WHITE PAPER

U.S. Coal Competitive in Global Markets: Domestic Production Forecast to Rebound

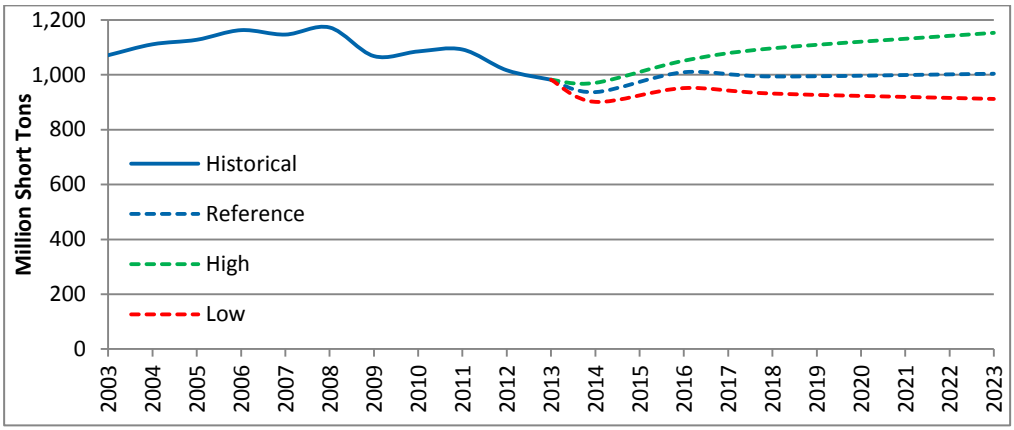
By James Wang, Jeffrey Archibald, and Judah Rose
ICF International

Executive Summary

ICF is forecasting an end to the decline in US coal production. We believe that 2014 will be the nadir for producers and that both domestic and foreign demand will pick up steam to stabilize the business. Demand for the next decade should average ~1,000 million short tons per year. The two biggest drivers of contraction—low natural gas prices driving coal-to-gas switching and EPA CO_2 emissions regulations—are likely to weigh less on the coal sector moving forward. ICF concludes that downside risk to coal consumption from persistently low natural gas prices is low. If gas generation displaces existing coal generators, it will be limited to brief episodes of low prices caused by unusually mild winter weather. Likewise, we expect NSPS emissions standards to be set in a way that provides sufficient flexibility for adoption by states—limiting the number of new coal plant retirements. ICF is carefully following EPA's NSPS rulemaking, as it is ongoing and our outlook could change.

Moreover, we see more upside than downside to our forecast in the out years. U.S. coal from the Pacific Basin can compete in international markets and provide a secure source of fuel for foreign generators and utilities. If all of the Pacific Northwest and Gulf Coast export terminals are built or expanded, a plausible scenario, annual coal export capacity has the potential to triple to over 320 million short tons. Permitting and foreign competition, however, will likely limit the maximum export expansion level.

Figure 1. U.S. Coal Production by Year.



Source: MSHA, ICF International

Proposed Pacific Northwest and Gulf Coast Coal Export Terminal Growth

There are currently seven proposed new coal export terminals or planned expansions in the Pacific Northwest region that could reasonably be expected to export U.S. thermal coal if completed.[1] These projects have a combined export potential totaling 150.7 million tons per year. The Gulf Coast region has

[1] Neptune and Ridley terminals have been excluded, as they are unlikely to export significant quantities of U.S. sourced coal. Houston's Deepwater terminal is also excluded because it is primarily being built to export petcoke.

five planned new terminals or expansions, totaling 47.0 million short tons per year. Assuming the full expansion[2] of these export terminals and full utilization, coal exports could almost triple relative to 2012 levels, increasing from about 126 to 323 million tons. Despite these lofty numbers, ICF expects that only 50 to 110 million tons of new export capacity will come online in the Pacific Northwest in the next five to ten years. The proposed coal export terminals include:

Figure 2. Export Terminals.

Terminal Name	Location	Type	Development Status[3]	Incr. Capacity (million short tons/year)
Gateway Pacific	Cherry Point, Washington	New	EIS started	52.8
Millennium Bulk	Longview, Washington	New	EIS started	48.4
Coyote Island	Boardman, Oregon	New	EA started	8.8
Fraser Surrey Docks	Vancouver, British Columbia	New	EIA completed	4.4
County Coal Terminal in BC	TBD, British Columbia	New	Planned	22.0
County Coal Terminal in WA or OR	TBD, Washington or Oregon	New	Planned	11.0
Westshore	Vancouver, British Columbia	Expansion	Permitted	3.3
Pacific Northwest Subtotal				***150.7***
Burnside	Port Allen, Louisiana	New	Permitting	7.0
RAM	Plaquemines, Louisiana	New	Permitting	8.0
International Marine	Myrtle Grove, Louisiana	Expansion	Permitted	6.0
United Bulk	Davant, Louisiana	Expansion	Permitting	10.0
Convent Marine	Convent, Louisiana	Expansion	Permitting	10.0
McDuffie	Mobile, Alabama	Expansion	Permitting	6.0
Gulf Coast Subtotal				***47.0***
TOTAL				**197.7**

Source: SNL, ICF International

Proposed Pacific Northwest and Gulf Coast Coal Export Terminal Growth Is Upside

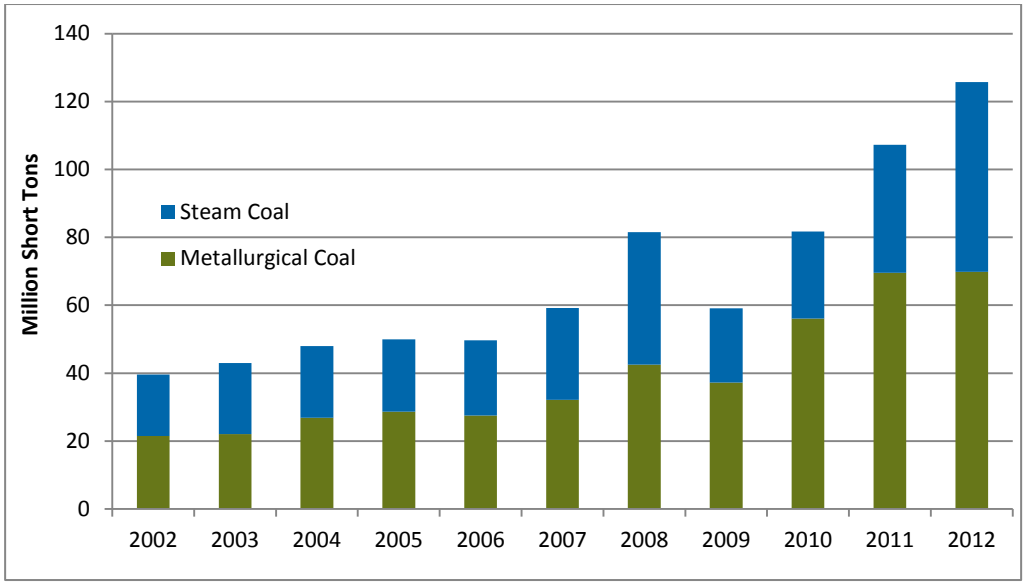
Historical exports of U.S. coal (thermal and metallurgical) set a twenty-year high in 2011 at 107 million short tons (38 million tons of thermal coal) and then set a record high in 2012 at 126 million short tons (56 million tons of thermal coal) as very low natural gas prices suppressed domestic coal consumption, increased coal stockpiles, and increased coal exports.[4] Thermal coal exports increased by 48% from 2011 to 2012, whereas metallurgical coal exports increased by 0.5% from 2011 to 2012. Figure 3 shows U.S. coal exports by year in million short tons, split by thermal (steam) and metallurgical coal.

[2] The eventual development of these coal export terminals is speculative and yet to be determined. Export capacity estimates are representative of recent terminal announcements.

[3] Environmental Impact Statements (EIS), Environmental Assessments (EA), and Environmental Impact Assessments (EIA) are various documents prepared during the permitting process to evaluate actions affecting the quality of the human environment.

[4] U.S. Energy Information Administration and the U.S. Department of Commerce, Bureau of the Census, "Monthly Report EM 545": *U.S. Coal Exports*, 2002–2012 http://www.eia.gov/coal/archive/coal_historical_exports.xls

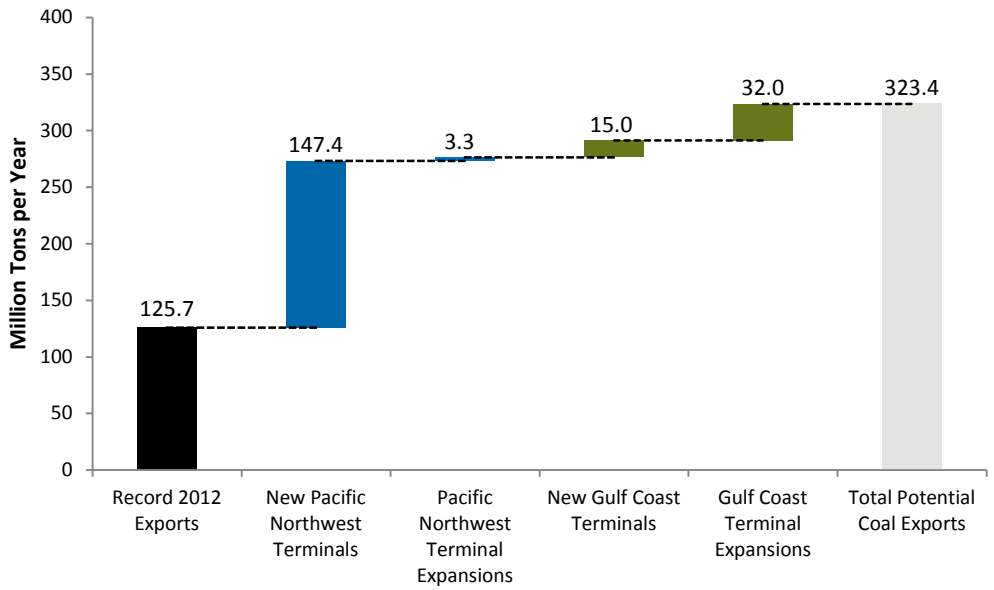
Figure 3. U.S. Coal Exports by Year.



Source: U.S. EIA

An aggregation of the record 2012 exports combined with Pacific Northwest and Gulf Coast export terminals (split by new terminals and terminal expansions) is presented in Figure 4. The total potential export figure of 323.4 million tons is almost a third of current domestic coal production.

Figure 4. U.S. 2012 Coal Exports with New and Proposed Expansions of Export Terminals.



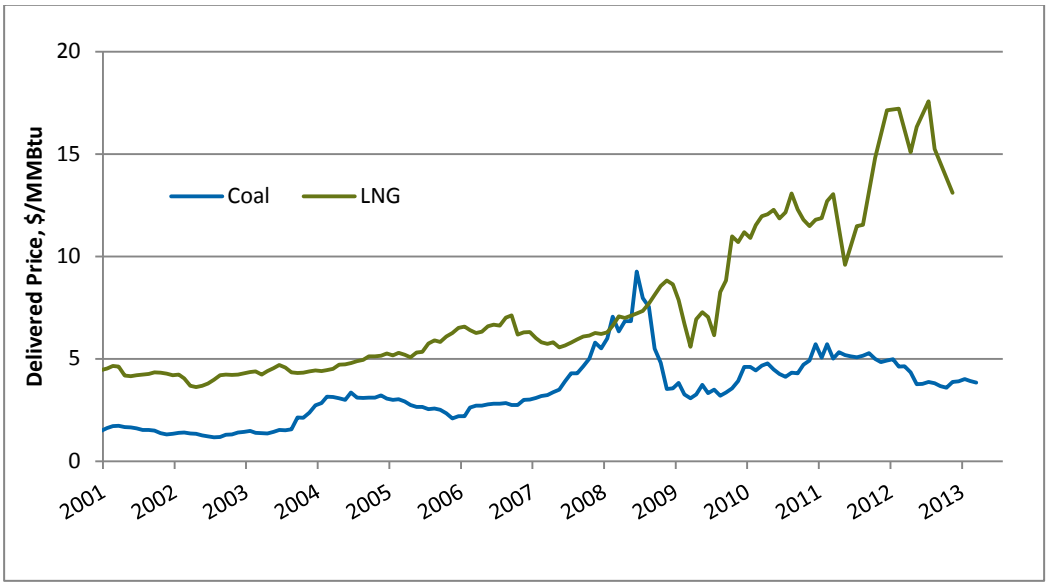
Source: SNL, ICF International

Pacific Basin Demand for Coal

The primary intent of the new Pacific Northwest export terminals is to ship thermal coal (likely originating from the U.S. Powder River Basin) for consumption in the Pacific Basin. Energy prices in the Pacific Basin are higher than in the U.S., and the two largest coal importers in the world—China and Japan—are expected to continue increasing coal consumption in the foreseeable future.

In Japan, liquefied natural gas (LNG) prices have been at least twice as expensive as coal prices on an equivalent energy basis since 2010. Japan's nuclear fleet has also idled since the Fukushima Daiichi nuclear disaster in early 2011, resulting in a significant share of Japan's generation to be made up by additional coal and gas generation. Figure 5 shows a comparison of coal versus LNG fuel prices in Japan on an equivalent energy basis.

Figure 5. Delivered Coal versus LNG Prices to Japan.



Source: Bloomberg L.P.

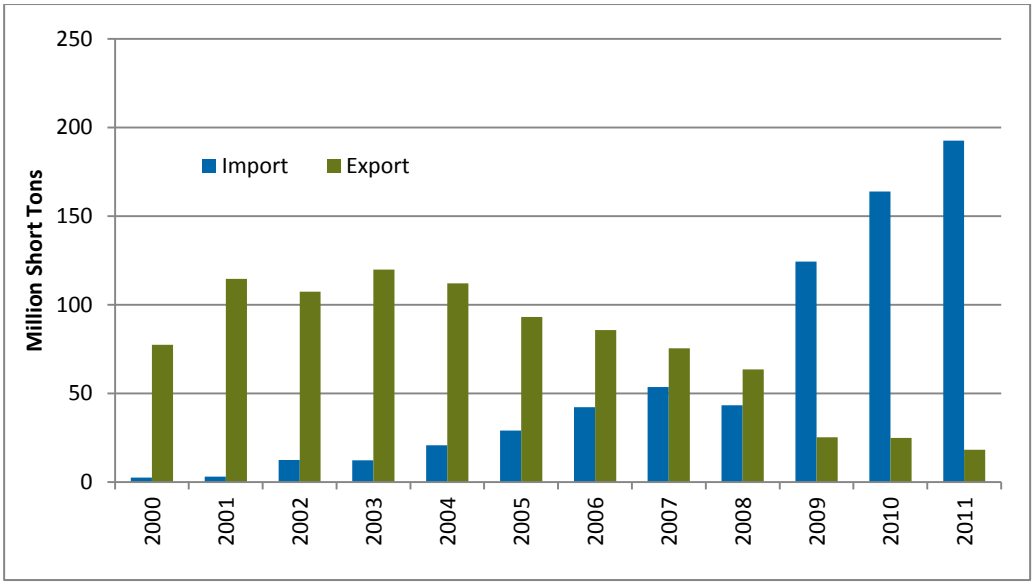
China transitioned from a net exporter of coal in 2008 to importing almost 200 million short tons in 2011 (Figure 6) and is expected to have imported 360 million short tons in 2013. While a significant portion of the large increase in China's coal imports can be attributed to short-term coal transportation bottlenecks, China is expected to continue its heavy reliance on coal through at least the next decade. China has proposed 558 GW[5] of new coal fired capacity, and the U.S. EIA IEO 2013[6] projects a 54% increase in China's coal consumption by 2035 relative to 2013 levels. South Korea, India, and Taiwan also import significant amounts of coal and are expected to continue consumption of thermal coal to meet demand growth. Strong demand for coal in the Pacific Basin is expected to continue for at least the next two decades.

---

[5] Ailun Yang and Yiyun Cui. 2012. "Global Coal Risk Assessment: Data Analysis and Market Research". WRI Working Paper. World Resources Institute, Washington DC. http://www.wri.org/publication/global-coal-risk-assessment

[6] U.S. Energy Information Administration International Energy Outlook 2013, Coal, World Coal Consumption by Region, Reference Case http://www.eia.gov/oiaf/aeo/tablebrowser/#release=IEO2013&subject=7-IEO2013&table=7-IEO2013&region=0-0&cases=Reference-d041117

Figure 6. China's Coal Imports and Exports: 2000 to 2011.



Source: U.S. EIA International Energy Statistics

Comparison of Delivered Coal Prices to Japan

Key factors affecting the cost of internationally delivered U.S. coals include minemouth cost, rail rate, rail distance, port fee, shipping vessel and rate, and shipping distance. The competitiveness of U.S. coals is also influenced by international exchange rates and other coal characteristics such as sulfur, heat, and ash content. The bottom line of a cost comparison is based on cost per energy content of coal, or dollars per million British thermal unit ($/MMBtu).

The example presented in Figure 7 on the next page is limited to a comparison of Powder River Basin (PRB) coal and Colorado (CO) coal as potential exports at Pacific Northwest export terminals. This is primarily because the Pacific Northwest has a significantly larger potential for coal export terminal growth than in the Gulf Coast, and the rail distance for Colorado coal to the Pacific Northwest is significantly shorter than the rail distance for Illinois Basin coal to the Pacific Northwest. This sample shows that U.S. coal could be competitive with Australian and Indonesian coal on a delivered basis.

Figure 7. Delivered Coal Cost Comparison.

	Comparison 1	Comparison 2	Comparison 3	Comparison 4	Comparison 5
Coal Basin	PRB	PRB	PRB	CO	CO
Heat Content (MMBtu/ton)	18.6	17.6	16.8	23.4	22.4
Sample Export Terminal	Gateway Pacific	Gateway Pacific	Gateway Pacific	Longview	Longview
Destination	Japan	Japan	Japan	Japan	Japan
Rail Distance (miles)	1,332	1,458	1,432	1,353	1,353
Rail Rate with Fuel Surcharge ($/ton-mile)	$0.018	$0.018	$0.018	$0.018	$0.018
Total Rail Cost ($/ton)	$23.98	$26.25	$25.78	$24.35	$24.35
Ship Distance (nautical miles)	4,273	4,273	4,273	4,541	4,541
Ship Rate ($/ton-nautical mile)	$0.0035	$0.0035	$0.0035	$0.0035	$0.0035
Total Ship Cost via Panamax[7] ($/ton)	$14.96	$14.96	$14.96	$15.89	$15.89
Port Fee ($/ton)	$11.00	$11.00	$11.00	$11.00	$11.00
Total Transportation Cost ($/ton)	$49.94	$52.20	$51.74	$51.24	$51.24
Illustrative Minemouth Price[8] ($/ton)	$15.00	$13.15	$11.00	$36.85	$32.50
Total Delivered Cost ($/ton)	$64.94	$65.35	$62.74	$88.09	$83.74
Delivered Cost to Japan ($/MMBtu)	**$3.49**	**$3.71**	**$3.73**	**$3.76**	**$3.74**

Source: ICF International

Pacific Basin Thermal Coal Market Competition

ICF believes infrastructure permitting, siting, and regulatory uncertainties for these export terminals are too large to include significant levels of export terminal growth in its Reference case. From a timing perspective, the proposed terminals that are not already in the permitting stage are likely to be eight to ten years away from completion. Even the proposed terminals that are in the permitting stage will likely take four to six years before reaching full export capacity. ICF is also following secondary export uncertainties. For example, although the delivered coal prices to Japan presented above are favorable for specific U.S. coal producers, other countries are also expanding or developing new coal export facilities. Australia has been expanding export capacity and is proposing to increase new mine and new port capacity up to 900 million metric tons per year (an ambitious, probably unlikely level of expansion).[9] Mozambique also has plans to develop additional coal export infrastructure to export over 30 million tons per year.

---

[7] Panamax vessels are cargo ships capable of carrying approximately 75,000 metric tons.

[8] Minemouth prices estimated for 2016 using ICAP futures.

[9] Ailun Yang and Yiyun Cui. 2012. "Global Coal Risk Assessment: Data Analysis and Market Research". WRI Working Paper. World Resources Institute, Washington DC. http://www.wri.org/publication/global-coal-risk-assessment

NSPS for CO_2 Applied to Existing Coal Power Plants

In June 2014, the EPA is expected to propose rules for the application of the CO_2 emission New Source Performance Standards (NSPS) to existing coal power plants. The EPA's schedule calls for finalization of the rules in 2015. The EPA has stated it will not require the application of Carbon Capture and Sequestration to existing coal units. However, beyond that statement, EPA policy could tend toward either (1) inside the fence on site controls—e.g., requiring modest efficiency improvements, or (2) outside the fence controls—e.g., tighter regulations that apply across fleets of plants including flexible multi-site regulations such as intrastate emission trading. ICF believes the uncertainty here favors near-term modest impacts and includes in its Reference case relatively modest NSPS regulations applied to the existing coal fleet.

Natural Gas Market Competition

ICF concludes that downside risk to coal consumption from persistently low natural gas prices is low; if gas generation displaces existing coal generators, it will be limited to brief episodes of low prices caused by unusually mild winter weather. While other gas price forecasts focus solely on the rapid increase in domestic gas production, ICF's gas market projection also accounts for significant increases in gas demand (due to LNG exports as well as increased domestic consumption), incremental costs for infrastructure required to bring new gas supplies to market, as well as interactions between coal and gas generation in the power sector. In ICF's view, gas prices are likely to play an important role in preventing the construction of new coal power plants as well as contributing to the retirement of older smaller units. Natural gas prices, however, are not likely to significantly eliminate coal demand at existing U.S. coal power plants over the next ten years.

For questions, please contact:

James Wang ▪ +1.703.934.3121 ▪ james.wang@icfi.com

Jeffrey Archibald ▪ +1.703.934.3917 ▪ jeffery.archibald@icfi.com

EET.WPR.0214.0039

About the Authors

James Z. Wang joined ICF in 2011 and has experience with energy markets, environmental regulations, and electric power sector modeling. Mr. Wang has supported coal market analyses for complex Environmental Impact Statements (EISs), and he also has experience performing valuations and developing models to evaluate the economics of solar photovolatics, onshore wind, offshore wind, combined heat and power (aka cogeneration), and coal-related projects. Mr. Wang received an M.S. in Environmental Engineering from Princeton University and a B.S. in Chemical Engineering from Washington University in St. Louis.

Jeffrey S. Archibald joined ICF in 1997 and has more than 21 years of experience performing asset valuations for power plants, coal price and production forecasting, economic assessments, financial analyses, environmental site investigations and remediation, and environmental management system evaluation. He has conducted a number of financial analyses for the U.S. Environmental Protection Agency (EPA) and Nuclear Regulatory Commission (NRC) and has conducted numerous environmental site investigations and completed several remedial actions. Mr. Archibald has assisted in the preparation of numerous reports, papers, and presentations and has constructed several mathematical models to assess the costs and benefits of proposed regulations. Mr. Archibald has a Master of Engineering degree and an M.B.A. from Cornell University and a B.A. in Physics from Swarthmore College.

Judah L. Rose joined ICF in 1982 and has over 30 years of experience in the energy industry. Mr. Rose's clients include electric utilities, financial institutions, law firms, government agencies, fuel companies, and Independent Power Producers (IPP). Mr. Rose is one of ICF's Distinguished Consultants, an honorary title given to three of ICF's 4,500 employees, and has served on the Board of Directors of ICF International as the Management Shareholder Representative. Mr. Rose has supported the development, acquisition, and financing of tens of billion dollars of new and existing power plants and is a trusted counselor to the utility, IPP, and financial community. Mr. Rose frequently provides expert testimony and litigation support. Mr. Rose has testified as an expert in scores of state and other legal proceedings including in nearly 25 states, federal and international jurisdictions. Mr. Rose has also addressed approximately 100 major energy conferences, authored numerous articles published in Public Utilities Fortnightly, the Electricity Journal, Project Finance International, and written numerous company studies. Mr. Rose received an M.P.P. from the John F. Kennedy School of Government, Harvard University, and an S.B. in Economics from the Massachusetts Institute of Technology.

About ICF International

Since 1969, ICF International (NASDAQ:ICFI) has been serving government at all levels, major corporations, and multilateral institutions. With more than 60 offices and more than 4,500 employees worldwide, we bring deep domain expertise, problem-solving capabilities, and a results-driven approach to deliver strategic value across the lifecycle of client programs.

At ICF, we partner with clients to conceive and implement solutions and services that protect and improve the quality of life, providing lasting answers to society's most challenging management, technology, and policy issues. As a company and individually, we live this mission, as evidenced by our commitment to sustainability and carbon neutrality, contribution to the global community, and dedication to employee growth. Our website is www.icfi.com.