Issue 3 ▪ 2019

coal ENERGY

From the Mine to the Utility

DOE'S $56M IN COAL TECHNOLOGY PROJECTS

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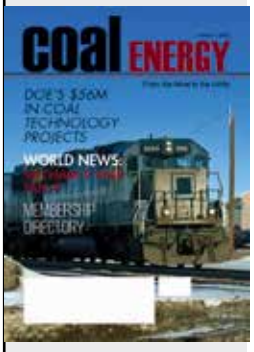

OCTOBER 2019

Dear readers,

Welcome to Issue 3, 2019 of ***Coal Energy.***

In this issue, we take a look at the U.S. Department of Energy's $56 Million investment in clean coal technology projects. An in depth look at the project descriptions can be found on page nine.

In every issue, ***Coal Energy*** includes a world news piece to bring the reader up to date on import/export and investment news around the globe. In our last issue we featured snapshots on Japan and Turkey. In this issue we celebrate the opening of Vietnam's Vihn Tan 4 thermal power plant. Held in Binh Thuan province on 21 September, the ceremony was attended by Vietnamese Deputy PM Truong Hoa Binh, EVN Chairman Duong Quang Thanh and CEO of DHIC plant EPC BG Inwon Park.

Coal Energy is pleased to bring back our opinion department to allow our readers to debate and take in to account the view of others in the industry. On page 36, you can find UMWA International President Cecil Robert's opinion regarding climate change. If you or someone you know in our industry has opinions to express in regards to recent events, please email us at **info@martonickpublications.com** to have your views considered for publish.

Coal Energy remains proud to be the source journal for information about coal related associations in the industry. We currently provide information at your fingertips on different groups to benefit your companies' needs and targets. By providing information at a glance on each group (page 4), and including current member lists (page 26), your company can analyze the forums available to market, promote, and lobby for America's future regarding coal energy.

Coal Energy is also proud to be able to provide quick news updates gathered from various sources to create an easy wealth of industry information at the click of a button. From newly released equipment, to quarterly finance news, you can easily review important industry happenings in our press release department beginning on page 19.

Please visit our website, www.coalenergyonline.com, for current and prior editions of ***Coal Energy***.

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And again, thank you for picking up, or clicking on, another edition of ***Coal Energy.***

If you have any questions, editorial submissions, advertising interest or just comments about ***Coal Energy*** please feel free to email me directly at **maria@martonickpublications.com.**

Warmest regards,

Maria Martonick

Maria Martonick

President
Martonick Publications, Inc.

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https://www.americancoalcouncil.org

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U.S. Department of Energy Invests $56 Million in Coal Technology Projects

September 20, 2019
WASHINGTON, D.C.

By James Taylor

Today, the U.S. Department of Energy (DOE) announced 32 winners for $56.5 million in federal funding for cost-shared research and development (R&D) projects for advanced coal technologies and research under six separate funding opportunity announcements (FOAs).

The projects further this Administration's commitment to strengthening clean coal technologies and cover a range of topics, including carbon capture, utilization, and storage; rare earth element recovery; coal to products; crosscutting coal R&D; steam turbine efficiency; and advanced materials.

"**The Department of Energy is committed to advancing technologies that will allow us to meet our energy needs in an environmentally responsible way,"** said U.S. Secretary of Energy Rick Perry. **"We will continue our commitment to investing in research, development, and demonstration initiatives to drive these innovative clean coal technologies forward."**

"We are excited about the transformative potential of these projects. Advancing this coal R&D is paving the way for future technology innovation and integration," said Assistant Secretary for Fossil Energy Steven Winberg.

The first funding opportunity award is for $10 million for ten projects under DE-FOA-0001992, Maximizing the Coal Value Chain. The projects will develop innovative uses of domestic coal for upgraded coal-based feedstocks used to produce power and make steel, and for producing high-value products from coal or coal by-products—ultimately creating new market opportunities for coal.

The second funding opportunity award is for $11.9 million under DE-FOA-0001996, Advancing Steam Turbines for Coal Boilers. The two projects selected under this FOA seek to improve the performance of steam-based power cycles, resulting in lower cost electricity with reduced emissions per megawatt-hour from coal fueled boilers.

The third funding opportunity award is for $9.3 million for ten projects under DE-FOA-0002001, Crosscutting Research for Coal-Fueled Power Plants. Selected projects will develop innovative technologies that enhance the performance and economics of the existing and future coal fleet—thereby lowering electricity costs for consumers. This effort supports DOE's Crosscutting Research Program, which develops technologies that can be applied to a range of fossil energy uses.

The fourth funding opportunity award is for $5 million under DE-FOA-0002002, Advanced Materials for High-Efficiency, Flexible and Reliable Coal-Fueled Power Plants. DOE selected five projects to support its Crosscutting Research program, which fosters the development and deployment of innovative systems for improving efficiency and environmental performance. The projects focus on enhancing the cyclic durability and reducing the cost of materials used in advanced ultra-supercritical (AUSC) power plants.

In the fifth funding opportunity award, three projects were selected to receive up to $15 million under DE-FOA-0002003, Process Scale-Up and Optimization/ Efficiency Improvements for Rare Earth Elements (REE) and Critical Materials (CM) Recovery from United States Coal-Based Resources. The selected projects will support DOE's Feasibility of Recovering REEs program and will advance technology development for recovery of REE and CM from domestic coal-based resources via conventional extraction, separation, and recovery processes.

Finally, through **the sixth** funding opportunity award, two projects were selected to receive $5.3 million under DE-FOA-0001998, Transformational Sensing Systems for Monitoring the Deep Subsurface. This award seeks to reduce uncertainty of and enable real-time decision-making associated with subsurface carbon dioxide (CO_2) storage. The selected projects support DOE's Carbon Storage Research Program by improving characterization and prediction of subsurface fluid movement and enhancing real-time measurement of critical subsurface properties.

News Media Contact:

(202) 586-4940

Project Descriptions: $56.5M for Clean Coal Technologies

Office of Fossil Energy

FOA 1992: Maximizing the Coal Value Chain

The ten projects fall under three areas of interest (AOIs) as follows:

AOI 1: IMPROVED DOMESTIC U.S. COAL FEEDSTOCKS FOR POWER PRODUCTION AND STEEL-MAKING

Subtopic 1B: Coal beneficiation pilot-plant testing

1. Low Emissions Upgraded Utility Fuel from Low-Rank Coals – Thermosolv LLC (Laramie, WY) will develop and test a patented coal upgrading/pyrolysis technology to recover value-added precursors from lower-rank coals while producing a low-emissions, higher British Thermal Unit beneficiated coal product for utility and industrial applications. The goal of the proposed work is to develop an advanced low-cost coal upgrading technology to produce a stable, upgraded utility fuel while extracting valuable liquid precursors for high-value carbon products.
DOE Funding: $1,891,501; Non-DOE Funding: $548,124; Total Value: $2,439,625

AOI 2: PRODUCING HIGH-VALUE SOLID PRODUCTS FROM DOMESTIC U.S. COAL

Subtopic 2A: Laboratory testing of technologies for making high-value solid products from coal

2. A Novel Process for Converting Coal to High-Value Polyurethane Products – Battelle Memorial Institute (Columbus, OH) will mature a novel process to convert high-volatile bituminous and sub-bituminous U.S. coals to high-value polyurethane (PU) foam (solid) products, along with some low-sulfur fuel oil by-product. The results of this project are expected to confirm the commercial viability of a coal-to-high-value, solid PU foam products process.
DOE Funding: $747,108; Non-DOE Funding: $190,000; Total Value: $937,108

3. Conversion of Coal to Li-ion Battery Grade "Potato" Graphite – The George Washington University (Washington, DC) will further develop a recently discovered process to efficiently transform low-cost coal (lignite) into high-performance, high-value (Li-ion grade) "potato" graphite. The project will result in the development of scalable processes for economically upgrading lignite to Li-ion quality graphite, enabling the domestic production of graphite—a strategic and critical material—and significantly reducing the cost of Li-ion batteries used to power a wide range of portable electronic and electric vehicles.
DOE Funding: $748,720; Non-DOE Funding: $200,310; Total Value: $949,030

4. Production of Carbon Nanomaterials and Sorbents from Domestic U.S. Coal – The Board of Trustees of the University of Illinois (Champaign, IL) will produce high-value carbon nanomaterials and carbon sorbents from domestic coal resources in a cost-effective manner. After further development, the proposed technology could provide low-cost graphene materials for numerous applications—such as composites, functional coatings, and electronics—generating a new market for domestic coal.
DOE Funding: $749,937; Non-DOE Funding: $238,494; Total Value: $988,431

5. Coal to Carbon Fiber – Novel Supercritical CO2 Solvated Process – Ramaco Carbon LLC (Sheridan, WY) will develop a vertically integrated continuous manufacturing process that can transform raw coal feedstocks into pitch and carbon fibers. The project offers a closed-system approach to processing environmentally hazardous intermediates like polycyclic aromatic compounds.
DOE Funding: $733,299; Non-DOE Funding: $323,500; Total Value: $1,056,799

Subtopic 2B: Continuous process testing of technologies for high-value solid products from coal

6. Direct Utilization of U.S. Coal as Feedstock for the Manufacture of High-Value Coal Plastic Composites – Ohio University (Athens, OH) will develop coal plastic composite (CPC) decking boards that possess lower manufacturing costs than current commercial wood plastic composite decking boards and meet all applicable ASTM and International Building Code performance specifications. The CPC manufacturing process offers significant advantages, utilizes existing commercial manufacturing equipment, and produces a CPC product with equivalent or superior properties than existing wood composite products.
DOE Funding: $1,500,000; Non-DOE Funding: $506,678; Total Value: $2,006,678

7. Coal to Carbon Fiber (C2CF) Continuous Processing for High-Value Composites – University of Kentucky Research Foundation (Lexington, KY) will develop and scale efficient processing technology for ultra-low quinoline insolubles (QI) coal tar pitch and subsequent mesophase pitch; clarify and simplify tedious continuous fiber processing technologies toward the efficient production of high-performance carbon

fiber products; and demonstrate and characterize representative composite parts derived from the coal-to-carbon-fiber (C2CF) paradigm. This project could show the maximized value of the coal resource stream; demonstrate a reduced capex investment risk for C2CF manufacture and pave the way for significant domestic C2CF manufacturing; and demonstrate end-uses for its derived composite materials.
DOE Funding: $1,475,250; Non-DOE Funding: $372,721; Total Value: $1,847,971

8. Experimental Validation and Continuous Testing of an On-Purpose High-Yield Pitch Synthesis Process for Producing Carbon Fiber from U.S. Domestic Coal – Ramaco Carbon LLC (Sheridan, WY) will develop a process to create high-quality carbon fiber precursor material from U.S. coal using low-severity direct coal liquefaction techniques in the synthesis of coal tar pitch. This project could lead to cost reductions to take advantage of a secure, plentiful domestic coal feedstock, and may significantly expand the market for pitch-based carbon fiber.
DOE Funding: $883,365; Non-DOE Funding: $220,842; Total Value: $1,104,207

AOI 3: ALTERNATIVE TECHNOLOGIES SUCH AS MICROWAVE OR LOW-TEMPERATURE PLASMA TO CONVERT DOMESTIC U.S. COAL INTO HIGH-PERFORMANCE CARBON MATERIALS

9. Efficient, Ultra-Rapid Microwave Plasma Process for Generation of High-Value, Industrial Carbons and 3D-Printable Composites from Domestic Coal – H Quest Vanguard Inc. (Pittsburgh, PA) will demonstrate rapid, efficient, high-yield conversion of commercially-sourced domestic coals using a low-temperature microwave plasma coal pyrolysis technology with subsequent conversion of liquid intermediaries into value-added solid carbon products, namely carbon and graphitic materials for industrial electrode applications and advanced 3D-printable carbon polymer composites. The potential impact of this project is the penetration of coal products into lucrative domestic industries such as energy storage, transportation, electric arc smelting, 3D manufacturing, water and air purification, aerospace, carbon composite manufacturing, and others.
DOE Funding: $750,000; Non-DOE Funding: $207,050; Total Value: $957,050

10. Conversion of Domestic U.S. Coal into Exceedingly High-Quality Graphene for $100 per Ton – William Marsh Rice University (Houston, TX) will study flash Joule heating of anthracite and bituminous coal, as well as other carbon sources, to produce flash graphene. The flash graphene manufactured from coal is poised to be the first price-competitive graphene additive for the plastics, steel, aluminum, and concrete industries to enhance the properties of their respective composite materials.
DOE Funding: $750,000; Non-DOE Funding: $187,500; Total Value: $937,500

FOA 1996: Advancing Steam Turbines for Coal Boilers

The two selected projects fall under one AOI as follows:

AOI 1: ADVANCED MANUFACTURING APPLIED TO STEAM TURBINE PARTS FOR HIGHER EFFICIENCY AND LOWER COST STEAM TURBINES

1. Improve Performance and Cost for Steam Turbine Maintenance, Repair, and Overhaul Using Additive Manufacturing – General Electric Company, GE Research (Niskayuna, NY) plans to develop additive manufacturing-enabled repair solutions for coal-fired steam turbines to reduce routine maintenance, repair, and overhaul costs, and improve the operational efficiency of steam turbines. Work will focus on components that are among the most commonly replaced and significantly impact performance. Additive manufacturing offers greater customization and flexibility, as compared to traditional manufacturing processes.
DOE Funding: $5,897,199; Non-DOE Funding: $1,474,300; Total Value: $7,371,499

2. Ensemble Manufacturing Techniques for Steam Turbine Components across Length Scales – Siemens Corporation, Corporate Technology (Princeton, NJ) aims to expedite the design and manufacture of steam turbine components through AM to meet the modern power grid demands for improved efficiency and enhanced operational flexibility. Siemens intends to use multidisciplinary technologies to accelerate the development of materials; high-throughput experiments for their qualification; and design flexibility/topology optimization for repair and redesign of components in order to address critical failure mechanisms for improved performance and increased reliability of existing power plant components.
DOE Funding: $5,999,999; Non-DOE Funding: $1,600,562; Total Value: $7,600,561

FOA 2001: Crosscutting Research for Coal-Fueled Power Plants

The ten selected projects fall under three AOIs as follows:

AOI 1: ADVANCED MANUFACTURING OF EMBEDDED SENSORS

1. Additive Manufacturing of Circumferentially Embedded Optical Probe Modules for In Situ Monitoring of Coal-Fueled Steam Turbines – Clemson University (Clemson, SC) will design, develop, additively manufacture, test, and validate three types of optical sensor modules (temperature, pressure, and blade tip timing/clearance) for in situ monitoring of the critical operation parameters in coal-fueled steam turbines. These sensor modules will be embedded into General Electric's Smart Ring and installed into the inner wall of the turbine casing for condition-based monitoring, control, and maintenance scheduling. These embedded smart parts present a novel solution for monitoring the critical equipment and systems in power and energy industry for improved efficiency, reduced emission, and enhanced reliability.
DOE Funding: $1,000,000; Non-DOE Funding: $250,000; Total Value: $1,250,000

2. Embedded Sensors Integrated into Critical Components for In Situ Health Monitoring of Steam Turbines – Siemens Corporation (Princeton, NJ) will develop embedded sensors capable of assessing position, angle, temperature, and the derivatives (e.g., velocity, acceleration, etc.). The goal of this project is to embed the novel sensors using either additively manufactured or extruded waveguides on rotating blades for recording, evaluating, and monitoring blade vibrations in low-pressure turbines.
DOE Funding: $999,918; Non-DOE Funding: $249,980; Total Value: $1,249,898

3. Advanced Manufacturing of Ceramic Anchors with Embedded Sensors for Process and Health Monitoring of Coal Boilers – West Virginia University Research Corporation (Morgantown, WV) will develop advanced manufacturing methods to fabricate and test ceramic anchors with an embedded sensor technology for monitoring the health and processing conditions within pulverized-coal and fluidized-bed combustion boiler systems. The sensors will be incorporated and interconnected through the volume of the ceramic anchor and will not negatively impact the intrinsic properties of the anchor or the monolithic (castable) boiler refractory liner—circumventing the need to insert an isolated stand-alone sensor into the monolithic refractory liners via an access port.
DOE Funding: $999,084; Non-DOE Funding: $255,635; Total Value: $1,254,719

AOI 2: COAL POWER PLANT COOLING TECHNOLOGIES

4. Enhanced Cooling Tower Technology for Power Plant Efficiency Increase and Operating Flexibility – Gas Technology Institute (Des Plaines, IL) will develop and demonstrate a prototype of an economically viable all-weather Sub-Dew Point Cooling Tower (SDPCT) up to 100 kilowatt-thermal with inlet air precooling and dehumidification. System performance will be experimentally tested and modeled for a wide range of process temperatures and flow rates. Data will be collected for the project team review, analysis, and modeling verifications. A technoeconomic analysis will consider supercritical coal-fired power plants located at three typical U.S. locations and three ambient conditions at each location. This range will assess if the SDPCT technology provides substantial benefits for specific locations.
DOE Funding: $1,230,043; Non-DOE Funding: $307,755; Total Value: $1,537,798

5. Water Recovery from Cooling Tower Plumes – Infinite Cooling Inc. (Somerville, MA) will build, optimize, and test an electrostatic plume collection system. The team will gain an understanding of cooling tower plume properties, which will be used to optimize the design, material, and electrical properties of the collection device; quantify the yield by flow rate and water quality; and finally push the collection efficiency further by advanced collection enhancement approaches. The final result will be a ready-to-deploy design for a high-throughput water collector. The technology can provide significant water savings and improve water quality, add minimal energy costs, and be retrofitted to existing towers, thereby having a large impact on the water-energy nexus. It could lead to a significant reduction in water usage by cooling towers of coal plants as well as a reduction in chemicals used for water treatment.
DOE Funding: $1,500,000; Non-DOE Funding: $375,000; Total Value: $1,875,000

6. Wastewater Recycling Using a Hygroscopic Cooling System – University of North Dakota (Grand Forks, ND) will test the feasibility of using the Energy & Environmental Research Center's hygroscopic cooling technology to eliminate power plant wastewater by recycling the water fraction to augment the plant's cooling load and collecting the remainder as a solid by-product for reuse or disposal. The team will survey wastewater sources at a candidate host site power plant and collect samples for analysis and

a laboratory evaluation of forced precipitation. A key benefit of this technology is that it improves the plant's overall water-use efficiency, while allowing it to conform with zero-liquid-discharge requirements.
DOE Funding: $660,000; Non-DOE Funding: $165,000; Total Value: $825,000

AOI 3: MODELING EXISTING COAL PLANT CHALLENGES

7. Damage Accumulations Predictions for Boiler Components via Macrostructurally Informed Material Models – General Electric Company (Niskayuna, NY) will model material behavior and degradation for nickel-based superalloys used in current and next-generation boiler components. The work will provide physically informed models, capturing the microstructural changes taking place in industrial components under cyclic loading, long duration stress, and high temperature exposure. The models will help the industry evaluate the efficiency and economics of introducing new materials in existing plants.
DOE Funding: $749,852; Non-DOE Funding: $187,463; Total Value: $937,315

8. Investigation of Cycling Coal-Fired Power Plants Using High-Fidelity Models – General Electric Company (Niskayuna, NY) will conduct a series of analyses to investigate the challenges of cycling coal-fired power plants. Model-based analyses will be performed for the critical components in the boiler island and its damage remediation solutions. These analyses will produce insights into existing coal power plant challenges impacted by cycling operations, and will generate practical and cost-effective solutions to cycle coal power plants to reduce plant failures and extend plant life.
DOE Funding: $749,943; Non-DOE Funding: $187,486; Total Value: $937,429

9. Component Level Modeling of Materials Degradation for Insights into Operational Flexibility of Existing Coal Power Plants – Siemens Corporation (Princeton, NJ) will develop a component level modeling toolkit for materials-based degradation for two key mechanisms that can accelerate with cyclic operations. The validated model developed can 1) be extrapolated to coal and other fossil plants with similar environmental conditions and failure mechanisms to enable plants to operate for longer periods of time under flexible load conditions and 2) be extended to combined-cycle power plants.
DOE Funding: $749,998; Non-DOE Funding: $202,817; Total Value: $952,815

10. Life Modeling of Critical Steam Cycle Components in Coal-Fueled Power Plants – Southern Research Institute (Birmingham, AL) will calibrate an existing damage accumulation and component life model to a coal-fueled power plant steam cycle, high-pressure turbine, disk/rotor alloy, and a steam cycle Y-block alloy. The model will inform proposed maintenance and inspection schedules based upon historical and current operational data. The model will also provide insight about component lifetime that may ultimately result in a more efficient power cycle.
DOE Funding: $689,876 Non-DOE Funding: $172,469 Total Value: $862,345

FOA 2002: Advanced Materials for High-Efficiency, Flexible and Reliable Coal-Fueled Power Plants

The five selected projects fall under two AOIs as follows:

AOI 1: SINGLE-TOPIC AWARDS

1. Development of Corrosion- and Erosion-Resistant Coatings for Advanced Ultra-Supercritical Materials – Tennessee Technological University (Cookeville, TN) aims to develop and evaluate corrosion- and erosion-resistant coatings for AUSC materials using a cost-effective electrolytic co-deposition process. The focus will be on enhancing both corrosion and erosion properties of the electro-co-deposited coatings for the protection of high-pressure steam turbine blades in AUSC pulverized coal-fired power plants.
DOE Funding: $999,999; Non-DOE Funding: $250,756; Total Value: $1,250,755

2. Optimization of WAAM Process to Produce AUSC Components with Increased Service Life – United Technologies Research Center (East Hartford, CT) will work to develop the capability for large-area wire arc additive manufacturing (WAAM) to cost-effectively produce AUSC components with extended design life under severe service conditions. The main objective of this project is to extend structural life through a combination of WAAM process augmentation and implementation of predictive physics-based and machine learning models for design life optimization.
DOE Funding: $999,933; Non-DOE Funding: $249,983; Total Value: $1,249,916

3. Additively Manufactured Graded Composite Transition Joints for Dissimilar Metal Weldments in Advanced Ultra-Supercritical Power Plant – West Virginia University Research Corporation (Morgantown, WV) will develop and demonstrate at the lab scale the technical feasibility of producing an innovative

functionally gradient composite transition joint part that can be used to connect and join dissimilar metals to cost-effectively solve the critical challenges of premature failure of the conventional dissimilar metal welds under increased cyclic operating conditions of fossil power plants.
DOE Funding: $999,966; Non-DOE Funding: $269,899; Total Value: $1,269,865

AOI 2: MULTI-TOPIC AWARDS

4. Low-Cost HIP Fabrication of Advanced Power Cycle Components and PM/Wrought IN740H Weld Development – General Electric Company, GE Research (Niskayuna, NY) will work to demonstrate the feasibility of fabricating certain advanced power cycle structures. The work will address both component fabrication cost reduction and welding, two areas of interest relevant to AUSC steam and supercritical carbon dioxide (sCO2) component manufacturing. The work may accelerate application/adoption of near net shape hot isostatic pressed (HIP) technology in manufacturing AUSC/sCO2 turbine components and other large, complex components for the aerospace, power, and nuclear industries.
DOE Funding: $999,505; Non-DOE Funding: $300,000; Total Value: $1,299,505

5. Welding of Haynes 282 to Steels to Enable Modular Rotors for Advanced Ultra-Supercritical Steam Turbines – Siemens Corporation, Corporate Technology (Princeton, NJ) is planning a technology development project to weld Haynes 282 to several grades of steels that are commonly used for steam turbine rotor applications, which enables the use of expensive superalloys only in locations where they are needed and avoids large monolithic forgings. Welding smaller forgings together will allow original equipment manufacturers in the United States to manufacture large forgings faster and more cheaply.
DOE Funding: $1,000,000; Non-DOE Funding: $408,866; Total Value: $1,408,866

FOA 2003: Process Scale-Up and Optimization/Efficiency Improvements for Rare Earth Elements (REE) and Critical Materials (CM) Recovery from United States Coal-Based Resources

Descriptions of the three selected projects follow:

1. Demonstration of Scaled-Production of Rare Earth Oxides and Critical Materials from Coal-Based Sources Using Innovative, Low-Cost Process Technologies and Circuits – University of Kentucky Research Foundation (Lexington, KY) will extend the activities of the existing REE pilot plant to integrate and test new technologies and circuits that will significantly reduce the cost of producing rare earth oxide mixes, cobalt, and manganese at purity levels significantly greater than 2 percent by weight. Concentrate production will be increased from a current rate of 10–100 grams per day to around 200 grams per day. To significantly reduce the primary cost of producing the concentrates, naturally occurring coal pyrite will be recovered and used in bioreactors to produce the acid needed for leaching.

2. Rare Earth Element Extraction and Concentration at Pilot-Scale from North Dakota Coal-Related Feedstocks – University of North Dakota (Grand Forks, ND) will demonstrate at a pilot-scale its novel technology for REE recovery from North Dakota lignite coal and related feedstocks, which have been identified to have some of the highest REE concentrations reported for U.S. coals. The pilot will process at least 100 tons of feedstock. The ultimate significance of this pilot-scale demonstration is the development of a high performance, environmentally benign, and economically viable technology for REE production from lignite coal resources that will limit dependence on foreign supplies, and strengthen the economic and national security of the nation.

3. Development and Testing of an Integrated AMD Treatment and Rare Earth/Critical Mineral Plant – West Virginia University Research Corporation (Morgantown, WV) will develop and test a pilot-scale, continuous process for efficiently treating Acid Mine Drainage (AMD) while producing an enriched REE/CM concentrate. In addition to addressing one of the region's largest sources of stream pollution, AMD, this new type of AMD treatment plant will generate a steady supply of REE/CM, a strategically important and valuable product stream. The upstream concentration unit to be installed at an active AMD discharge treatment site will simultaneously treat up to 1,000 gallons per minute of AMD while recovering and concentrating a commercially attractive REE/CM product.

FOA 1998: Transformational Sensing Systems for Monitoring the Deep Subsurface

The two selected projects fall under one AOI. Descriptions follow:

AOI 1: TRANSFORMATIONAL SENSING CAPABILITIES FOR CHARACTERIZING THE DEEP SUBSURFACE

1. Wireless Microsensors System for Monitoring Deep Subsurface Operations – Battelle Memorial Institute (Columbus, OH) intends to develop, fabricate, and demonstrate a fully integrated wireless microsensor-based downhole sensing system to measure temperature as the primary indicator of CO2 presence, with pressure as a secondary indicator. Deploying this system can produce a network of real-time monitoring points above CO2 storage zones and provide critical data to accurately track and model subsurface movement of the CO2 plume.

2. Casing Annulus Monitoring of CO2 Injection Using Wireless Autonomous Distributed Sensor Networks – The University of Texas at Austin (Austin, TX) plans to develop and validate an innovative transformational sensor system that integrates wireless autonomous microsensor technology, sensor packaging, emplacement technology, and smart well completions from multiple sources. The expected results will provide field laboratory validation of an integrated distributed wireless intelligent sensor system that provides real-time data, improving the ability to monitor movement of fluids in the subsurface through direct formation measurements.

World News: VIETNAM

DOOSAN COMPLETES CONSTRUCTION OF VINH TAN 4 THERMAL POWER PLANT IN VIETNAM

Doosan Heavy Industries & Construction (DHIC) announced on 22 September that it had held the construction completion ceremony for the Vinh Tan 4 thermal power plant ordered by Electricity of Vietnam (EVN).

Doosan Heavy Industries & Construction (DHIC) announced on 22 September that it had held the construction completion ceremony for the Vinh Tan 4 thermal power plant ordered by Electricity of Vietnam (EVN).

Held in Binh Thuan province on 21 September, the ceremony was attended by Vietnamese Deputy PM Truong Hoa Binh, EVN Chairman Duong Quang Thanh and CEO of DHIC plant EPC BG Inwon Park.

The Vinh Tan 4 thermal power plant has been built in Binh Thuan province, about 230 km east of Ho Chi Minh City, to resolve the power shortage in Southern Vietnam. DHIC received the turnkey project to construct the 1200 MW power plant for about KRW 1.6 trillion in 2013, and has been responsible for the entire EPC process from design and equipment manufacturing to installation and commissioning.

"Since the construction of the Mong Duong II coal-fired power plant in 2010, DHIC has been recognised for its know-how in Vietnam, receiving eight projects in total. We plan to broaden our presence in the Vietnamese power generation market, which is expected to expand its power generation capacity to 136 GW by 2030," said Inwon Park, CEO of the DHIC Plant EPC BG.

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PRESS RELEASES

Contura Announces Agreement to Resolve Reclamation Obligations Related to Powder River Basin Mines / BRISTOL, Tenn.,

September 18, 2019

Deal Allows for the Replacement of $237M in Contura-Held Reclamation Bonds and Related Collateral

Contura Energy, Inc. (NYSE: CTRA), a leading U.S. coal supplier, today announced that it has entered into an agreement with Eagle Specialty Materials, LLC (Eagle Specialty Materials), an affiliate of FM Coal, LLC, related to Eagle Specialty Materials' interest in acquiring and operating the Eagle Butte and Belle Ayr thermal coal mines located in the Powder River Basin (PRB) in Campbell County, Wyoming. Subject to the completion of certain agreements with other private and governmental interested parties, the approval of regulatory and legal authorities, the occurrence of the closing and certain other covenants and conditions, Contura will be released of any and all bonding, reclamation, and operational liabilities related to the two PRB mines.

"We've been clear that operating long-term in the PRB was not in Contura's strategic plans, and that the best possible outcome for all interested parties would be for another responsible operator to step up that was interested in doing just that," said chairman and chief executive officer, David Stetson. "We are extremely pleased that this deal outlines a path to relieve Contura from any go-forward liabilities related to these assets, while also providing long-term employment opportunities for hard-working miners and ongoing revenue to local, state, and federal governments."

As previously announced, Blackjewel L.L.C., Blackjewel Holdings L.L.C. and certain affiliated entities filed voluntary petitions for reorganization under Chapter 11 of the Bankruptcy Code in the U.S. Bankruptcy Court for the Southern District of West Virginia on July 1, 2019, and were joined by several other affiliated entities which filed voluntary petitions on July 24, 2019 (all such debtor entities, collectively, Blackjewel, or the Debtors). Subsequently, on July 25, 2019, Contura announced that it would serve as the stalking horse purchaser for certain assets offered for sale through Blackjewel's bankruptcy proceedings, including substantially all of the assets of the Belle Ayr and Eagle Butte mines, related facilities and equipment (Western Assets), as well as substantially all of the assets, related facilities and equipment of the S-7 Surface metallurgical coal mine (commonly referred to as the Pax Surface mine), in Fayette County, West Virginia (Pax Assets). In conjunction with the proposed transaction, Contura provided to the Debtors a cash purchase deposit of $8.1 million to be applied to the overall purchase price.

Since that time, the U.S. Bankruptcy Court approved the terms of the sale related to the Pax Assets, including the application of $5.05 million of the purchase deposit toward the Pax transaction, which closed on September 17, 2019.

Simultaneously with the process outlined above, Contura has been negotiating with the Debtors and relevant local, state, and federal regulatory agencies in an effort to finalize the terms of the sale of the Western Assets, but has not reached a resolution to date that satisfies all parties. As previously disclosed, Contura was a prior owner of the Western Assets through its subsidiary, Contura Coal West, LLC (Contura Coal West), though the company has not operated the mines since selling the assets to Blackjewel in December 2017. Because the permit transfer process relating to that transaction was not completed prior to Blackjewel filing for Chapter 11 bankruptcy protection, however, Contura Coal West remains the permitholder in good standing for both mines and maintains sufficient bonding to cover related reclamation and other obligations, as determined

by the Wyoming Department of Environmental Quality.

Pursuant to the terms of the agreement announced today, Contura and Eagle Specialty Materials will use commercially reasonable efforts to enter into definitive agreements with the Debtors; third-party sureties; local, state, and federal governmental entities; and other interested parties as necessary to accomplish the purchase and subsequent immediate operation of the Western Assets by Eagle Specialty Materials, the transfer of certain state and federal permits and leases from both Contura and Blackjewel to Eagle Specialty Materials, and the replacement of Contura-held bonds related to the Western Assets with new bonding provided by Eagle Specialty Materials. The Debtors are not party to the agreement, and the sale of the two PRB mines to Eagle Specialty Materials is contingent upon Eagle Specialty Materials reaching agreement with the Debtors and other third parties regarding the terms of such sale and obtaining approval of the United States Bankruptcy Court for the Southern District of West Virginia.

Also pursuant to the agreement, subject to closing and certain other covenants and conditions, Contura will provide $90.0 million in cash and convey certain Wyoming real property to Eagle Specialty Materials, will pay $13.5 million to Campbell County, Wyoming for ad valorem back taxes, and will waive its rights to the remaining $3.05 million of the previously-referenced purchase deposit provided to the Debtors. Concurrently, Eagle Specialty Materials will make a specified cash payment to the Debtors, will assume all reclamation obligations and certain other liabilities relating to the Western Assets, will pay off certain debts owed by the Debtors, including certain debtor-in-possession financing, and will agree to make certain payments in respect of royalties, taxes, Abandoned Mine Land (AML) reclamation fees, and other amounts arising from the permitted mining operations.

Assuming consummation of the various agreements outlined, Contura expects to have returned to it approximately $9 million of cash collateral related to posted bonds, as well as to be released of any and all remaining claims against the company with regard to past federal and state royalties; federal, state, and local taxes; or other fees associated with the Western Assets. In addition, Contura and Eagle Specialty Materials are working with the United States Department of Interior's Office of Surface Mining, Reclamation and Enforcement (OSM) toward an agreement that, upon Eagle Specialty Materials' assumption of operational responsibility, neither Contura nor its subsidiaries, directors, officers, or employees would be held liable for any violations or other conditions related to mining op-

erations of Eagle Specialty Materials regardless of the status of planned permit and lease transfers related to the Western Assets.

"The hard work and guidance we've received from OSM has been integral to getting where we are today, and this transaction simply will not be possible without their ongoing involvement and support," added Mr. Stetson. "The Trump Administration has been steadfast in its support for our industry, our miners, and the important role coal plays in meeting our nation's energy and infrastructure needs."

The agreement in its entirety is subject to approval by both Contura's board of directors and the U.S. Bankruptcy Court. The closing of the transactions described are subject to numerous conditions, many of which require the agreement or consent of third parties and/or are otherwise outside of the control of Contura and Eagle Specialty Materials. Therefore, there can be no assurance that those conditions will be satisfied and/or waived and therefore no assurance that the transactions described will be consummated.

ABOUT CONTURA ENERGY

Contura Energy (NYSE: CTRA) is a Tennessee-based coal supplier with affiliate mining operations across major coal basins in Pennsylvania, Virginia and West Virginia. With customers across the globe, high-quality reserves and significant port capacity, Contura Energy reliably supplies both metallurgical coal to produce steel and thermal coal to generate power. For more information, visit www.conturaenergy.com.

FORWARD-LOOKING STATEMENTS

This news release includes forward-looking statements. These forward-looking statements are based on Contura's expectations and beliefs concerning future events and involve risks and uncertainties that may cause actual results to differ materially from current expectations. These factors are difficult to predict accurately and may be beyond Contura's control. Forward-looking statements in this news release or elsewhere speak only as of the date made. New uncertainties and risks arise from time to time, and it is impossible for Contura to predict these events or how they may affect Contura. Except as required by law, Contura has no duty to, and does not intend to, update or revise the forward-looking statements in this news release or elsewhere after the date this release is issued. In light of these risks and uncertainties, investors should keep in mind that results, events or developments discussed in any forward-looking statement made in this news release may not occur.

U.S. Department of Labor Awards $400,000 in Brookwood-Sago Grants for Mine Safety Education and Training / ARLINGTON, VA

The U.S. Department of Labor's Mine Safety and Health Administration (MSHA) has announced the award of $400,000 in funding through its Brookwood-Sago grant program to support education and training to help identify, avoid and prevent unsafe working conditions in and around the nation's mines.

The Fiscal Year 2019 grants focus on powered haulage safety (such as reducing vehicle-on-vehicle collisions, increasing seat belt use, and improving belt conveyor safety), emergency prevention and preparedness, examinations of working places at metal and nonmetal mines, or other programs to prevent unsafe conditions in and around mines. Funding will enable grant recipients to develop training materials, provide mine safety training or educational programs, recruit mine operators and miners for the training and conduct and evaluate the training.

Established by the Mine Improvement and New Emergency Response (MINER) Act of 2006, the program promotes mine safety in honor of 25 miners who died in 2001 in Brookwood, Alabama, at the Jim Walter Resources #5 mine, and in 2006 in Buckhannon, West Virginia, at the Sago Mine.

The grant recipients are as follows:

Hutchinson Community College in Hutchinson, Kansas, received $50,000 to develop a powered haulage training module, including virtual reality simulation, that will focus on powered haulage-blind spot safety and workplace examinations;

Penn State University in University Park, Pennsylvania, received $158,181 to plan, design and develop a three-module, web-based mobile equipment safety education and training program on the potential hazards associated with mobile equipment visibility; designing and maintaining berms; and performing proper, thorough pre-shift examinations per the equipment manufacturer's specifications;

The United Mine Workers of America Career Centers Inc. in Prosperity, Pennsylvania, received $50,000 to develop a video and companion training documents emphasizing mine rescue team exploration and recovery procedures; University of Arizona in Tucson, Arizona, received $85,974 to develop modular training programs for workplace examinations, conveyor and mobile equipment interactions, and mine emergency preparedness, with a focus on small- and medium-sized metal and nonmetal mines. The training program will include an evidence-based, train-the-trainer and evaluations program; and

West Virginia University Research Corporation in Morgantown, West Virginia, received $55,845 to provide emergency prevention and preparedness training to coal miners and operators in the areas of self-contained self-rescuer expectations and mine rescue.

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Release Number 19-1505-NAT

Rich Nolan Named President and CEO of the National Mining Association / September 25, 2019, WASHINGTON, D.C.

The National Mining Association (NMA) today announced that Rich Nolan has been elected the Association's new President and Chief Executive Officer (CEO), following a detailed search process led by a Search Committee comprised of members of the Association's Board of Directors' Executive Committee. With more than 20 years of experience advocating on many natural resources sector issues, Mr. Nolan most recently served NMA for 13 years as Senior Vice President of Government and Political Affairs.

Mr. Nolan succeeds Hal Quinn, who last Spring announced his intention to retire before the end of 2019. Mr. Quinn will remain as an advisor to Mr. Nolan for the remainder of the year to ensure a successful transition.

"For more than a decade, I have worked alongside colleagues at NMA and at our member companies who I believe to be the leading experts in their areas. I am honored and humbled to take the helm of this great organization. Ours is a vital industry that

impacts every facet of American life – providing the raw materials and energy necessary for America's greatest innovations and technologies, national defense, manufacturing and much more. Mining and America's miners provide the foundation for American prosperity, and I look forward to helping to shape a positive, productive future for this essential industry," said Mr. Nolan.

Mr. Nolan's three decades in government affairs and political advocacy have spanned a number of industries including mining, forestry, paper, chemicals and agriculture. His career began on Capitol Hill, where he served as an aide to several members of Congress and worked as an advisor on multiple campaign committees. After his time on the Hill, he held leadership roles at associations and firms focusing on natural resources and environmental issues, including the American Forest & Paper Association, CropLife America and the U.S. Chamber of Commerce, among others.

"Rich knows our industry and the broad portfolio of issues. As a member of NMA's executive team, Rich has been critical in delivering successful outcomes for the membership year after year, and shaping the Association's multi-year strategic plans," said Phillips S. Baker, Jr., Chairman of the NMA Board and President and Chief Executive Officer of Hecla Mining Company. "The NMA strategy already bears the mark of his innovative thinking. That experience, coupled with his proven leadership, management and advocacy abilities, makes Rich the right leader for the next chapter in NMA's future.

"Finally, I want to thank Hal for his 34 years of service. His leadership to the NMA and the industry has been unparalleled. While he will be missed, he has built a foundation that will sustain the NMA for years to come," said Baker.

Warner, Kaine Request Fix for Miners' Healthcare / September 16, 2019

Source: Augusta Free Press

U.S. Sens. Mark Warner and Tim Kaine (both D-VA), along with Sens. Joe Manchin (D-WV), Doug Jones (D-AL), Sherrod Brown (D-OH), and Bob Casey (D-PA) wrote to House and Senate leadership advocating for the inclusion of a permanent fix for miners' health care and pensions in the short-term spending package that is currently being negotiated to keep the government open after September 30th, 2019.

"In July, we were alarmed to learn that 1,200 retired coal miners, their widows and their dependents would lose their health care benefits at the end of the calendar year. If we don't take action now, these families in Virginia, West Virginia, Wyoming, Alabama, Colorado, North Dakota and New Mexico will begin receiving health care termination notices at the end of October. Without congressional action to keep this from happening, they will spend their holiday season worrying about whether or not they will have to choose between their life-saving medications and putting food on the table," wrote the Senators.

Currently, the 1974 UMWA Pension Plan is on the road to insolvency due to coal company bankruptcies and the 2008 financial crisis. Earlier this year, Sens. Warner and Kaine introduced the American Miners Act of 2019 to shore up the 1974 UMWA Pension Plan to make sure that 87,000 current beneficiaries and an additional 20,000 retirees won't lose the pensions they have paid into for decades. In Virginia alone, there are approximately 7,000 retirees who are at risk of losing their benefits if Congress does not act. Additionally, the legislation would protect the 500 Virginians affected by the Westmoreland bankruptcy that has endangered health care benefits for additional miners and dependents.

In their letter, the senators also request that congressional leadership extend the Black Lung Disability Trust Fund that finances medical treatment and basic expenses for miners suffering from black lung disease.

"We are proud to cosponsor the American Miners Act (S. 27) which would protect and preserve not only these healthcare and pension benefits in perpetuity, but restore the Black Lung Trust Fund contribution rate to a much more sustainable level. During Senate consideration of the National Defense Authorization Act (NDAA), the entire Democratic caucus cosponsored this bill. Unfortunately, we were blocked from even having a vote on that amendment," continued the senators.

Sens. Warner and Kaine have continued to advocate on behalf of Virginia's coal miners and their families. In August 2018, they introduced and passed into law legislation to improve early detection and treatment of black lung disease among coal miners. The Senators also introduced legislation to make it easier for miners to access federal black lung benefits, make the benefit claims process fairer, and strengthen the benefits miners receive.

CONSOL Energy Receives NMA's CORESafety® Certification / October 8, 2019, WASHINGTON, D.C.

The National Mining Association (NMA) today recognized CONSOL Energy Inc. for becoming certified under its CORESafety® initiative. CONSOL is the 10th mining company to be fully certified utilizing the framework, which aims for zero fatalities and a 50 percent reduction in rate of injuries within five years.

"Certification is the culmination of a multi-step, multi-year process that requires dedication at every level of an organization – from the miner through management – and I commend CONSOL for prioritizing the safety of its people through this significant commitment," said Rich Nolan, NMA President and CEO. "Safety is an area where complacency has no place and the CORESafety framework is an important tool to drive constant vigilance and awareness."

"It is a tremendous honor and a true testament to the work and dedication of our miners, to receive this certification from the CORESafety initiative," said Jimmy Brock, President and CEO of CONSOL Energy. "Safety is more than a core value at CONSOL Energy, it is a condition of employment and a way of life. Reaching this milestone demonstrates our employees' commitment to safety and our focus on continually integrating best-practices while embracing technology and innovation, as we strive towards an incident-free workplace."

CORESafety's approach to safety and health emphasizes accident prevention and uses a risk-based management system anchored in leadership, management and assurance. The framework is designed to go beyond what is required by regulations, focusing on a goal of continuous improvement. Its objective is zero fatalities and a 50 percent reduction in mining's injury rate within five years of implementation. In 2017, companies participating in the CORESafety system closed the year with zero fatalities across U.S. operations.

CORESafety is a risk-based mine safety and health management system developed by NMA. CORESafety participants agree to: commit to the CORESafety system; implement a functionally-equivalent version of the CORESafety safety and health management system; submit to NMA annual self-assessments of progress toward implementation of the CORESafety safety and health management system; and, if the company elects to become or maintain CORESafety certification, complete a thorough third-party assessment of its safety and health management system to verify that it is functionally equivalent to CORESafety and submit the assessment report to NMA.

CONSOL Energy Inc. is a publicly owned Canonsburg-based producer and exporter of coal. Its origins date to 1860, and today CONSOL helps generate nearly one-third of the fuel for America's power supply. For over 10 years, CONSOL has operated under an Absolute ZERO value system based on the premise that having zero accidents is normal and that any accident is uncharacteristic and inconsistent with company values.

M&S Insurance and Safety Consultants Inc. conducted the independent audit in September 2019.

Navajo Company Keeps 1,200 Workers after Buying 3 Coal Mines / October 4, 2019, BILLLINGS, Mont. (AP)

A Navajo Nation company says it will retain 1,200 employees at three coal mines in Wyoming and Montana that it bought through a bankruptcy auction.

The announcement Thursday came a day after a federal judge gave final approval for the transfer of the mines from bankrupt Cloud Peak Energy to the Navajo Transitional Energy Co.

The purchase makes the Navajo company the third largest coal producer in the United States.

It comes as the industry is reeling from closures of coal-fired power plants across the U.S. Utilities increasingly favor natural gas and renewable energy sources over coal.

The deal covers Wyoming's Antelope and Cordero Rojo mines Montana's Spring Creek mine.

Navajo Transitional Energy Co. Chief Executive Clark Moseley says the company has a "solid record of returning mines to profitability."

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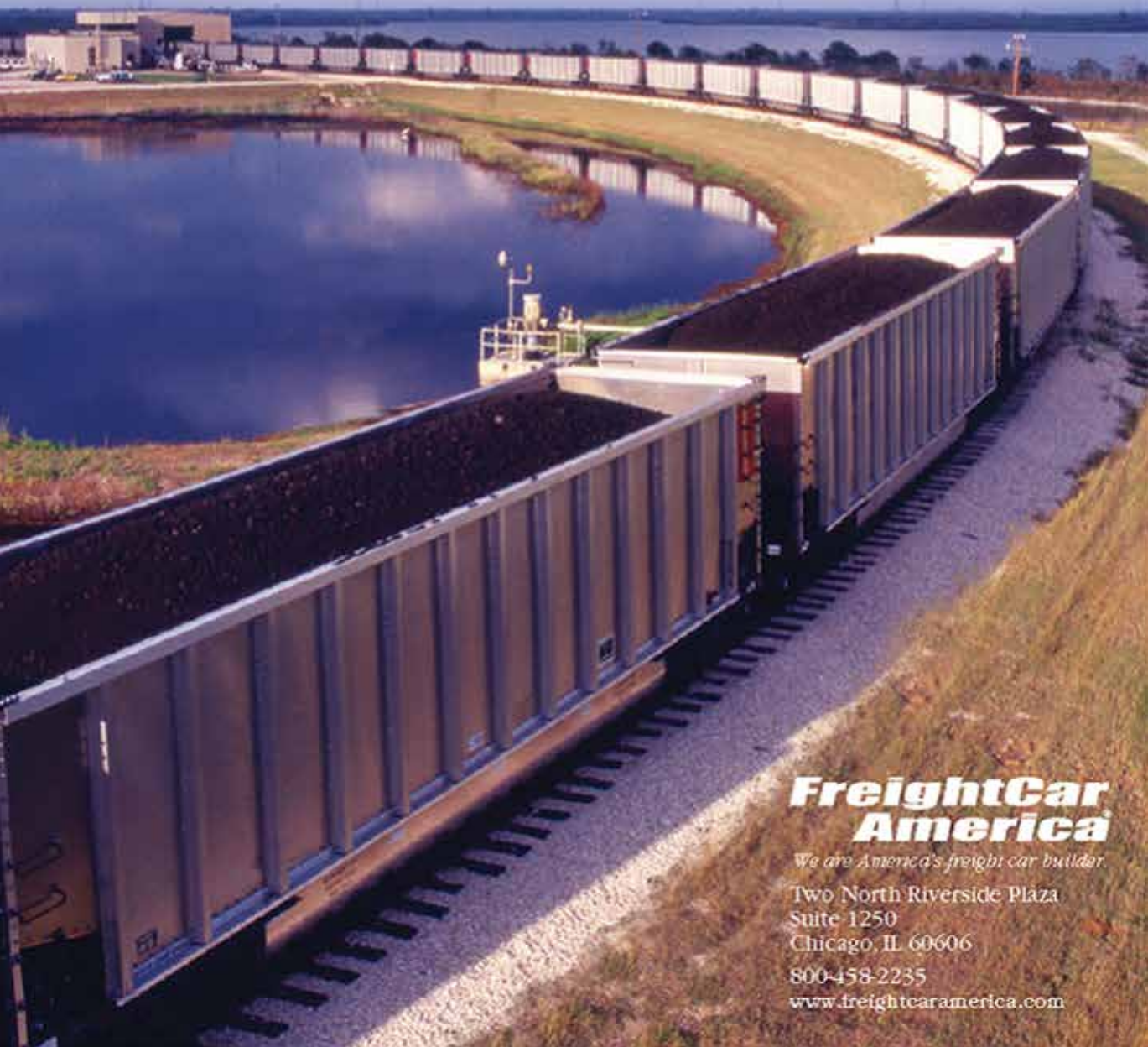

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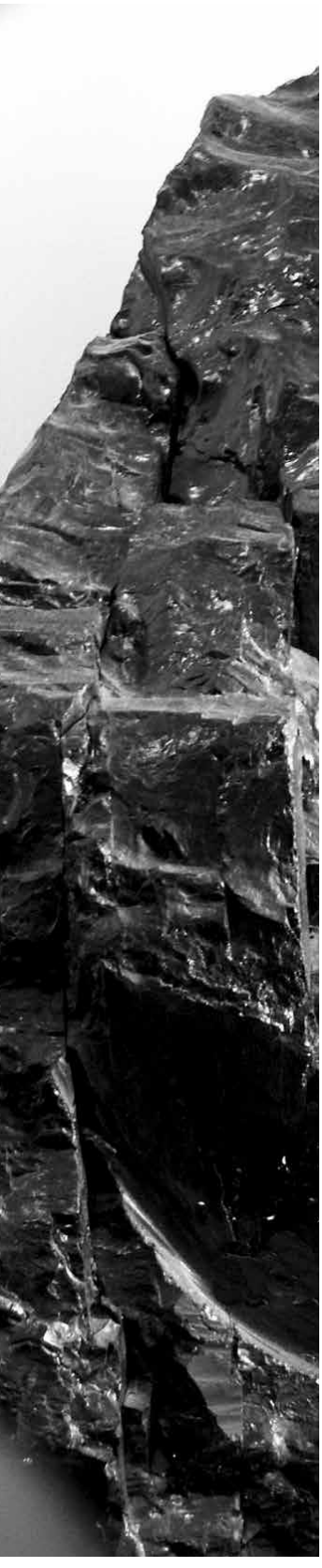
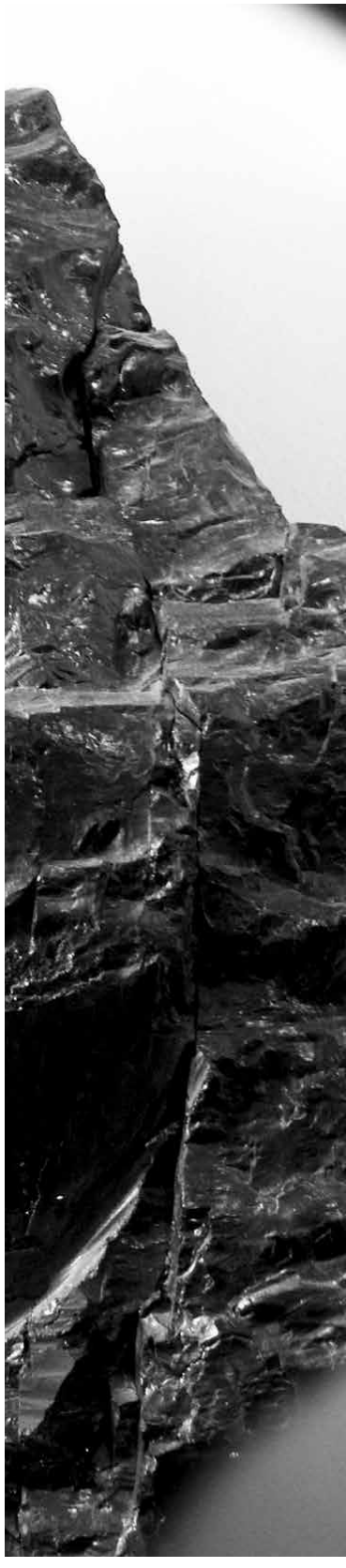


Cecil Roberts:

"Shutting down coal WILL NOT solve climate change"



Opinion

Source: The Charleston Gazette-Mail
Written by: Cecil Roberts, UMWA International President

In a speech at the National Press Club on Sept. 4, I made the statement that there were 1,600 coal plants being built around the world. Those who were at the speech or who registered to watch it online were provided my prepared remarks, which noted that the 1,600 figure was from a 2017 study and included plants under construction and planned.

Maybe I should have been more precise in my oral remarks, because my statement has been called "mostly false" by PolitiFact and prompted an editorial by the Gazette-Mail accusing me of misleading UMWA members and somehow providing them with false hope.

That's just bull. When I need advice from the Gazette-Mail about how to talk to coal miners, I'll ask for it.

Don't hold your breath.

The thrust of what I said was that, "Coal is not back. Nobody saved the coal industry." Coal-fired power plants are closing at a rapid pace and miners are losing their jobs.

I also mentioned several other things, including how much coal is being used in the United States compared to the rest of the world (our coal consumption in 2018 was less than one-tenth of global consumption), how many coal miners there are in the world (7,000,000 globally, 52,000 in the United States) and more. None of those statements has been challenged.

Those who actually heard the speech know that it was a call to action. Nitpicking about whether the number of new coal-fired power plants under construction or on the drawing boards is 1,600 or 1,100 or 400 misses the point, which is that those who advocate shutting down the American coal industry either fail to mention or just do not understand that global carbon emissions from fossil fuels will keep growing, even if every coal-fired power plant in this country is shut down.

China, India, Vietnam, Pakistan and dozens of other countries will continue to use coal and natural gas to power their economies for at least the next 50 years, and probably longer. The only way to deal with the greenhouse gas emissions that will result is to quickly develop and deploy commercial-grade carbon capture and storage technology worldwide, including here in the United States. As I said in my speech, that's not just me saying that. The Intergovernmental Panel on Climate Change of the United Nations says the same thing.

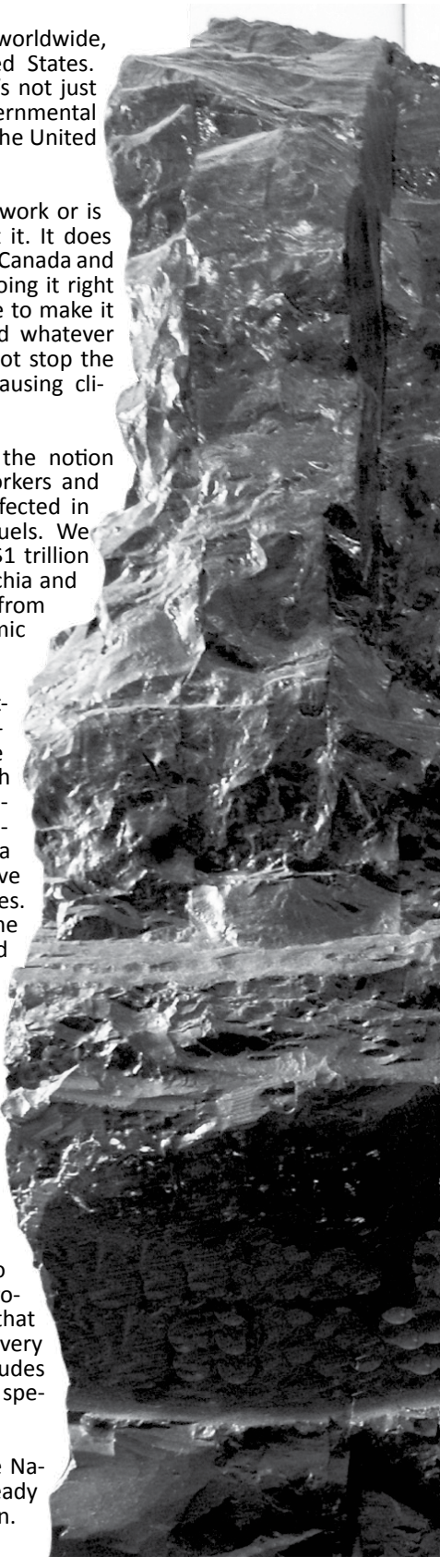
Those who say CCS will not work or is too expensive just don't get it. It does work, and there are plants in Canada and the United States that are doing it right now. But the fact is, we have to make it work and we have to spend whatever it takes to do it or we will not stop the global emissions that are causing climate change. Period.

I also called into question the notion of a "just transition" for workers and communities that will be affected in a move away from fossil fuels. We are talking about a cost of $1 trillion to $3 trillion to keep Appalachia and other parts of the country from spiraling into further economic despair.

I have nothing against creating good, union jobs in Appalachia that would provide similar high pay, quality health care benefits, retirement security and safe working conditions that only come with a union contract. We should have been doing that for decades. But no one can explain to me what those jobs will be and how they can guarantee they will be union jobs. Do not talk about a "just transition" until you can prove there will actually be one, and that the government will actually pay the cost of it.

So, instead of playing a numbers game, pointing fingers and saying, "gotcha," I believe our time would be better spent working together to develop a more sustainable, robust economy in Appalachia that provides opportunity for every working family, and that includes coal miners. We need to talk specifics, not wishes.

That was my message at the National Press Club. We are ready to be part of this conversation.



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SEPTEMBER 14-16, 2020
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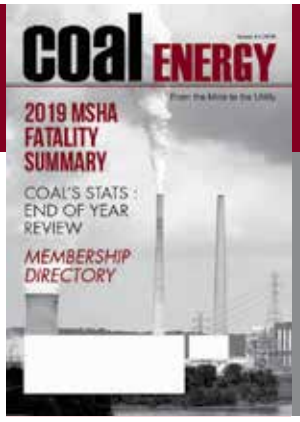

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