability and utilization must also include the qualitative decisions regarding mining method and the mode of application.

Improving Truck-and-Shovel Utilization with a Surge Feeder

By David Pitchford, President, MMD Mineral Sizing (America)

Typical truck and shovel operations have "start/stop" operations; shovel loads a truck and then waits for the next truck to back into a loading position. Mine production is totally dependent, in terms of volume, on the efficiency of that loading method. MMD offers a system that allows the shovel to load continuously; size the rock; feed the surge bunker; load the trucks to max capacity; eliminate trucks having to reverse into the loading position and achieves 20%-35% increase in terms of tons per hour over traditional truck-shovel methods.

Shovel-Based Fragmentation Analysis of ROM to Improve Blast Planning

By Tom BoBo, Director of Technical Sales & Marketing, Split Engineering

This presentation will discuss the importance of providing real time fragmentation analysis as an important metric for determining energy factors for each hole and blast. This study presumes the energy factor is primarily determined by rock type, desired fragmentation distribution, and in-situ fracturing. Data collected over time at Asarco Mission Mine in Arizona, USA supports the evaluation of a shovel based PSD analysis system wherein mine blasting engineers use blast patterns in their short-range planning, therefore; the energy input is changed based on the fragmentation analysis.

FREEDOM for Shovels Advancements

By Shawn Rea, Excavators Manager, Flanders

In 2012, FLANDERS installed the Freedom adaptive control system called "Optimized Bank Performance," and the high performance M21 crowd motor—termed Freedom Level 3. A case study was presented at Haulage & Loading 2015 to demonstrate the pre- and post-upgrade performance. FLANDERS has now taken it a step further by installing two high performance M24 hoist motors—this upgraded configuration is termed Freedom Level 7. An updated case study will be presented to outline the performance results of the Freedom Level 7 upgrade.

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USING OPERATIONAL EXPERIENCE TO BETTER ENGINEER PROJECTS

DRA Taggart is looking to expand globally while maintaining its leadership position in North America

BY STEVE FISCOR, EDITOR-IN-CHIEF

Those who witnessed that last major build-out of U.S. coal preparation plants will likely remember that Taggart Global was the engineering firm that led the charge with much of the engineering, design and construction work. In July 2013, Taggart Global, which was having financial difficulties, was acquired by Forge Group, an engineering, procurement and construction management (EPCM) firm based in Perth, Australia, for \$43 million plus an additional \$25 million of potential earn-out payments. Forge's parent company went into administration. One year later, DRA Group Holdings Pty Ltd., a global multidisciplinary engineering group that originated in South Africa and specializes in mining, minerals processing and infrastructure services, stepped forward and rescued what remained of Taggart Global.

The Taggart acquisition added extensive experience in coal preparation and diverse mineral and aggregate handling systems in North America, Africa, Australia and China to DRA's mix. At the time, DRA had offices and operations in nine African

countries, Australia, Canada, China and India. The Taggart business was rebranded DRA Taggart and consolidated into DRA's operations in the Americas.

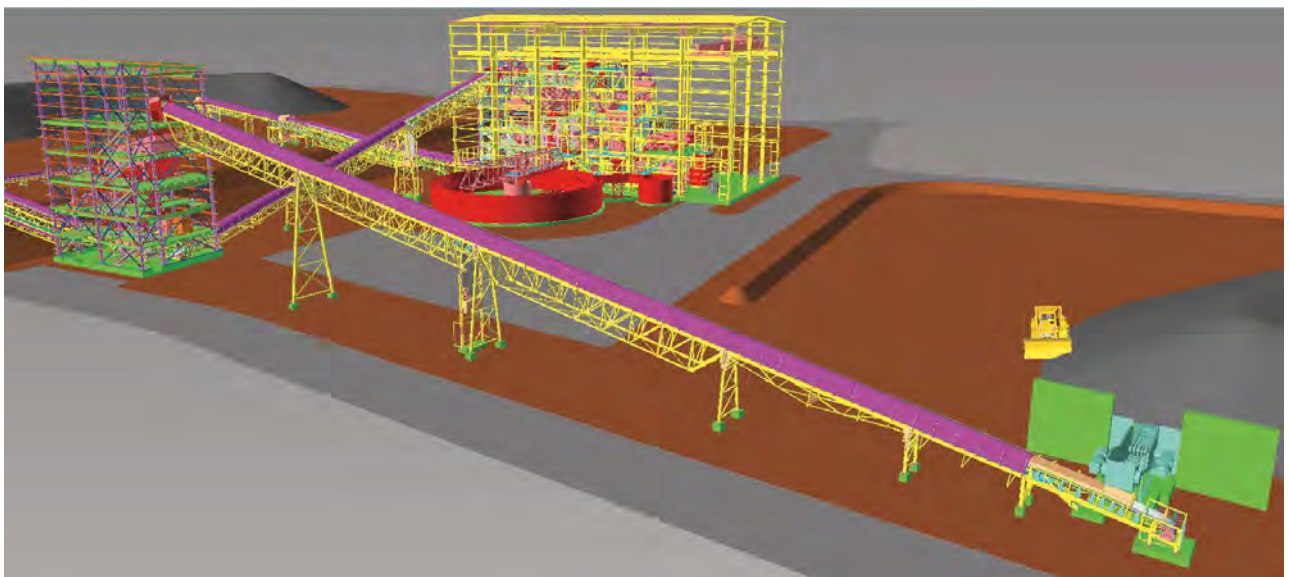
The business climate, especially as it relates to coal mining and processing, forced a lot of companies to readjust their strategies, and DRA Taggart was no different.

Some former Taggart executives in the Pittsburgh office were relieved of their duties last year as DRA initiated an aggressive cleanup campaign. In October 2016, Wray Carvelas was appointed CEO for DRA Group Holdings and he is also an executive director of DRA Group Holdings, based out of the DRA Americas Toronto office in Canada. With a background in process engineering, he spent his formative years at the mines at Anglo Gold and De Beers and then joined DRA as a project manager more than 16 years ago. It's safe to say he has seen the mineral processing business from just about every angle, moving from an operations position to managing projects through to business management and development.

Outside of China, DRA Taggart, together with DRA's global coal experience, is the largest engineering contractor as far as delivering coal handling and preparation facilities. "Combining the two companies doubled our size over our nearest competitor," Carvelas said. "Together we have formidable coal experience around the globe."

The Rebuilding Process Begins

The Taggart business had three components when DRA acquired it: project engineering and construction, coal operations, and energy operations (a Refined Coal Operations business). "The shining star at the time of the acquisition was the Refined Coal Operations business, and it has continued to grow and we are pleased with its performance," Carvelas said. "We needed to steady the ship on the project engineering and construction side of the business. There were some internal management issues and we needed to adjust the business to handle the diminished pipeline of projects and make sure that the business could stand on its own two feet. We reduced the



DRA Taggart designed and engineered the new Donkin prep plant (above) in Nova Scotia.

overhead and we are in the process of rebuilding that business from an aggressive 'right sizing' process that began about a year ago."

Timing is, as they say, everything, and now more coal operators are considering projects again. "We have seen a resurgence in metallurgical coal," Carvelas said. "We are currently working on two execution projects: the Donkin project in Nova Scotia and a significant project in Australia. We are engaging in a number of other coal projects in Africa, USA, Canada and Australia, and we plan to remain the dominant player in this sector."

Securing the Australian project allows DRA to break into the Australian coal sector. "For years, Sedgman had the Australian market wrapped up and this is a big step forward for us," Carvelas said. "It has put us on the map in Australia. We have a few other initiatives under way to build capacity and credibility in Australia."

The Donkin coal project, owned by U.S.-based Cline Group, began producing metallurgical coal in January. Located on Cape Breton, Donkin at one time operated longwalls beneath the Atlantic Ocean. The new Donkin operation is now projected to produce at a rate of about 2.75 million metric tons per year (mtpy) by the close of 2017 using room-and-pillar mining. It has enough crossover met-quality reserves to last for at least 20 years.

"We consider ourselves a global engi-

neering company and a global operations company," Carvelas said. "We offer full life cycle service for a mining facility, not just the project engineering and construction. We get involved early with feasibility and concept studies and follow the project right through to detailed design and detailed engineering and then construction, commissioning and commercial operations, if needed."

DRA currently operates 32 facilities around the globe. "We believe that is a significant differentiator for us," Carvelas said. "Only a few mining companies can say that they operate 32 facilities around the globe. Some of these are coal assets, but others are producing iron ore, platinum, diamonds and gold. The strategy now is to increase the enterprise value by 2020. That means adding business in the Americas and the Asia Pacific region with a key focus on delivering projects that add value for our customers through engineering, construction and operation."

Part of that strategy is to expand the recurring revenue stream from plant operations, which de-risks the business, he added. "We are hoping that more of our engineering and construction projects will lead to operating contracts," Carvelas said. "With our large database of operational experience, we offer unique advantages to mine developers and operators."

DRA has a robust balance sheet, Carvelas explained, and to achieve its 2020 ambitions, partnering and mergers and acquisi-

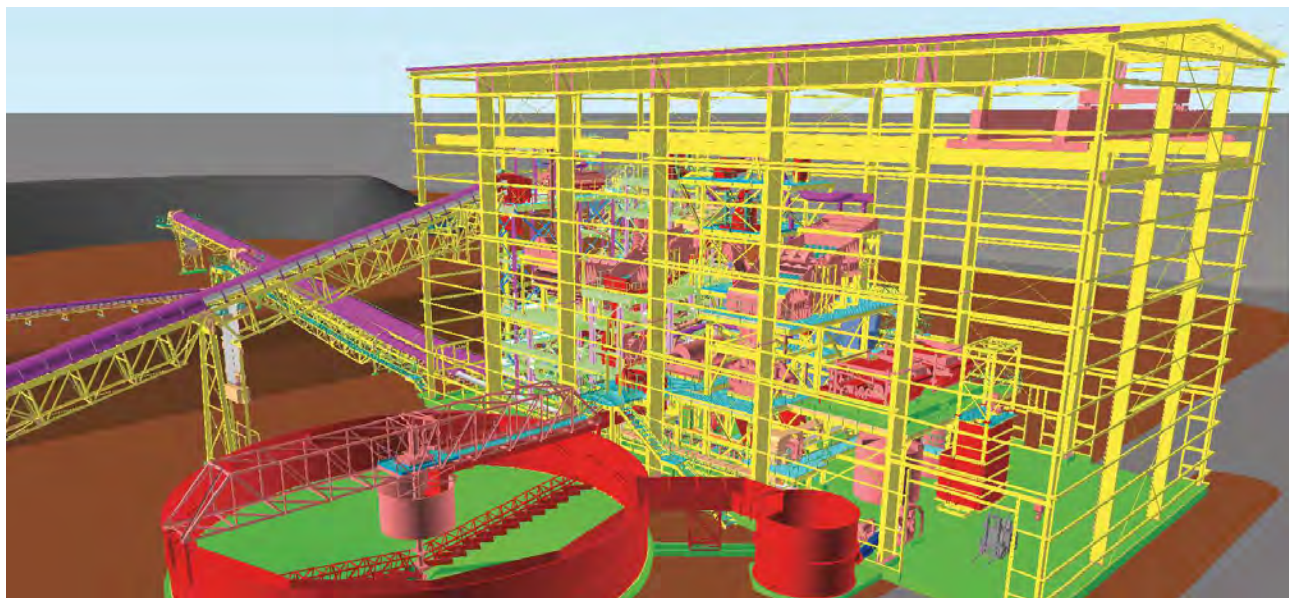
tions (M&A) will be a key part of its strategy. "We are advancing a corporate strategy to identify and negotiate with M&A targets," he said.

Another part of DRA's strategy is also to offer diversified services that support the mining business. "In Central and South America, and parts of Africa, mining projects will not advance without access to energy and water," Carvelas said. "More pressure is being placed on developing and producing clean energy, and we already understand that part of the market. We will soon acquire an engineering firm that specializes in water projects and operations."

Providing Design and Engineering Expertise

DRA developed a popular modular design for many of the plants in Africa. "We find that most clients want a custom-engineered facility, but they do not want to pay for it," Carvelas said. "So, we have the ability to offer a custom modular design. There are some real advantages to this approach, particularly in remote locations, especially when there are time constraints and it's difficult to get equipment to and from the sites. We see opportunities across multiple commodities for modular design and construction, not just coal.

"With a large project, components can be engineered and built in modules, which saves an enormous amount of construction time on site," Carvelas said. He believes that



The Donkin facility, which is under construction now, will produce at a capacity of 2.75 million mtpy by the end of the year.

mines throughout the Americas could benefit from modular design especially in North America where labor can be quite expensive.

DRA takes a deliberate hands-on approach and they want to work with like-minded partners, he said. "We prefer to roll up our sleeves and take ownership of projects as if they were our own," Carvelas said. "Our project teams take ownership from concept to commissioning and commercial operations. The engineer does the design and follows the project and the components through commissioning. We have an ethos in the company of taking complete ownership and we seek partners that can embrace that and have a similar ethos of accounting for every dollar as if it was their own."

Of course, depending on whether it's a reimbursable type project or an EPC turnkey type project, DRA also needs to make sure that it is not taking on undue risk, Carvelas explained. "It's important to understand the partners we work with and their track record and vice versa," Carvelas said. "There needs to be a set of identified synergies and an understanding of how they will be integrated for success."

Success begins at the ground level and Carvelas stresses that investors and owners need to make sure that feasibility studies are conducted properly and followed. "That is the foundation for any project and, if the feasibility study is not followed, the project gets off on the wrong foot," Carvelas said.

Carvelas acknowledged that the mining industry has a bad habit of dusting off old designs for new plants, forgetting that the last project was not optimal, and repeating previous mistakes. "Because we operate so many of the plants we have engineered, we are mindful of not making those mistakes," Carvelas said. "We are actively recycling that operational knowledge back to the engineers to make sure that errors are not repeated."

DRA is seeing a strong push from investors and mine owners to get it right the first time and to make sure the estimates and the schedules are accurate. "Our full life cycle service sets us apart from other engineering firms in that regard," Carvelas said.

The Transition to the Digital Mine

There is a lot of talk these days about the transition to the digital mine, but few people know how to advance that agenda.

DRA has developed a system called Mine Operations Management System (MOMS), which gathers information from pit to port across all technical operating facilities, as well as the ERP and procurement systems, and captures information in one database. "This allows us to optimize business processes and the facility itself," Carvelas said. "We are working very hard to advance the concept of the digital mine. With our large operating database and MOMS, we have the ability to analyze data and predict performance against the original mine mod-

el. We believe this is the next step for the mining business. We are well-positioned to implement our first intelligent mine site. That's quite exciting. It's in the early stages now, but it's high on our agenda."

DRA experienced a slowdown in business and had to work through a rationalization process. It's clear, however, that they not only plan to remain the leaders in the coal space, especially in the eastern U.S., but they plan on being one of the leading engineering firms for minerals processing worldwide.



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JENNMAR SOLVES THE PUMPABLE RESIN RIDDLE

New automated resin injection system should improve safety for operators in weak ground conditions

BY STEVE FISCOR, EDITOR-IN-CHIEF

The ground control specialists at Jenmar have made a major breakthrough. For the last two years, they have been working on a system that will allow an operator to pump resin into the hole from his cabin before he spins the bolt, eliminating the use of traditional resin cartridges. The benefits for the system would be twofold: the bolting machine operator remains in a safe position when the machine is likely in the riskiest location and the automation function will only further enhance productivity.

Similar to others in the mining industry, Jenmar saw activity decrease substantially in the first half of last year. They opted to use that time to advance some of the projects they had on the drawing board and to reinforce sound ground control principles to an industry fraught with

turnover. “We have been working with both the mines and the regulatory agencies as far as roof control training programs,” said Dr. John Stankus, president, Keystone Mining Service, the engineering affiliate of Jenmar. “On top of that, our ground control engineering group has been incredibly busy since the election. Idled mines are reopening and that requires rehab activity with steel supports.” Jenmar makes various steel supports at its Virginia facility, and one of the more popular products is its impact-resistant steel sets for supporting roof fall cavities.

As far as new products and equipment, Jenmar has developed a self-drilling, injectable hollow-bar bolt for yielding ground. The hollow-bar system was designed to work with an automated pumpable resin system (J-Lok P). This ground

control technique combines drilling and grouting as a single operation, ensuring that resin is placed over the full length of the borehole. It is ideal for ground conditions where boreholes collapse.

Working with Signal Peak, which just completed the fifth right panel longwall recovery, Jenmar is looking at ways to improve the full-face recovery system they use with cuttable concrete. “They will likely never perform another recovery any other way, and we are fine tuning that process with cellular concrete compositions and a plan to avoid areas where they do not need to fill the entire entry,” Stankus said. “We have also developed a new type of cuttable crib block for longwalls that have to mine through existing entries.”

Jenmar has also brought the Sumo



The skid-mounted J-Lok P pumpable resin system uses specially developed cylinders as part of the pumping system.



Resin can be injected through these self-drilling, hollow-bar bolts.

cable bolt to North America. “The 62-ton Sumo cable bolt was developed by Peter Craig, Engineering Manager, with our affiliate in Australia,” Stankus said. “It works well for extreme conditions and it should be popular in the West and some of the deeper coal mines in Alabama and Virginia. We used it at Signal Peak, and other western mine operators have shown an interest in it.”

While the early months of 2016 were difficult, Stankus said Jennmar used that opportunity to advance programs in other areas. “That decision has paid dividends because now we are very busy again,” Stankus said. “Everybody was struggling, and some activity started in spring 2016, and then almost the day after the election, business improved dramatically.”

Developing the Pumpable Resin System

“Over the years, many engineers have attempted to develop a pumpable resin system, but none of them succeeded until now,” Stankus said. “We came up with some new ideas and we have several machines in operation. To get to that automated system, where the roof bolter does not have to leave his station to insert a cartridge, especially in the high places out West, that has been a big push for Jennmar. These self-drilling pumpable hollow-bar bolts, which are designated Multiple Point Anchor (MPA), have multiple point-anchor locations that yield under load, will work great for deep mines with high stress.”

This injectable resin aspect of the system is really slick, Stankus explained. “The units can mount right on the bolting machines or be a stand-alone, skid-mounted unit,” Stankus said. “It’s all computer controlled with a monitor in the cabin and the operator does not have to leave his station.”

To develop this system, a major technological hurdle had to be cleared. “The problem that everyone encountered was getting the resin and the catalyst into the hole without mixing them,” Stankus said. “We perfected a system that places both in the hole without mixing and we developed a special pump that works well. We

took this on working with a few mining companies and now we have interest from bolter manufacturers.”

Different professionals have tried to develop this system since miners started using resin and Jennmar finally solved the riddle. They developed a special manifold that allows the pump to push resin through a two-line system into the hole using an injection nozzle. Resin is relatively abrasive. Jennmar’s J-Lok subsidiary developed a new resin that pumps easier and is less abrasive. Then they developed a set of special cylinders as part of the pumping system that would withstand the abrasion.

Engineering Slopes

Jennmar has been heavily involved with the design of slopes for years. Many slope projects were placed on hold during the Obama administration and now there are four major slopes being constructed for new mines, one in Pennsylvania, one in West Virginia, one in western Kentucky and another in Nebraska. The Nebraska project is a 3,500-ft double-entry slope supporting an aggregates operation.

For slope work, Jennmar developed the patented Stress Geologic and Support

(SGS) system about eight years ago. An SGS analysis assists with slope support design. “We have designed more than 50 slopes using this system,” Stankus said. “No one installs a slope without drilling a few holes. With some geologic data and knowing some of the rock mechanics properties associated with the geology, the SGS system develops a model where the entire profile of the slope can be plotted. The system identifies the strong and weak zones and then we design primary and supplemental bolting support systems and then follow up with the long-term steel structure supports, which could be square sets, long-radius arches or semicircular arches. Once the lagging is in place, the mine backfills it with cementitious material.”

Slope projects are a sign of new development activity and Stankus said there are several more slope projects on the drawing boards. “Money has loosened up a little for these capital projects and it has helped the coal-mining business,” Stankus said. He believes it is just going to get better in 2017 and 2018.

Editors note: patents applied for both J-Lok P and MPA systems.



Jennmar is bringing the 62-ton Sumo cable bolt (above) to the North American markets.

THE NEED FOR A REMOTE DUAL-BOOM ROOF DRILL

The current market in South Africa is flooded with “Man in Position” roof bolters. There are currently more than 200 of these roof bolters in South Africa, with the bulk of the machines being twin-boom units. When operated correctly, these machines are safe, versatile, reliable and productive. However, with operators located close to the drilling and bolting operations, they can be exposed to operational hazards.

These hazards are from a variety of reasons, as roof drilling and bolt installation is labor intensive and repetitive. The job requirements can often lead to cumulative trauma. Operators are expected to perform a considerable amount of lifting, carrying, bending, reaching and stretching. This includes bending and twisting to install bolts or lift and position drill steels, wrenches and bolts. Confined operator spaces can also contribute to difficult and awkward working positions.

With “Man in Position” style machines, the operator is in close proximity to where the drilling and bolting process is performed. When proper operational procedures are followed, it has been proven to be a very effective, productive and safe system. The Mine Safety and Health Administration (MSHA)-certified ATRS, canopies and dust collection system of Fletcher bolters all provide the operator with unparalleled protection. However, there are some occupational hazards inherent to the zone located next to the drilling and bolting zone. This has led some customers to request relocating the operator away from this zone. The idea being that the operators will no longer be located in the face area, greatly reducing their exposure to dust, noise, machine and geological hazards.

This resulted in J.H. Fletcher & Co. teaming with a South African customer to develop a new roof bolter that would alleviate exposure to many of these potential hazards, while still maintaining current production rates.

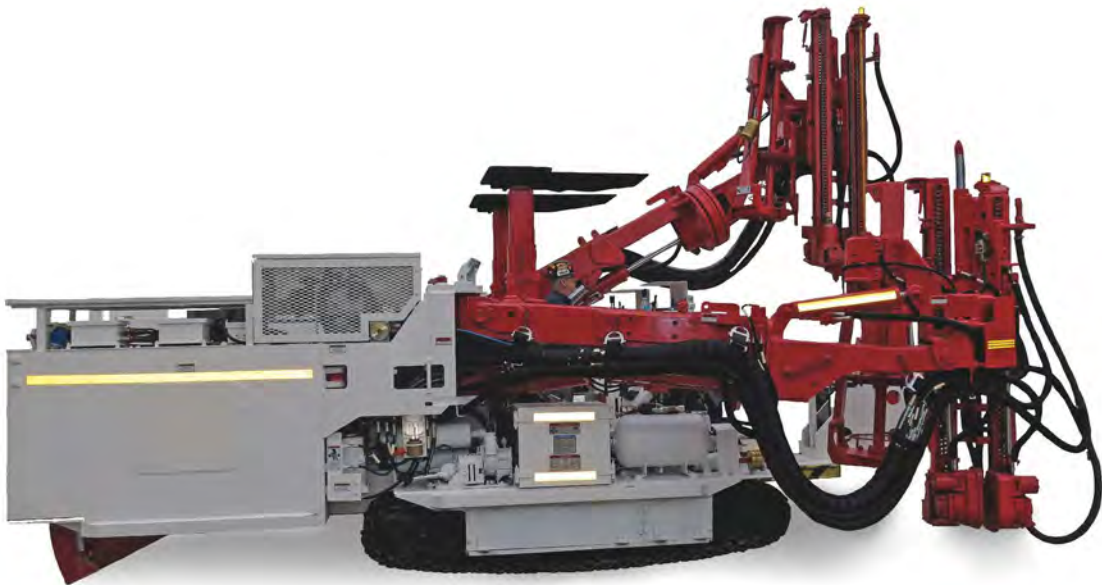
From this, a new Fletcher model CHDDR-AC remote bolter was born. The crawler driven machine is fitted with a fork lift-loaded material pod, along with a rear lifting ramp to provide easier access to the back of the machine. The machine features large walkways paired with ergonomic operators’ compartments. A walkway was provided on the front of the machine to allow loading of the bolt carousels without having to step off of the machine. A hydraulic actuated, MSHA-certified canopy covers each operator’s compartment. The two independent canopies help with transporting the bolts from the material pod to the bolt carousel when reload-

ing. The design was specifically targeted to alleviate some of the material handling burdens imposed on a roof bolter operator.

The bolt module for the CHDDR-AC implemented a dual mast design. Each mast is equipped with individual crowds to reduce the roof profile of the mast. One mast is dedicated to drilling the hole and inserting the resin while the other mast is dedicated to installing a bolt. The dual mast design eliminates the need to stow and manipulate the drill steel providing the ability to rib bolt. The resin is inserted using pneumatics. The resin inserter is fixed to the drill mast assembly and uses the same roof reference guide as the drill steel. This eliminates the potential for misalignment providing reliable resin insertion. The bolt carousel is equipped for a capacity of 16 bolts. Several bolts can be loaded in the carousel from one position, meaning the carousel does not need to be rotated after inserting only one bolt.

The new design uses all purely hydraulic controls with manually actuated handles. This provides a machine that is reliable and easy to troubleshoot and maintain. Even though the controls are fairly simple, there are still advancements incorporated. There is a latched drilling feature, which aids in reducing overall drill/bolt cycle times. There is also a feed force selector valve that allows the operator to choose one of three settings: high, medium or low. This is helpful in combating the many different roof conditions encountered in a coal mine. The machine is also equipped with a hydraulic resin timer. Once the operator has installed the bolt, they will turn on the resin timer. The resin timer will spin the bolt for a preset amount of time. After this mixing process, the machine automatically torques the bolt to a preset torque. All of these added features help the operator perform his/her job in a more efficient manner.

Through this project, Fletcher has showcased its ability to custom engineer solutions for customers. Taking current day issues operators face due to manual labor along with locational hazards, Fletcher was able to engineer and manufacture a new machine. The Fletcher model CHDDR-AC is a remote dual-boom bolter, which removes operators from the face area. The machine is equipped with material handling and a bolt carousel that has the ability to secure a complete heading, which aids in alleviating some of the labor burdens placed on operators. Fletcher has made the ability to remove the operator from the front of the machine in coal mines a reality.



Working with miners in South Africa, Fletcher recently introduced the CHDDR-AC remote bolter.

DELIVERING WET FUEL TO THE FIRE

Saturated coal does not have to dampen plant efficiency

The Scherer coal plant, operated by Southern Co., had spent many years suffering from issues with transfer system efficiency due to wet coal. Wet coal has forced the coal plant's bulk handling systems to reduce, or "derate," capacity on conveyors for more than 15 years.

Power plant operations have become accustomed to derated operation under certain conditions and have begun to accept it as normal. A redesign and retrofit of critical bulk-handling systems, taking wet coal into account by leveraging cutting-edge 3-D laser scanning and modeling technology, increased transfer system efficiency and throughput.

After the Scherer retrofit, the redesigned chute-work systems so effectively conveyed wet coal that the plant was unprepared for the first time wet material arrived at the pulverizers. The increased throughput in the redesigned transfer systems exposed other weaknesses in the handling system downstream. A thorough analysis of these bottlenecks provided the ability for the Scherer team to budget

for rework where necessary. Working in close coordination with the Scherer team, Acensium was able to assess client goals based on their priorities and deliver a retrofit that fulfilled the set goal beyond stated expectations.

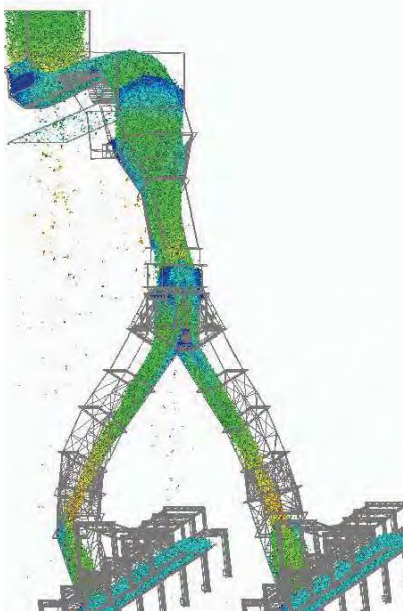
A true partner doesn't limit their focus to project requirements, explained Jason Schwartz, principal, Acensium. "To build value in a relationship, we must discover the deepest challenges to operational efficiency and do whatever it takes to eliminate them," he said. "One of our clients learned the value of this philosophy recently. A four-unit, coal-fired plant contracted us originally for new transfer chutes, as the existing equipment was nearing the end of its service life. The overarching goal was dust control, but we uncovered a much deeper issue that had been plaguing the plant."

During discussions with the client, Acensium learned that moving wet coal was a serious bottleneck for this plant, located in an area that can receive significant amounts of rain. While the normal goal

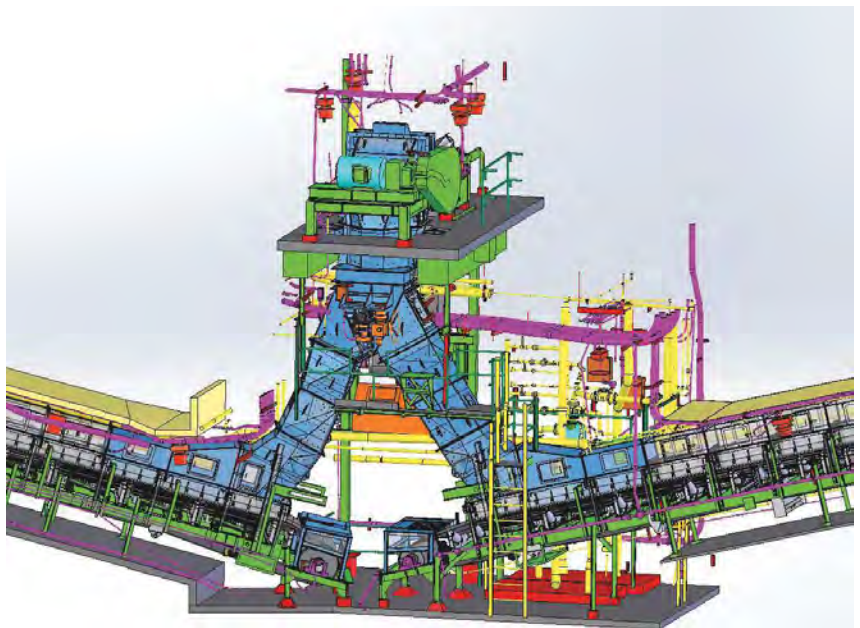
was to move 1,200 tons per hour (tph) of coal, wet coal would drive this figure down to around 800 tph. With four trains coming into the facility delivering 42,000 tons daily, this was a problem.

Continuing to run the system at an optimal rate was not an option. Wet coal would clog chutes, and if sensors did not alert operators quickly enough, the potential result was 650 pounds of coal spilling every second. Reducing the transfer rate meant derating generators during periods of wet coal — also not an option for a plant supplying a major metropolitan area.

The only option left was for the system to run 24 hours per day to compensate for the lower transfer rate of wet coal, Schwartz explained. "This meant eliminating maintenance and inspection periods, and also eliminating any margin for error in the process," Schwartz said. "The facility would push through equipment failures, incur overtime as extra staff was added to watch the system, and basically operate under a 'code red' posture during rainy periods."



When redesigning the system, Acensium uses DEM to look at coal flow.



An important aspect was controlling the Kinetic energy. After redesigning the chute work, other weaknesses were exposed downstream.

When they heard this, Acensium asked: What transfer rate was needed to alleviate the burden from the plant? The operators told them 1,200 tph during wet conditions as well as dry. “Our response was, let’s get to work,” Schwartz said.

3 Steps to Efficiently Move Wet Coal

When redesigning the system, Acensium used discrete element modeling (DEM) to look at every particle of coal. They used more than 30 coefficients to replicate the condition of the coal as it moved through the transfer process. But modeling is only the start. Building a successful system involved three key components:

Get in the field — Modeling only accomplishes so much, if it is not validated through real-world observation. “Our modeling parameters come from observations of systems in the field,” Schwartz said. “We create a feedback loop from these observations to drive every system improvement we consider, from liners to flow design. Firms that do not follow this process tend to struggle at the start of the project, and this negative impact will carry all the way through to limitations in long-term performance.”

Control the kinetic energy — “Our designs pay careful attention to the kinetic energy of the coal as it moves through the transfer,” Schwartz said. “We want to know where coal comes to rest and where it might be approaching a terminal velocity.”

Shape matters — “We also focus heavily on the shape of our chutes, as the most efficient shape will enable us to achieve optimal velocity throughout the transfer,” Schwartz said. “When it comes to shape, a minute change can have an exponential impact on kinetic energy and velocity. We’ve experienced significant improvements to our system designs by changing a single flange by 0.5°.”

Dry Coal Performance From Wet Coal Transfer

Acensium applied the above techniques and upgraded one of the five main transfer points in the yard of the plant in December 2013. “It performed very well, but at first, we did not hear anything back from the client,” Schwartz said. “It turned out that in the spring of that same year, the yard was able to push wet coal at such a high rate that it exposed previously unknown bottlenecks inside the boiler house.”

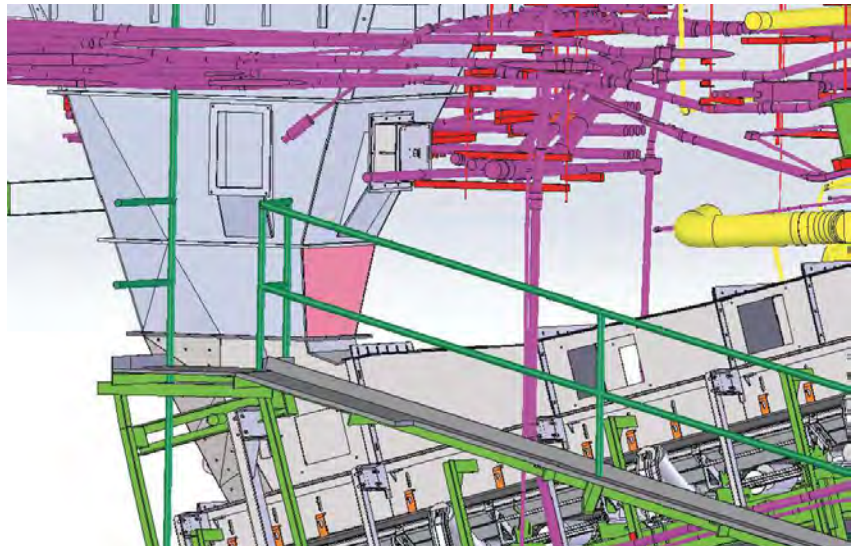
The redesigned chute-work systems performed so effectively in the conveyance of wet coal that the plant was unprepared for the first time wet material arrived at the pulverizers. The increased throughput in the redesigned transfer systems exposed other weaknesses in the handling system downstream.

A thorough analysis of these bottlenecks provided the ability for the plant team to budget for rework where necessary. “And, they were so impressed with the performance of our previous work, that we are now contracted to eliminate all bottlenecks throughout the entire system,” Schwartz said. “We are in the process of finishing the upgrade to the re-

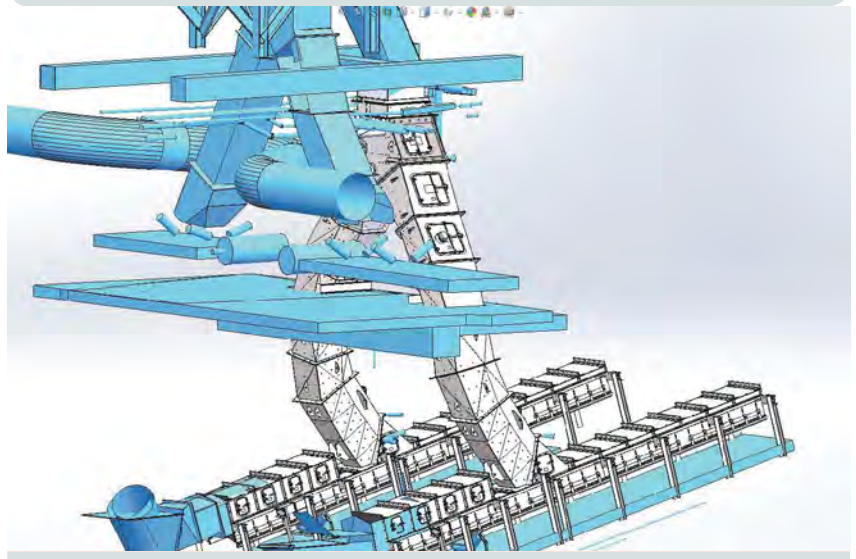
maining four transfer points in the yard, and from there we move to the feeders and the pulverizers within the boiler house.”

Working in close coordination with the plant’s internal team, Acensium was able to assess client goals based on their priorities and deliver a retrofit that fulfilled the set goal beyond stated expectations. And they are working to a point where there will be a system that can handle virtually any coal — in any condition — and deliver it at a rate demanded by the boiler.

This article was submitted by Acensium with approval from the Scherer power plant. www.acensium.com



The shape of the chute was also an important consideration.



A feedback loop from field observations offers more detail and drives improvement.

INNOVATIVE CONVEYOR TECHNOLOGY

Martin Engineering has introduced a number of new products to improve safety and productivity

A leading developer of conveyor system accessories recently added several products to its line. In addition to new products, Martin Engineering has also improved its training module and published a new reference for conveyor safety. The new FOUNDATIONS Plus seminar provides miners with a methodology for assessing risk and analyzing life cycle costs, helping them better understand the true return on investment from conveyor upgrades to increase safety, efficiency and profitability.

"We've worked with customers on capital projects spread across the globe in a wide range of industries for more than 70 years, and our expertise in conveyor systems and material flow is truly unique," said Tim O'Harran Sr., business development manager, Martin Engineering.

The company's first reference book dedicated to reducing conveyor risk and injuries, *Foundations for Conveyor Safety*, by experts with vast experience in bulk material handling from around the world, written and published with the simple mission of improving conveyor safety. Designed to educate readers by identifying hazards, danger zones and unsafe work practices around conveyors, the volume helps raise awareness and provides guidance to management, operators and maintenance personnel. The content delivers a detailed overview of hardware solutions, global best practices, risk assessment and safer conveyor construction, with a summary discussion of the return on safety investment and how to measure the payback.

One of the new products, the Martin Roll Gen System, is designed to create a self-contained mini power station that allows operators to run a wide variety of electrical systems, including monitoring devices, safety mechanisms and pneumatic belt cleaner tensioners. It can also be used to power tracking devices, industrial lighting and solenoids for air cannons or dust control in areas without convenient access to an electrical source. Suitable for retrofitting on existing idler support structures,

the device is considered a first step toward eliminating power production obstacles, as conveyors move into the next generation of "smart systems" that are predicted to be more sustainable and autonomous.

Reducing Total Ownership Cost

Martin Engineering said it has made a significant investment in tooling and engineering and produced a patented conveyor belt cleaner that is projected to reduce the cost of ownership by cleaning better and lasting longer. A lower purchase price was also one of the primary goals in designing the Martin QB1 Cleaner HD, achieved by adopting state-of-the-art roll forming equipment as part of Martin Engineering's manufacturing capabilities. The move is part of an overall plan to deliver high-performance components at industry-best prices.

"Rather than fabricating the mainframe from individual steel profiles welded together, the frame for the new design is roll-formed out of a single piece of steel, which produces an extremely strong and durable component," said Paul Harrison, director of Martin's Conveyor Products Business Group. "The process eliminates

the time-consuming steps of having to weld any portion of the frame, which also contributes to the reduced purchase price."

Described as one of the most comprehensive patents the company has ever been awarded, protection covers the mainframe design, manufacturing process and attachment method. The new cleaner features Martin Engineering's unique Constant Angle Radial Pressure (CARP) technology to maintain the most efficient cleaning angle throughout its service life, with a no-tool replacement process that can be performed safely by one person in less than five minutes. It delivers outstanding performance and durability, while reducing the total cost of ownership, the company said.

"We've simplified the manufacturing process and also re-engineered the blade itself," Harrison said. "The new profile is less complex to produce, and because it can be roll-formed or manufactured on a press brake, it will be easier to source throughout the world from any Martin Engineering manufacturing site."

The new design also features a special alignment system to facilitate extremely precise installation, he said.



The Roll Gen System acts as a self-contained mini power station.



The QB1 Cleaner HD has an alignment system for precise installation.

“One of the most common problems we see in the field is primary cleaners installed in the wrong position,” said Senior Product Specialist Dave Mueller. “This cleaner was engineered for easy, accurate installation.”

This product announcement comes on the heels of Martin Engineering’s introduction of the company’s “Forever Guarantee,” which ensures lifetime no-cost replacement of tensioners and mainframes for any belt cleaner assemblies that are exclusively fitted with the company’s replacement blades.

The Martin QB1 Cleaner HD is engineered to represent the next generation of belt cleaning technology, delivering the cleanest belt and longest blade life — at the lowest cost. It can be retrofitted onto any existing Martin Engineering tensioners, as well as most competitive systems.

In addition to its cost advantages, the QB1 HD design features a square mainframe positioned to shed dust and spillage. The urethane blade formulation can accommodate belt speeds of up to 900 feet per minute (fpm) and service temperatures of -40° to 160°F.

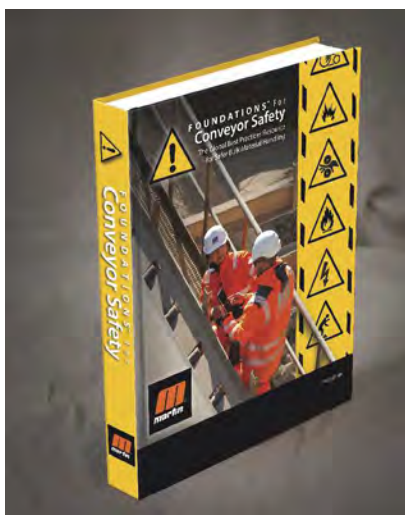
The QB1 HD is available in lengths of 18 to 96 inches (and can also be ordered in 10-ft sections, allowing distributors or customers to cut to length for increased versatility. The new design is one of the many belt cleaners covered by the company’s new Mr. Blade program, under which Martin Engineering’s mobile technicians provide fresh, factory-direct replacement

blades, delivered and custom-fitted on-site — installed free of charge.

Expanded Training Program

Based on the company’s highly successful conveyor training series that has been educating operations, maintenance and management personnel for more than 20 years, the new FOUNDATIONS Plus seminar begins with the complete Operations and Maintenance Seminar on day one. Content is focused on practical solutions to the problems commonly experienced with controlling dust, spillage and carryback.

The new module adds a full day to the program and includes a complete walking inspection, action plan and proposal for



Foundations for Conveyor Safety is a global roundup of best practices.

upgrades. “FOUNDATIONS Plus takes the Operations and Maintenance module to the next step,” said Training Manager Jerad Heitzler. “It’s been developed for plant and mine managers who not only want a highly skilled conveyor workforce, but also want to maximize the benefits of improved system performance.”

The new class offering also includes multiple copies of FOUNDATIONS for Conveyor Safety, the newly published reference volume from Martin Engineering that offers wide-ranging collection of information assembled specifically to help conveyor system operators achieve safer production. To assess the true value of system upgrades, the book includes ground-breaking methodology for calculating the payback from safety investments, sometimes referred to as ROCST for Return On Conveyor Safety. It’s believed to be the world’s first aggregation of global best practices dedicated to reducing conveyor risk and injuries.

“The book is really a global roundup of best practices to keep safe those who must work on or around belt conveyors,” observed lead author Todd Swinderman. “Part of that is recognizing the hazards, hardware systems and work practices that will improve safety. But it also includes content on how to design conveyors to be safer, and how to justify the expenses for those improved systems.”

The company’s original FOUNDATIONS Training Program includes customizable seminars on the design and development of more productive belt conveyors, as well as an advanced module for managers, engineers, and health, safety and environmental personnel. Training is available to suit individuals with varied levels of experience and responsibility, from new hire to senior engineer. The sessions are designed as a primary education on conveyor operations, risks and performance, helping attendees enhance capacity and reduce downtime.

Together, the reference book and training modules serve as components of a powerful educational tool. “We believe that industry education is critical to continued advancements in safety and productivity, and it’s more true now than ever,” Heitzler said. “As experienced employees across a wide range of industries are retiring, it creates an acute need to pass on knowledge to a new generation of workers.”

POINT-LEVEL BLOCKAGE DETECTION TECHNOLOGIES REDUCE DOWNTIME

By STEVE STONE

Blockage detection for coal chutes is a key factor in the transfer of solid material in bulk handling applications. When moving coal continuously over long (or short) distances, it's important to consider directional changes to maintain high productivity and keep production schedules on point. As coal transfers from conveyors to inlet/outlet chutes to holding areas, such as silos and bins, to trucks or railcars for distribution, the potential for jams and blockages is high.

Production losses from a blocked transfer chute can cost thousands of dollars per hour. Once production stops to clear the blockage, downtime can stretch from a few minutes to a few hours depending on the severity of the blockage and the required cleanup. The unexpected disruption translates to lost production, lost material, possible equipment damage and safety hazards for employees.

With the potential for hours of downtime, equipment damage and lost revenue, installing a detection system becomes a necessary and inexpensive way of pre-empting blocked chute debacles. Point-level monitoring is the most commonly used technology for avoiding blockages. A point-level system indicates the blockage and sends a notification signal to a predetermined location, most commonly a control room.

The point-level technologies range from invasive to non-evasive. The technology used depends on a variety of factors. Each technology has its place in the operation of bulk solids handling and processing depending on the application.

Selecting Chute Blockage Detection Systems

Point-level technologies for blockage detection fall into two categories, contact (evasive) and non-contact (non-evasive). Contact technologies are vibrating devices (tuning fork type), capacitance (aka admit-



The downtime associated with coal chute blockages can cost thousands of dollars per hour in lost production.

tance), and mechanical devices (such as tilt switch, either mercury filled or non-mercury filled) where contact with the material is required. Non-contact devices are microwave switches, acoustic switches and nuclear (nuclear) switches where contact with the material is not required, but the material needs to be viewed by the sensors. Most non-contact technologies require a sender and receiver to communicate with each other mounted opposite of each other.

With several options available for point-level blockage detection, what criteria should be followed? There are several items to consider during the selection process. Points to consider are the material used (powder, granules, lumps, etc.), the vessel transferring or holding the material (conveyor, chute, etc.) and the environment (high temperatures, noisy, wet, dusty, etc.).

Some questions to consider about the process:

- **What type of material?** The material processed will determine the technology

one uses. Microwave technology will pass through the material whereas acoustic technology and contact switches will not. Size of the material also matters. Is the material diameter large or small? The spacing gaps between the compacted large materials will allow certain technologies to pass through, making it ineffective. Is the material abrasive? If it is abrasive, contact technology could be damaged from the material.

- **What are the environmental conditions?**

Is it a heavy dust area that will coat the sensor, therefore causing false trips? If buildup potential is high, coating and buildup on contact switches will cause false tripping. Are there spray washers or is it a high moisture area? If yes, it is best to look at a system that is not affected by moisture. Does the material cause static electricity? If the vessel containing the material is not grounded, the static electricity will cause material buildup around all the process measurement devices.

- **Where will the sensor be mounted?**

Mounting of the sensor will depend on the location of the equipment and where one wants the blockage detected. It brings into consideration what mounting accessories one will need and cable lengths required to communicate the data to the transmitter. The area size of the chute or silo being monitored also comes into consideration. Non-contact detection systems have a minimum and maximum range. If the area is too narrow, it may fall into the systems blanking range, making the system useless. For contacting detection systems, the probe length would need to be thought out.

- **What type of output is needed?** Once the potential blockage is detected, how will that information be processed and what will be done with that information? Do they want 4-20 mA output? Do they want it to trigger an alert or an automatic action? Where should the signal be sent? Do they want to have local indication or remote indication? Should the signal be viewable at the location of the equipment or have the information sent to a control room?

Point-level Technologies for Chute Blockage Detection

After factoring in the process conditions and the process needs, selecting the point level technology is a matter of reliability, ease-of-use and available budget.

Mechanical Switch — Mechanical or “tilt” switches use the principle of a “hinged” element inside the chute. When the material rises to a preset level, the switch body is tilted by approximately 15° to 25°, causing a conductive liquid (mercury, in some of the older switches) to produce an electrical connection across a pair of contacts, activating an alarm. This method is a simple and reliable method for many installations when used with dry products and in dry conditions. They are not recommended for harsh or abrasive materials or wet, dusty environments, which are typically found in coal applications. These switches are mechanical in design so they can become damaged due to large, rough solids impacting them. Preferably, the switch should be mounted hanging inside a chute at a level that the material won’t reach until a blockage occurs and under the feed conveyor in order to prevent material from beating on it. They are also susceptible to failure due to buildup

when used in wet and dusty environments due to buildup potential.

Capacitance Probe — Capacitance (Admittance) technology works on the principle of applying a small radio frequency voltage to an element and measuring the capacitance in Pico farads of the element as an antenna installed into the chute. An electrical “bridge” is set to measure an imbalance, caused by contact with the product and triggering the alarm. While the development of various “guard” elements has improved their ability to ignore coatings, they are still subject to a false trip by a coating. Varying probe styles have been developed and some are actually flush with the chute wall but they are still subject to coatings. Capacitance switches also require calibration to the material being detected and, in some cases, require a large surface area for a plate probe for chute detection or probes for containment like silos. Installation requires inserting a probe through an opening in the vessel so that sensing element is positioned at the desired level. In the case of a flush-mounted sensor-plate, the unit is mounted to a cutout in the vessel at the

desired level. Indication results when the material level reaches the probe. Like the tile switch, this technology is best for dry products and dry conditions since abrasive or wet material can cause false trips.

Vibration Probe — Vibrating technology uses the principle of exciting a piezo-crystal to induce vibration on to a set of tines. When material touches the tines, the vibration frequency is dampened and an alarm relay is triggered. Because of the mechanical design, the vibration switch is susceptible to mechanical contact and high vibration. It works best for dry granular material that is small in particle size. It is not recommended for high-impact applications. These systems are potentially subject to issues of false indication due to buildup on the tines. Washing the tines periodically is recommended. Like similar invasive probes, the vibration switch is inserted into an opening in the vessel so that it is positioned at the desired high level. Indication results when the material reaches the tines.

Nucleonic Switch — Nucleonic (nuclear) technology uses a radiation source and a detector, mounted on opposite sides



An acoustic switch can be mounted to a chute to monitor material levels.

of the chute. During normal “free flowing” conditions, the rate of absorption of the emitted radiation is low. It rises significantly when a blockage occurs and is used to trigger the alarm. Proper positioning and alignment of the components is required since the signals used are relatively small. This is the most expensive method to use and maintain since it is subject to yearly NRC licensing, regular inspections, and mandates the employment of a nuclear safety officer for the site. These devices are also the most difficult to remove and dispose of after their life cycle due to the nuclear technology. These devices can have false trips by material building up on the wall of the chute, which necessitates either cleaning the chute or making adjustments to the sensitivity settings. Without proper care and maintenance, the ability to see a blockage can be compromised.

Microwave Switch — Microwave technology uses high frequency electromagnetic waves of radar that are pulsed between a

sender and receiver. The units are mounted opposite each other outside of the vessel behind a wear-resistant window. Once material blocks the path between the sender and receiver, the receiver will no longer detect the complete transmission chain and sends a signal indicating blockage. This in turn closes or opens a switch (depending upon the electrical configuration), which then activates or deactivates an external circuit giving indication of blockage.

Previously, the technology used linear polarization that transmitted between the two units, which required the units to be perfectly aligned. The technology has evolved to circular polarization so the units do not have to be in perfect alignment, making installation easier.

Since this technology does not make any intrusion into the chute wall but through a high-grade transparent window, the material cannot wear down the sensor face. For temperatures above 160°F, the sensors can be remotely mounted with a

wave guide extension to direct the signal to a remote amplifier. This technology is best suited for dry granular material, lumps and fines that can absorb or reflect microwave energy. If the material cannot absorb or reflect the energy, a blockage will not be detected. They also should be in a dry environment. Moisture in the process causes a potential for coating the instrument with a dust film.

Acoustic Wave Technology — Acoustic wave technology relies on a very low frequency (15 kHz), high-powered transducer pair. This technology requires a pair of transducers to be located apart but aligned with each other. They are installed on either side of the chute or silo through a cutout in the vessel and do not require contact with the material. The transducers both pulse and receive signals from each other, and as soon as the signal is blocked, the attenuated acoustic signal is amplified and sent to the plant monitoring system.

The low frequency and high power applied to the sensors generates a pressure wave on the sensor face of each transducer, creating a self-cleaning feature. This pulsing pressure wave keeps material from adhering to the face and provides for maintenance-free operation in critical applications since they are immune to dust, particles in suspension and water sprays.

With all the available technologies, selecting the best system can be overwhelming. As mentioned, all these technologies have a place in blockage detection applications. This is a quick overview of the criteria for selection and the technologies available. To pick the best system, one needs to thoroughly understand the process conditions. Explore all the available technologies and their track record in similar conditions to the environment and process. It is also beneficial to discuss the application and the point-level detection goals with the manufacturer or manufacturer’s representative to fine tune one’s needs. They can guide one through the technologies available and give a fresh perspective on what technologies have been used in similar environments and processes and their track records, saving time related to research.

Steve Stone is vice president of sales and marketing for Hawk, a leader in innovative level measurement, positioning and flow solutions. He can be reached at (978) 304-3000 or at steve.stone@hawkmeasure.com.



Microwaves can also be used to monitor material flow. The sender units can be seen in the inset.

JOY REPORTS MIXED Q1 NUMBERS, OUTLOOK

Joy Global's first quarter numbers were mixed, with increases in bookings but a decline in sales. The company valued its first quarter 2017 service bookings at \$524 million, up 21% over the same period last year. The company reported total bookings of \$615 million, an increase of 12%. Net sales fell \$498 million, or 5%.

Bookings for underground mining machinery increased 14% over the same period last year. Original equipment orders decreased 28%. Net sales for underground mining machinery decreased 8%. Bookings for surface mining equipment increased 12%. Original equipment orders increased 19%. Net sales for surface mining equipment decreased 4%.

Operating loss for the first quarter totaled \$2 million, compared to \$45 million in the same period last year.

CEO Ted Doheny said he does not expect the trend in increased production levels to continue. "The mining industry remains cautious with overall capital expenditures still projected to decline in 2017," he said. "While there is evidence the deferred maintenance cycle on installed equipment is coming to an end, investment in new capacity remains slow. Only projects that deliver a step change in productivity are proceeding."

Doheny said he expects the Komatsu merger to close at the latest by mid-2017. The merger is subject to, among other things, stockholder approval and the resolution of any waiting period.

Predictive Safety Formed From 4 Safety Specialists

The founding members of Predictive Safety SRP Inc. have announced that an official closing has been reached in the joining of their four companies. Mark Savit of Predictive Compliance LLC, Dave Lauriski of Safety Solutions International Inc., and Tim Hobbs of Data Connect Corp., all located in Denver, Colorado, and Henry Bowles of Bowles-Langley Technology in Alameda, California, have now merged to form Predictive Safety SRP Inc., to be managed by CEO Mark Premo, former president and CEO of Chevron Mining.

Focused on human performance, Predictive Safety has integrated the founders' patented and proprietary suite of workplace safety, risk and performance products for its clients around the globe. This suite includes the AlertMeter Fatigue Management System, which was developed in the United States and has been in operation in South Africa for four years; Predictive Compliance, which has been used for regulatory compliance data management in the U.S. mining industry since 2009; the AlertMeter Fit for Work test, a patented workplace impairment detection app developed with NIOSH; and work site safety audits and leadership training under the direction of longtime safety consultant Dave Lauriski.

"To create a culture of prevention, 'the path to zero harm,' you have to use all the data that are available to you — historic, real-time, and predictive," said Lauriski.

"We live in a data-driven world," said Mark Savit, chairman of Predictive Safety and the 2016 recipient of the President's Citation

Award by the Society of Mine Safety Professionals. "By tapping into that data, safety and performance professionals can shift their focus from reactive to proactive and from subjective to objective."

Coke Producer Signs Maintenance Supplier

SunCoke Energy contracted Fluor to provide maintenance support and capital project services at the former's U.S. facilities. The contract spans five years. Fluor transitioned to the sites in early March.

SunCoke is a raw material and coal processing and handling company serving steel and power customers. With 4.2 million tons of U.S. capacity, it represents roughly 25% of the U.S. and Canadian markets, the company reported. Fluor, along with its Stork division, delivers maintenance, modification and asset integrity services at more than 200 sites in North America. It is a global engineering, procurement, fabrication, construction and maintenance company that designs, builds and maintains capital-efficient facilities for clients on six continents.



Feds Search Caterpillar Offices

On March 2, law enforcement authorities entered three Peoria, Illinois, Caterpillar Inc. facilities, including the corporate headquarters, to execute a search and seizure warrant. The warrant was focused on the collection of documents and electronic information.

In a statement, Caterpillar said, "While the warrant is broadly drafted, we believe the execution of this search warrant is regarding, among other things, export filings that relate to the CSARL matter first disclosed in Caterpillar's Form 10-K filed on February 17, 2015, and updated in Caterpillar's most recent Form 10-K filed with the SEC on February 15, 2017." CSARL is a Switzerland-based subsidiary of Caterpillar.

During Caterpillar's press event at ConExpo-Con/Agg held in Las Vegas in early March, several questions were asked regarding the raid. CEO Jim Umpleby, who took over from former CEO Doug Oberhelman in January, told those in attendance they were surprised by the raid because the company had been cooperating

fully with the investigation. He said, “We have a long and good reputation of being ethical.” And he added that the company would continue in that fashion. Umpleby would not go into any specifics regarding the investigation.

The search comes just weeks after Oberhelman, who is the chairman of the board until March 31, met with President Donald Trump along with the heads of 23 other manufacturing companies in the U.S. to discuss bringing manufacturing jobs back to the U.S.

During the meeting at the Whitehouse, Trump said told Oberhelman, “I love Caterpillar. I’ve been driving them for a long time.”

In January, Caterpillar announced plans to move its global headquarters from Peoria to Chicago.

Screening Manufacturer to Up Capacity

Metso is reportedly expanding rubber screening media manufacturing capacity by investing in three new injection presses. The investment, valued at EUR 1.7 million, is in response to growing global demand, the company reported. The presses will be installed at Metso’s facilities in Australia, India and Sweden by early 2018.

The demand for Metso’s screening media has risen in the mining segment after the 2016 introduction of 1-in. by 1-in. modular screening media, Trellex™ 305PS.

Expanded capacity and the new offering will enable the company to gain market space, said Jose E. Perez, senior vice president, crushing and screening wears. “Complementing our extensive wear parts portfolio with an industry standard such as 1-in. by 1-in. screening media is a natural step in strengthening [our] position,” he added.

Metso’s products range from mining and aggregates processing equipment and systems to industrial valves and controls.



HUESKER Buys Minegrid Maker

Geosynthetic and technical textile manufacturer HUESKER Synthetic GmbH acquired longtime partner NBW Mining (AUST) Pty Ltd. in Australia, supplier of Minegrid. HUESKER and NBW were exclusive partners for 20 years, the former reported.

Minegrid reportedly recovers longwalls, supports ribs, and reinforces highwalls in mines and quarries around the world. Established in 1996, NBW Mining supplied HUESKER Minegrid Systems to the longwall mining industry in Australia. The system was introduced in 2004 to miners in Siberia, South Africa, the U.K. and Norway.

The 150-year-old Huesker Group, headquartered in Gescher, Germany, has 10 subsidiaries and trading and distribution partners

in more than 60 countries. The NBW team reportedly has a combined 140 years of experience in underground mining.

Partnership Offers 3-D Reclamation Maps

BGC Engineering Inc. partnered with LOOOK Inc. on an application that turns traditional flat engineering drawings and data into interactive 3-D maps and immersive landscapes experienced using Microsoft’s HoloLens technology.

Reportedly, BGC’s biggest projects involve land reclamation for mining companies. “Reclamation is about making good on the commitment that a mine is a temporary use of the land,” Bill Burton, vice president, said. Through HoloLens, “we can give you sense of what it’s like to stand in the reclaimed environment and see what that final landscape will be. This is easier to understand, for experts and non-experts alike.”

BGC is a consulting firm. LOOOK is a mixed-reality design and development studio.



JENNMAR to Supply EcoVent Doors

American Mine Door contracted JENNMAR Corp. to be the sole and exclusive U.S. distributor of the EcoVent Equipment Doors for underground mining. The product is designed as an alternative to traditional reusable underground equipment and/or machine doors for the current price-sensitive market, American Mine Door reported. The EcoVent Doors use a patented opposing wing design for easy operation, the company reported. Door wings are connected so when one wing is opening, the other wing also opens simultaneously in the opposite direction. This means equalized air pressure assists the door in opening and closing with little effort. Doors will not slam closed, the company reported, reducing the potential for injuries.

In addition, the corrugated wing design minimizes weight, maximizes strength and keeps pricing affordable, the company added. The design reportedly ensures minimal required maintenance over years of service. Additionally, the doors can be moved around easily and reused repeatedly, the company reported.

American Mine Door is an original equipment manufacturer established in 1906 and based in Cleveland, Ohio. JENNMAR is a ground control technology solution supplier for the mining and tunneling industries.

HITACHI INTRODUCES MULTIPLE TECHNOLOGICAL INNOVATIONS



Available in backhoe and front-shovel configurations, the EX5600-6 hydraulic excavator is now offered in diesel- and electric-powered configurations. It comes equipped with Hitachi's Global e-Service remote machine management system, which allows managers to access the machine remotely using the internet.

Last fall, Hitachi showcased several technological advancements at its MINExpo 2016 exhibit. These innovations ranged from autonomous haulage to an advanced AC-drive system to electric-powered hydraulic mining excavators.

"Hitachi built the first hydraulic excavator in Japan exclusively using Japanese technology," said Craig Lamarque, division manager, Hitachi Construction Machinery-Americas. "Building on this legacy, Hitachi continues to lead the industry with technological innovation."

Hitachi's Autonomous Haulage System (AHS) leverages technologies developed for Hitachi Ltd.'s automotive and railroad solutions as well as Wenco's fleet management and dispatch system to increase productivity and lower the total cost of ownership. The system features automated navigation and route optimization; the ability to negotiate traffic conditions; optimized accelerating, braking and steering control, site awareness and forward collision warning; and the Wenco fleet management system for overall supervisor control.

"As a fully integrated system, our autonomous haulage system is Hitachi to the core," said Lamarque. "It results in a truck

that can determine the most efficient paths without constant communication with traffic control. We've also included components that make it possible to convert any Hitachi AC-3 truck bought today to AHS in the future."

Hitachi's Advanced AC-Drive System propulsion technology outperforms previous systems through its simplicity, improved efficiency and enhanced dependability, resulting in some of the most technologically advanced Hitachi trucks on the market, the company said. "The entire Hitachi AC-Drive system is designed, built and supported by the same company — Hitachi," said Lamarque. "As a result, the system delivers higher torque, faster acceleration, smoother retardation and lower operating costs."

The system's slip/slide control feature acts like both an active traction control and an antilock brake system. It reduces tire slippage on acceleration and tire lock-up during braking. A pitch control feature reduces bouncing/rebounding on the truck as it hits bumps or uneven ground on the haul road. As the truck comes to a stop, the rebounding or rocking effect due to the change in inertia of the truck is also reduced.

Hitachi's recently introduced five mining electric-powered hydraulic shovels to the U.S. and Latin American markets that feature an advanced electric-drive motor designed to provide a cost-effective solution to mining operations where low-cost electric power is available. While Hitachi has been delivering electric-powered excavators to other parts of the world for many years in countries with a 50-hertz power supply, Hitachi engineers had to review U.S. and Latin American countries' specific safety regulations to ensure compliant operations in these countries with a 60-hertz power supply. The machines do not need costly consumables such as engine oil, filters, coolant or fan belts. Components related to an engine are also eliminated, such as radiators, air filters and mufflers.

Hitachi next generation of mining excavators, which will be released soon, will give customers the ability to choose what engine they want in their excavator. Next generation mining excavators in emissions-regulated countries like the U.S. and Canada will have a Final Tier 4 (FT4) engine choice of Cummins or MTU depending on model. For countries outside of an emissions-regulated country, there will be a non-certified version of both.

The new excavator will also include improved hydraulic system designs; advanced electronic controls on the hydraulic pumps, improving response and economic control of the pump; and increased efficiency of the pump and system operation, reducing fuel consumption and lowering operating costs.

Eriez Celebrates 75 Years

This year marks 75 years in business for Eriez. From humble beginnings in 1942, the company has evolved into a world leader in separation technologies with manufacturing facilities in Australia, Brazil, China, India, Japan, Mexico, South Africa and the U.K., as well as its Erie, Pennsylvania, headquarters. Eriez has sales offices across the United States and some 80 international markets on five continents.



The terminating end of a pendant, which was made from synthetic rope, can be seen on a dragline in Wyoming.

“Eriez’ dedication to constant innovation has enabled us to flourish over the past 75 years,” said Tim Shuttleworth, president and CEO. “New robotic welders, laser cutting tables, high-efficiency manufacturing cells, proprietary automated assembly systems and global lean initiatives across the company have driven cost out of operations, improved quality and enhanced customer satisfaction.” The company has continued to develop new and refined process solutions, which lead to industry-changing breakthroughs, he added.

To celebrate the 75-year milestone, Eriez will release “From Pioneer to World Leader, Volume II,” an update of a book the company published in 1992 to chronicle the events and people that shaped Eriez during its first 50 years in business. According to Eriez, this new edition will cover the company’s entire 75-year history through photos and stories about its product breakthroughs, business practices and employee culture. The book will be printed later this year.

Synthetic Pendant Cables

Three companies, Applied Fiber, WireCo WorldGroup and DSM Dyneema, have joined forces to deliver synthetic fiber dragline and rope shovel pendants. The announcement was made after Applied Fiber successfully installed the mining industry’s first synthetic fiber main pendant cables on a Marion 8200 dragline for Cloud Peak Energy.

Applied Fiber engineers, manufactures and tests the pendants. They specifically engineered the termination and rope system for the demanding pendant applications. The rope was produced by Lankhorst Ropes, a WireCo WorldGroup brand, who designed and manufactured the rope to give specific performance characteristics using the latest advancement in synthetic fiber, the DM20 manufactured by DSM Dyneema.

“Following thousands of tests and years of development, we are excited to introduce a suite of advanced solutions that address the historical challenges of terminating large and critical rope systems,” said Jim Pumphrey, vice president of industrial products, Applied Fiber. “By incorporating high-efficiency termination technology designed to mitigate bend fatigue in extreme conditions with the latest high-performance fiber technology from DSM Dyneema, we were able to design a solution that offers considerable weight savings and dampens the dynamic forces versus traditional steel pendants. This results in increased payload with dramatically reduced boom compression cycling, providing the mine owner numerous economic benefits.”

“The use of our Lankhorst synthetic rope for this demanding application will be a very positive development for miners,” said Blake Chandler, senior vice president-global mining for WireCo WorldGroup. “The product is lighter, easier

to handle during installation and provides increased service life over conventional technology. This is a significant innovation for shovel and dragline boom pendants.”

“The design and installation of the world’s first fiber dragline main pendant has been an impressive engineering feat,” said Edwin Grootendorst, global segment director for DSM Dyneema. “DSM Dyneema worked closely with Applied Fiber and WireCo to turn an innovative idea into reality. The Dyneema DM20 XBO fiber was a critical enabling technology, ensuring the main boom pendant was able to reduce stresses on the dragline while improving its efficiency. We remain committed to supporting the mining community, and together with them, explore possibilities of improving profitability and safety in their operations.”

DSM Dyneema manufactures ultra-high molecular weight polyethylene fiber branded as Dyneema — the world’s strongest fiber, according to Dyneema. Dyneema DM20 combines the high-performance properties of Dyneema fibers with a unique resistance to creep.

<http://applied-fiber.com/draglinevideo>

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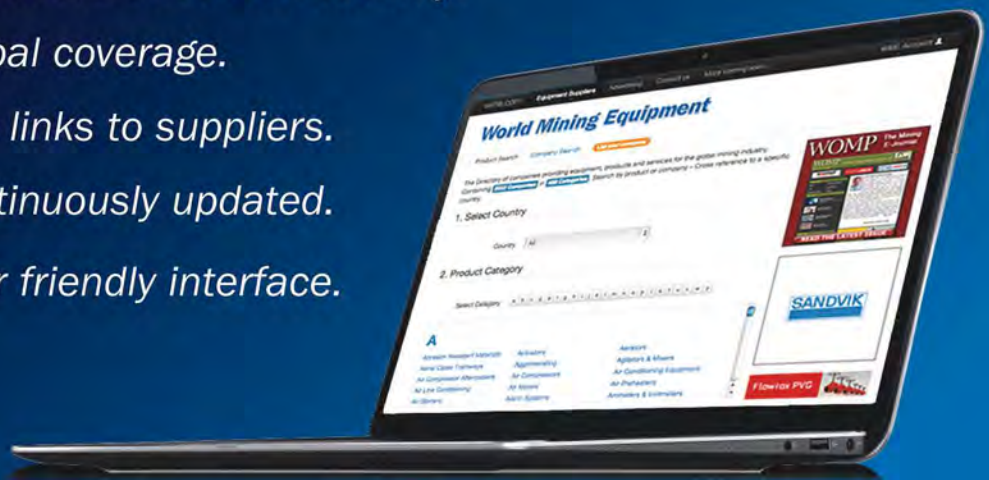
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How Will Trump's Nominee for DOL Secretary Affect MSHA, OSHA?

By Erik Dullea



January was anticipated to mark the beginning of change for the Department of Labor (DOL) and its safety agencies, the Mine Safety and Health Administration (MSHA) and Occupational Safety and Health Administration (OSHA). President Donald Trump nominated Andrew Puzder as the next secretary of labor, but Puzder withdrew as a nominee. President Trump then nominated Alexander Acosta, a former member of the National Labor Relations Board (NLRB) and former United States attorney.

What changes will Acosta bring? Several factors make it hard to predict those changes: he was a law clerk for the now Supreme Court Justice Samuel Alito; he prosecuted a multitude of white collar fraud and civil rights cases; and while on the NLRB, he garnered praise from both sides of the aisle.

Former Assistant Secretary of Labor for Mine Safety and Health Joseph Main wound down his tenure with a series of interviews regarding the agency's safety statistics. MSHA's annual report indicated that fiscal year 2016 was the safest year in mining history—with nine fatalities in coal mines and 16 fatalities in metal/nonmetal mines. The mining industry is the first to acknowledge that one miner fatality is one too many, and thus should also take pride with the ongoing reduction in fatalities.

Main described himself as a proponent of enforcement, and credited MSHA's increased enforcement efforts over the last eight years for the improved safety statistics, claiming that MSHA is trying to develop a "better culture in the mining industry." He also said MSHA has a good working relationship with the industry.

Main's belief that the agency has any semblance of a working relationship with its stakeholders is questionable at best in

light of his agency's actions in the last three years. For example, MSHA encountered vocal opposition to its ill-conceived attempt to change the existing civil penalty scheme and hamstringing the ability of the Federal Mine Safety and Health Review Commission's authority to independently assess penalties against operators. Similarly, MSHA expended significant effort to preclude the courts from reviewing its Pattern of Violations criteria. Main advocates that criminal violations of the Mine Act should be elevated from misdemeanors to felonies.

These positions might be based on Main's belief that recent safety improvements were attributed to MSHA's track record of tougher enforcement, stricter regulations and increased penalties for specific standards known as the Rules to Live By. The Trump administration likely disagrees, having referred to overregulation as a "quiet tyranny" oppressing the economy.

To anticipate MSHA's future priorities, we must look at agency enforcement patterns under Republican administrations and past statements from Acosta.

Generally speaking, Democrat administrations are inclined to promulgate new regulations to address a perceived problem while Republican administrations are inclined to address that problem by enforcing existing regulations, if only to prove new regulations are unnecessary.

Acosta's credentials in the area of labor-employment law are undisputedly strong, if not stellar. However, in the area of safety and health, there is scant evidence that he has any practical experience with regulatory enforcement, or any first-hand knowledge of mining. Also, it is not clear that Acosta is in complete agreement with the president regarding an overabundance of regulations. Acosta wrote a 2010 law review article for Florida International University, where he is currently the law school dean, recommending that the NLRB abandon its "pre-World War II quasi-judicial

administrative agency model" and promulgate rules instead.

Nevertheless, cabinet secretaries work for the president. If the Trump administration sees similarities between excessive regulatory burdens between OSHA and MSHA, the following initiatives and priorities could be in store for both agencies:

- **Discrimination/Whistleblower policies:** This was an area of emphasis for both OSHA and MSHA in the Obama administration, which was simplifying, if not encouraging employees to file complaints against their employers, and lowering the burdens of proof associated with those complaints. The Trump administration can change its policies without having to go through formal rulemaking or legislative procedures.
- **Respirable Silica standard:** MSHA has previously indicated it would follow OSHA's lead on this topic. If Acosta revises or abandons this OSHA standard, it would not be a surprise for MSHA to follow suit.
- **Regulatory Enforcement versus Compliance Assistance:** Under President Obama, OSHA and MSHA prioritized enforcement as a means to alter industry behavior. This was a departure from the previous four administrations.
- **Occupational and Federal Mine Safety and Health Review Commission post:** There is a vacancy on both commissions. Republican appointees are likely to fill the current and future vacancies on both review commissions.

The appointment of DOL assistant secretaries for OSHA and MSHA will not be made until after the Senate confirms Acosta. As a result, MSHA will most likely remain in the status quo mode we have watched since the election.

Erik Dullea is a senior counsel for the technology, manufacturing and transportation areas at Husch Blackwell. He can be reached at erik.dullea@huschblackwell.com.

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