

*A Norfolk Southern train  
hauls coal across Dryfork  
Bridge near Bluefield, W. Va.*



# THE FUTURE OF COAL

## Prospects for West Virginia's Highest-Paying Industry Appear Bleak

BY KARL RHODES

Forty years ago, President Richard Nixon announced Project Independence, a series of steps to make the United States energy self-sufficient by 1980. At the top of the list, Nixon wanted factories and utilities to burn less oil and more coal.

Four years later, President Jimmy Carter declared “the moral equivalent of war” on the energy crisis and echoed Nixon’s call for “the renewed use of coal.” Oil and natural gas supplies, Carter said, were “simply running out.”

Fortunately, the nation did not run out of oil and natural gas — quite the opposite. In recent years, U.S. producers have learned how to economically extract vast new supplies, mostly from hydraulic fracturing (fracking), a process that breaks apart shale to release oil and natural gas.

Now the U.S. Energy Information Administration (EIA) is predicting that the United States will become a net exporter of liquefied natural gas by 2016 and dry natural gas

by 2019. EIA also notes that U.S. crude oil production has increased 30 percent from 2008 through 2012, causing net imports of petroleum and other liquid fuels to decrease significantly. Energy independence, defined as becoming a net exporter of energy, will arrive in 2023, according to energy consultant and author Philip Verleger Jr.

Verleger and other analysts who are forecasting energy independence cite burgeoning supplies of domestic oil and natural gas. They barely mention the nation’s vast coal reserves. To be sure, dramatic predictions regarding fossil fuel production and consumption have been notoriously wrong over the years. But the U.S. coal industry seems to be facing unprecedented economic and regulatory challenges, including substantially lower natural gas prices, more stringent environmental standards for coal-fired power plants, and higher costs for mining methods that are common in West Virginia.

Tony Yuen, a global energy strategist for Citi, is pessimistic about the future of coal — especially thermal coal mined in West Virginia. “If electricity demand is basically flat, and renewables are continually rising, then something has to give,” he says, and coal already is losing ground.

The days when presidents from both major parties recommended burning more coal are long gone — primarily

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because coal-fired power plants emit about twice the carbon dioxide of gas-fired plants. Federal regulations have made it more costly to mine coal in recent years, and the Environmental Protection Agency (EPA) has proposed CO<sub>2</sub> emission standards that would make it nearly impossible for electric utilities to build profitable coal plants in the United States. In an effort to extend that policy throughout the world, the Treasury Department announced in October 2013 that it was “ending U.S. support for multilateral development bank funding for new overseas coal projects except in narrowly defined circumstances.” The announcement was largely symbolic, since the United States has no such veto power, but it put developing nations on notice that they should not attempt to replicate the United States’ coal-fired path to industrialization.

### West Virginia Gold

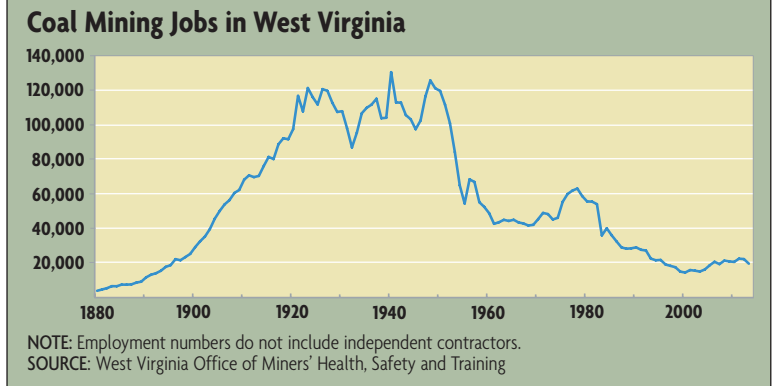
Coal fueled the industrial revolution, and in the United States much of that coal came from West Virginia. For heating buildings and fueling steam engines, burning coal was much more efficient than burning wood. Also, metallurgical (met) coal helped produce the steel that supported the nation’s flourishing factories and soaring skylines.

There is some overlap between thermal coal and met coal, but met coal generally has higher carbon content and fewer impurities. Met coal is primarily used to produce coke (nearly pure carbon), a key ingredient for making steel. West Virginia continues to be a major producer of met coal.

By the early 20th century, coal barons were making vast fortunes in West Virginia, and by mid-century, the labor movement was beginning to spread more of that wealth to miners and other residents of the state. Coal mining remains West Virginia’s highest-paying industry, but coal mining jobs in the state have plummeted from an all-time high of 130,457 in 1940 to a 100-year low of 14,281 in 2000. (See chart.) Technological improvements accounted for the vast majority of that 88 percent decline.

During the 1960s and 1970s, the environmental movement began to affect the coal industry. The Clean Air Act clamped down on six common pollutants — particulate matter, sulfur oxides, nitrogen oxides, carbon monoxide, ground-level ozone, and lead. The new emission standards initially helped West Virginia’s thermal coal producers because West Virginia coal generally burned cleaner than coal from the Illinois Basin. But as more coal plants added scrubbers to remove these pollutants from their emissions, West Virginia lost much of its “clean coal” competitive advantage.

In the years that followed, the coal industry passed through boom and bust cycles. Most recently, downward trends in domestic demand were more than offset by a surge in exports that helped keep West Virginia’s unemployment rate below the national average during the recession of 2007-2009. As the U.S. economy slumped, China was swinging from a net exporter to a net importer of coal. At the same time, there were massive floods in Queensland, Australia,



which produced far more met coal than any other region.

“You had a classic price spike,” recalls Jeremy Sussman, a coal analyst for Clarkson Capital Markets in New York. “Companies at the peak were selling metallurgical coal for \$400 a ton. It was something they had never really witnessed.”

The Dow Jones U.S. Coal Index soared to its all-time high of 741 in June 2008, but it plunged to 111 by that November and has stayed below 200 since May 2012. (See chart on next page.) Clearly the market is not expecting another domestic coal boom, but the market also has demonstrated that prospects for the industry can change quickly. Even so, energy analysts are pessimistic about the long-term outlook for West Virginia coal.

“You won’t see metallurgical coal prices like you did before the financial crisis, but you will see metallurgical coal prices where companies can make a healthy margin,” Sussman says. “I could easily envision a scenario where, in the not-too-distant future, West Virginia is producing almost all metallurgical coal, and only the absolute lowest-cost thermal mines survive.”

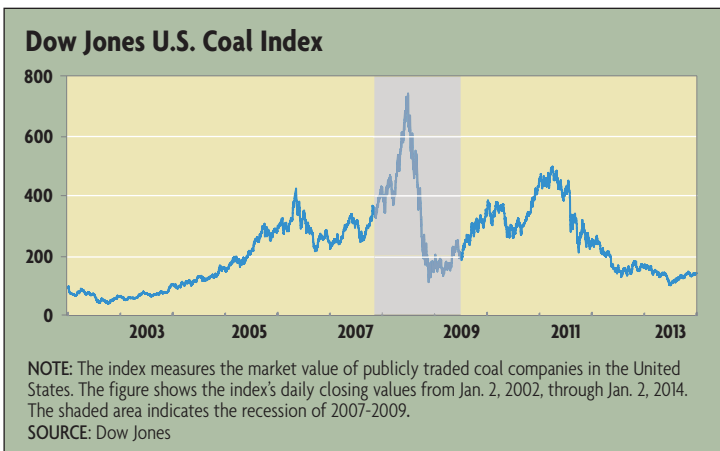
### Energy Mix

Carter’s “moral equivalent of war” speech traced 200 years of energy consumption — from wood to coal to oil and natural gas and back to coal.

But fracking has shaken up the energy mix. The availability of natural gas has increased dramatically, and prices have come down accordingly. Some environmentalists have claimed that fracking has contaminated ground water. (See “The Once and Future Fuel,” *Region Focus*, Second/Third Quarter 2012.) But few, if any, peer-reviewed studies have reached that conclusion.

The federal government is researching contamination claims but doing nothing to slow down the fracking frenzy, Yuen notes. To the contrary, the Department of Energy (DOE) has been approving more export terminals for liquefied natural gas, and the Obama administration’s Climate Action Plan relies heavily on burning less coal and more natural gas. “It looks like the government is supportive of natural gas development,” Yuen says, “and the whole of natural gas development right now is based on the ability to drill and hydraulically fracture.”





In the long run, natural gas will fare better than coal under more stringent CO<sub>2</sub> standards, but the more immediate problem for West Virginia's thermal coal is the relative price of coal and natural gas. After spiking above \$13 per million Btu in 2008, the price of natural gas generally has ranged from \$2.50 to \$5.

"At \$3 gas or below, coal that is produced west of the Mississippi can compete with natural gas, but coal east of the Mississippi just absolutely cannot compete," Sussman says. During a few weeks in 2012, the gas price dipped below \$2, and electric utilities generated more power from natural gas than coal for the first time in U.S. history. Since then, the gas price has recovered to \$4.50, but that's still not high enough to put the majority of West Virginia's thermal coal in the money, and no one is predicting a large increase anytime soon. "Assuming the status quo for regulations and so on, it's tough to imagine natural gas prices getting anywhere close to the levels where they were before fracking," Sussman says.

As a result, electric utilities are shutting down old, inefficient coal plants and increasing production at gas plants. Yuen expects the coal shutdowns to peak in 2015, but in that year alone, there could be 15 plant retirements, he says. A lot of those old plants are in Pennsylvania, New Jersey, Maryland, and the Southeast, where power companies tend to use West Virginia coal.

"As long as the natural gas price stays low, it can hide many sins, but gas prices will go up sooner or later," says Howard Herzog, senior research engineer in the MIT Energy Initiative in Cambridge, Mass. Herzog believes the United States should continue developing "clean coal" technologies that would create a more robust electricity-generation system by keeping coal in the energy mix.

He cites the example of New England: "We are at the end of the gas pipeline, and we were never big on coal anyway, and a lot of our coal plants went away," he says. "We have some nuclear, but we are very dependent on natural gas. Two winters ago, this was no problem because it was a very mild winter. Then we had a pretty cold winter last year, and the price of natural gas to utilities went up" — driving wholesale electricity prices four times higher than they were during the previous winter.

Population centers in the Mid-Atlantic region might

get caught in the same trap if they become too reliant on natural gas. West Virginia coal has served Mid-Atlantic utilities for many years, but coal transportation costs are higher than natural gas transportation costs via pipeline, "especially now that the heart of Pennsylvania has one of the largest gas fuel reserves in the world," Yuen says.

Nuclear power also competes with West Virginia coal, and nuclear plants emit almost no CO<sub>2</sub>, but no one has built a new nuclear plant in the United States in more than 30 years, and utilities have been closing down some older reactors. A few new units are under construction, but the Fukushima disaster has put a damper on nuclear power — much like the Three Mile Island accident did in 1979, less than two years after Carter's speech.

### Bleak Prospects

The proposed CO<sub>2</sub> standards do not apply to existing coal plants, so the United States will continue burning coal for a long time. About 40 percent of the nation's electricity still comes from coal, and EPA officials have indicated that CO<sub>2</sub> proposed standards for existing coal plants — due out in 2014 — will be far less stringent than proposed requirements for new plants.

EPA officials realize that coal plants remain a necessary part of the electricity-generation mix, Sussman says, but West Virginia's thermal coal has lost key competitive advantages. Thermal coal supplies from the Illinois Basin and Wyoming's Powder River Basin are significantly cheaper because open-pit mining is less costly than the underground mining and mountaintop removal that are common in West Virginia. Also, West Virginia mining accidents in 2006 and 2010 prompted new regulations that have made underground mining and mountaintop removal even more expensive relative to open-pit mining.

Sussman estimates the gap by comparing Alpha Natural Resources, the largest Eastern producer, with Arch Coal, a large producer in the Powder River Basin. From 2007 to 2012, Alpha's cost per ton increased 64 percent, while Arch's cost per ton increased only 37 percent, he says. "The majority of that difference can be attributed to increased mining regulations" that affect Eastern coal mining more than Western coal mining.

East of the Mississippi River, "low-cost regions, like parts of Pennsylvania and parts of Illinois, will be just fine," Sussman predicts. "Higher-cost regions, which unfortunately would encompass West Virginia, are going to have a much more difficult time."

West Virginia remains, however, a large producer of metallurgical coal. West Virginia's production is currently split roughly 50-50 between thermal and met coal, but nearly two-thirds of the state's coal sales come from met coal.

The state has exported more met coal in recent years, but global demand for U.S. coal softened in 2013. China continues to drive worldwide demand for met coal, and West Virginia has exported more coal to China in recent years, but Yuen expects that trend to decline as well.

“A lot of steel-making happens in China these days, but there is an economic transition from this investment-led growth model in China toward something a little more consumer-led,” he says. “Then the demand for steel may not really be there as strong as what other people expect.”

### Clean Coal

The future of West Virginia’s thermal coal may hinge on new technologies for carbon capture and sequestration (CCS) — a way to capture CO<sub>2</sub> from coal plants and inject it into rock formations far below the earth’s surface.

“The U.S. appears to have considerable capacity for carbon sequestration located suitably in relation to coal plants,” wrote Ernest Moniz in 2007, while he was director of the MIT Energy Initiative. (He has since become secretary of energy.) Carbon capture, however, presents a bigger challenge. “A dramatic cost reduction is needed, and this calls for a large-scale research program that emphasizes new concepts and scales the promising ones to commercial demonstration,” Moniz wrote. “If this is not accomplished, coal would eventually be squeezed out of the U.S. electricity mix by future stringent CO<sub>2</sub> emission constraints.”

Six years later, the CO<sub>2</sub> constraints are imminent, but only one large-scale coal plant with CCS technology is under construction in the United States. Mississippi Power is building a 582-megawatt plant in Kemper County, Miss., but the project has been plagued by delays and cost overruns despite a DOE grant of \$270 million and another \$133 million in tax credits.

MIT’s Herzog advocates a market-based approach instead of relying on subsidies from the DOE and “command-and-control” standards from EPA. “The only way you are going to get markets that are big enough and pay enough to make these CCS projects commercial is through climate policy, and the climate road we are on now — new-source

performance standards — gives gas a free ride,” he argues. “If gas gets a free ride and coal takes a hit, it just widens that gap.” Instead, Herzog believes the government should tax all CO<sub>2</sub> emissions. This approach would affect coal plants about twice as much as gas plants, but it could narrow the regulatory gap compared with a system that requires expensive CCS for new coal plants and nothing for new gas plants.

CCS projects start to look attractive if carbon is taxed between \$50 and \$100 per ton of CO<sub>2</sub>, according to Herzog. “The question is how would the competitors do — such as nuclear and the like. It’s hard to tell, but there is a strong feeling in the CCS community that we would see modern coal plants.”

Herzog concedes, however, that the politics of carbon taxation are extremely difficult. “It’s internal U.S. politics and also international politics,” he says. “You have China just building coal plants without CCS. If you can’t get them into the fold, then you start to have issues of international competitiveness.”

A sustained period of cheap and abundant natural gas would give many U.S. industries a new competitive advantage, but the economic consequences for thermal coal mining in West Virginia would be dire. Researchers at West Virginia University’s College of Business and Economics expect overall coal employment in the state to decline gradually through 2018, but private sector analysts anticipate far more severe job losses.

“If gas prices stay where they are, Central Appalachian production will be down somewhere between 25 percent and 40 percent five years from now,” Sussman says. If productivity continues to decline due to increased regulation and coal-seam depletion, coal mining employment in West Virginia likely will decline substantially as well. “The companies have to focus on low-cost production, and you don’t lower your cost by hiring more miners.” **EF**

### READINGS

“Annual Energy Outlook 2013 with Projections to 2040.” U.S. Energy Information Administration, April 2013.

“Energy 2020: Independence Day.” Citi Global Perspectives and Solutions, February 2013.

Verleger, Philip K. Jr. “The Amazing Tale of U.S. Energy Independence.” *The International Economy*, Spring 2012, p. 8.

“West Virginia Economic Outlook 2014.” Bureau of Business and Economic Research, West Virginia University College of Business and Economics.

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