

Railroads and Coal

ASSOCIATION OF AMERICAN RAILROADS

JULY 2015

Summary

No single commodity is more important to America's railroads than coal, which accounted for 38.8 percent of rail tonnage and 18.8 percent of rail revenue in 2014. Most coal in the United States is consumed at power plants. Historically, coal has dominated U.S. electricity generation because it is such a cost-effective fuel choice, and freight railroads are a big reason for that. Approximately 70 percent of the coal delivered to coal-fueled power plants is delivered by rail. Electricity is also generated using other fuels, including nuclear power, wind, solar power, hydroelectric power, and natural gas. Recently, U.S. natural gas production has surged due to "fracking," resulting in lower natural gas prices to electricity generators and increasing the competitiveness of electricity generated from natural gas vis-à-vis electricity generated from coal. In addition, increasingly stringent environmental regulations have targeted coal-fueled generation. Consequently, electricity generated from coal — and associated rail coal volumes — have fallen. Whether this is a short- or a long-term phenomenon remains to be seen.

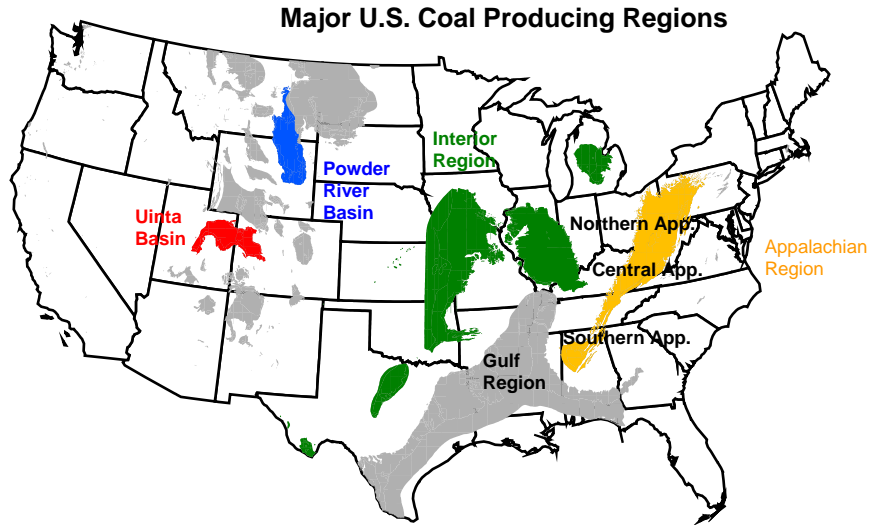
Overview of Coal

Coal is formed over millions of years through pressure and temperature by the slow underground decomposition and chemical conversion of plant matter in what at one time were enormous swamps. Over time, the plant matter is transformed into peat, then lignite, then subbituminous coal, then bituminous coal, and finally anthracite.

Coal has value primarily because it yields a lot of energy when it's burned. It can be steam coal (used in power plants) or metallurgical coal (used to make coke for steelmaking). Energy content is measured in British Thermal Units (BTUs). On average, one ton of coal yields 20 to 21 million BTUs, but energy content varies considerably by type of coal. For example, the average heating value of bituminous coal is around 24 million BTUs per ton; for subbituminous, 18 million; for lignite, 13 million; and for anthracite, 23 million. Coal quality also varies based on the level of impurities found in the coal.

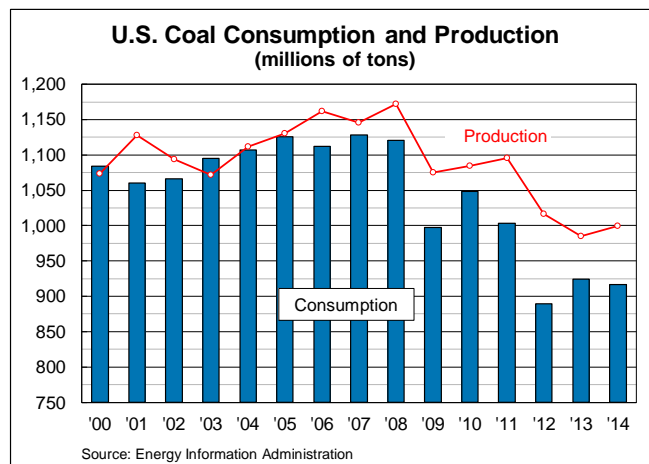
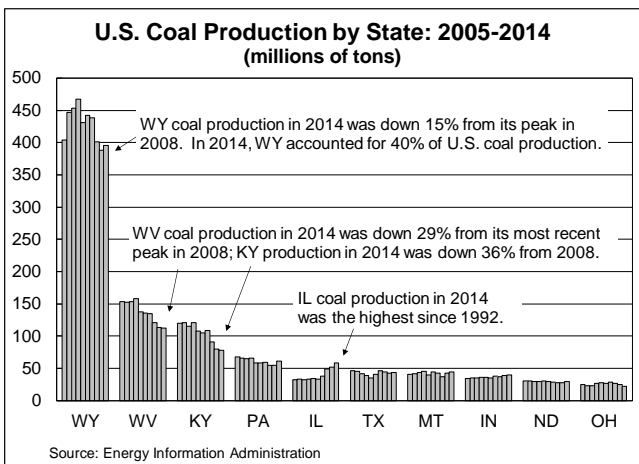
U.S. Coal Production

According to the Energy Information Administration (EIA), U.S. coal production was 999.7 million tons in 2014, up 1.5 percent from 2013's 984.8 million tons. Other than 2013, this was the lowest annual coal production since 1993. The all-time peak production was 1.17 billion tons in 2008, or 17 percent higher than 2014 production. Wyoming accounted for 40 percent of U.S. coal production in 2014, followed by West Virginia (11 percent) and Kentucky (8 percent). Eight of the top ten mines in terms of annual coal production are in Wyoming.



Most U.S. coal production takes place in three major coal-producing areas:

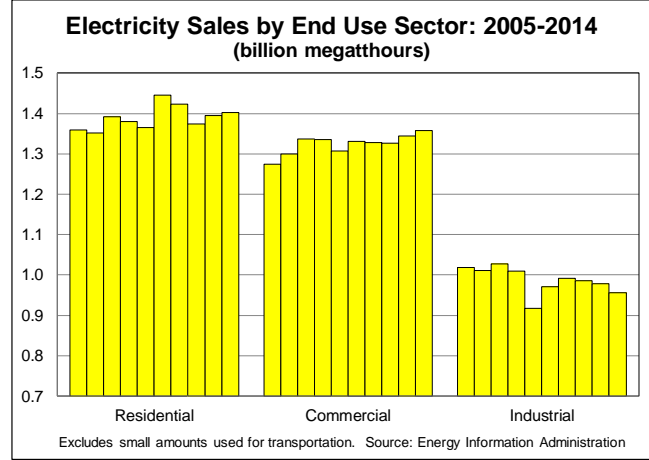
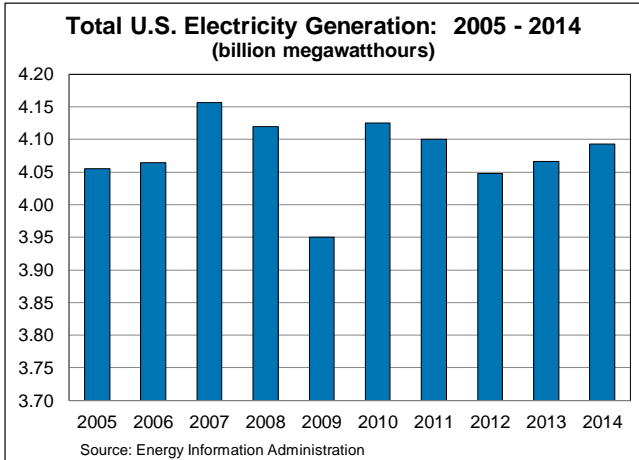
- “Appalachian” coal is mined in Pennsylvania, Maryland, Virginia, West Virginia, Tennessee, Alabama, Ohio, and eastern Kentucky. It is often further broken down into Southern, Central, and Northern Appalachia.
- “Interior” coal is mined in Illinois, Indiana, Missouri, Texas, and western Kentucky.
- “Western” coal is mined in Wyoming, Montana, Utah, Colorado, North Dakota, New Mexico, and Arizona. Most Western coal originates in the Powder River Basin (PRB) of northeast Wyoming and southeast Montana. PRB coal has low sulfur content. Over the past two decades its consumption has surged due to increasingly-stringent clean air laws.



U.S. Coal Consumption

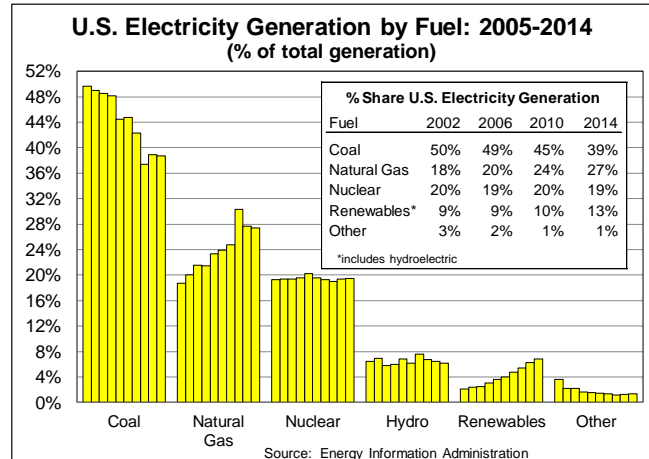
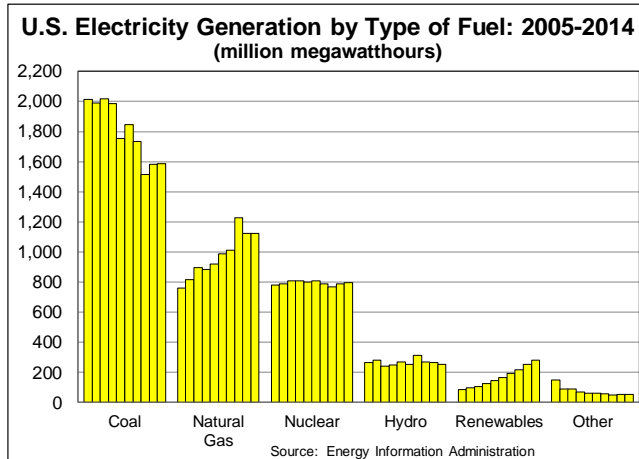
U.S. coal consumption in 2014 was 916.9 million tons, down 0.8 percent from 2013’s 924.4 million tons and 18.7 percent lower than the 2007 peak of 1.13 billion tons. In 2014, 92.9 percent of coal consumption was for electricity generation; 2.2 percent was to produce coke; and 4.9 percent was for other purposes, including combined heat and power plants.

Because power plants account for so much of U.S. coal consumption, the electricity marketplace is key to coal's fortunes. Historically, U.S. electricity production has risen steadily: from 1949 to 2007, total year-over-year U.S. electricity generation fell just twice: in 1982 (-2.3 percent) and in 2001 (-1.7 percent). However, total U.S. electricity generation fell in four of the six years from 2008 to 2013, and in one year (2013) the increase was very small (0.4 percent). Growth in 2014 over 2013 was slightly higher at 0.7 percent. The trend line for U.S. electricity generation from 2005 to 2014 is flat.



A huge amount of electricity is needed for day-to-day purposes, but on the margin electricity demand is largely a function of weather and the economy. For example, in 2008 and 2009, lower total electricity generation was in large part a function of the severe recession; a big increase in electricity generation in 2010 was in part due to stronger industrial demand and in part due to a hotter than usual summer, which meant more demand for electricity for air conditioning. The relatively small increases in 2013 and 2014 were a function of, among other things, continued slow economic growth and improvements in fuel efficiency.

In the United States, the main fuel sources for generating electricity are (in order) coal, natural gas, nuclear power, hydroelectric power, and renewables such as wind and solar. If market shares stayed constant, coal-based generation would rise or fall with total electricity generation. Market shares don't stay constant, though, and both the absolute amount of electricity generated from coal and coal's share of the total has been trending down the past few years.

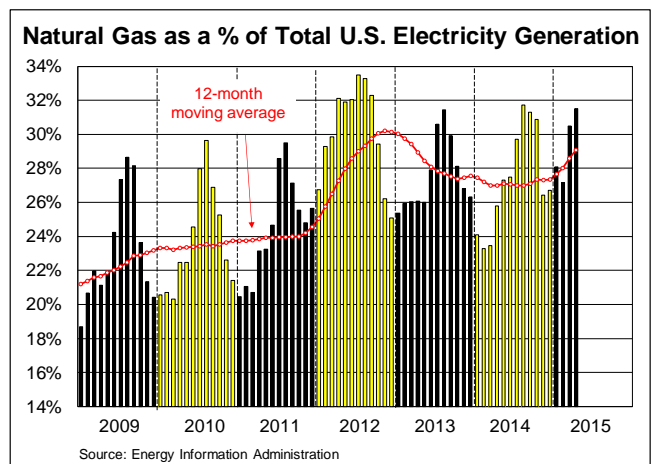
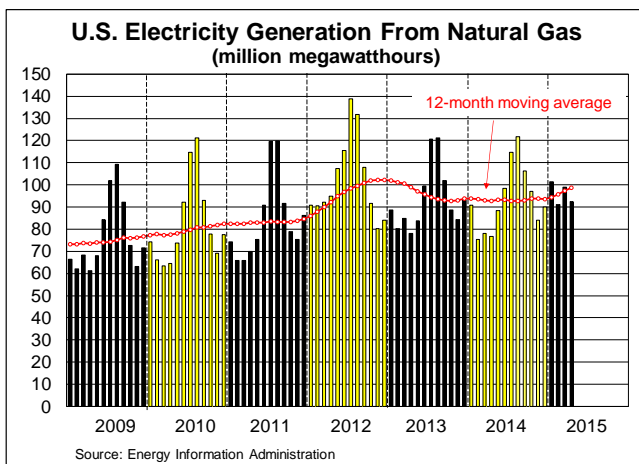
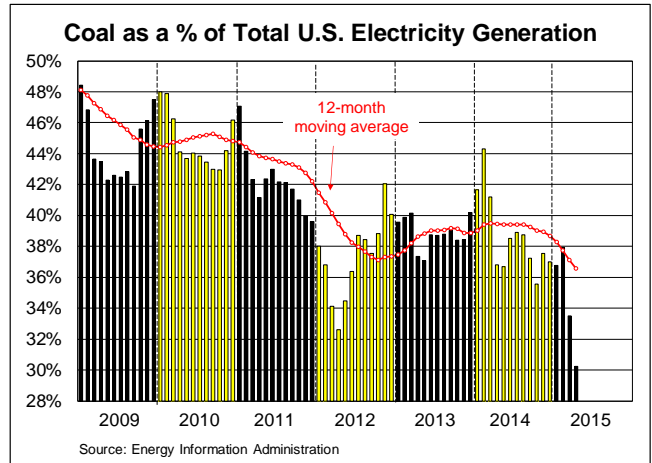
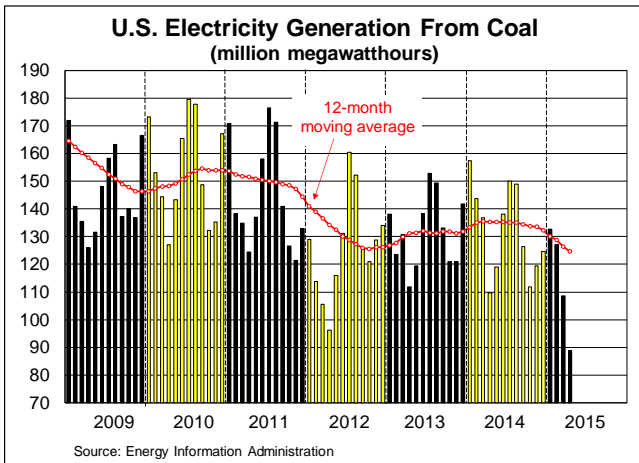


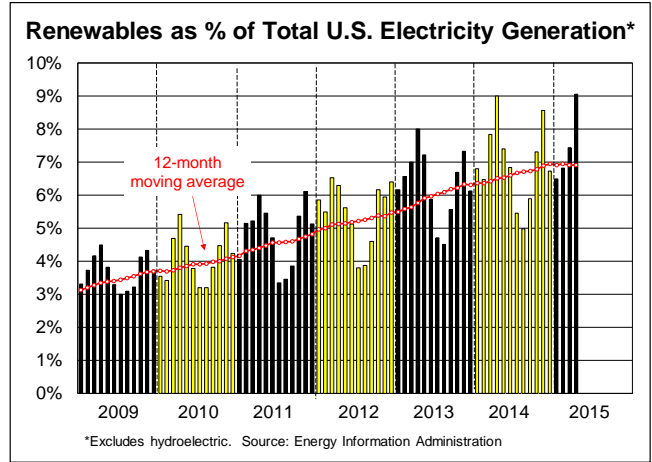
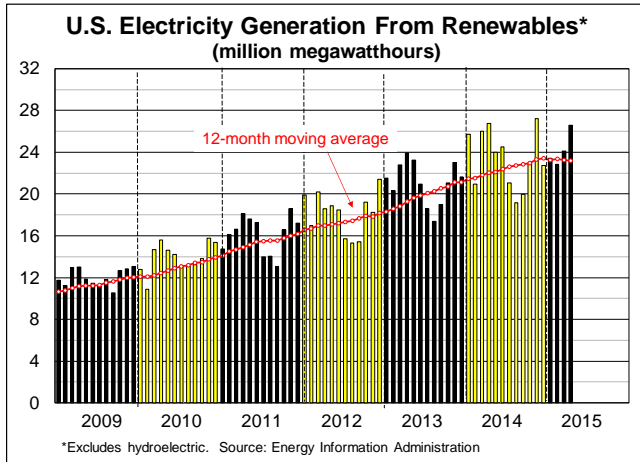
The chart on the bottom left of the previous page shows the absolute amount of electricity generated by various fuels; the chart on the bottom right of the previous page shows the percentage of total generation accounted for by each fuel.

In the 1990s, coal's share of electricity generation averaged 56 percent. In 2000, it was 52 percent, but by 2012 it had fallen to 37 percent, by far its lowest share since sometime prior to when EIA data begin in 1949. Coal's share was 39 percent in 2013 and 2014. Meanwhile, the natural gas share rose from 16 percent in 2000 to 30 percent in 2012 before falling to 28 percent in 2013 and 27 percent in 2014. The share accounted for by renewables (mainly solar and wind but excluding hydroelectric) rose from 2 percent in 2000 to 7 percent in 2014.

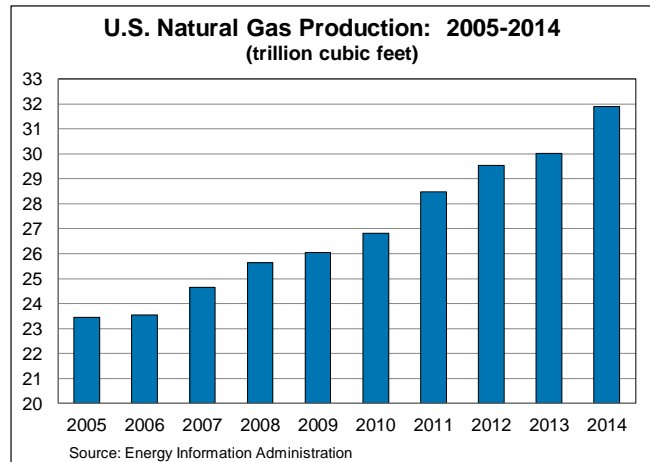
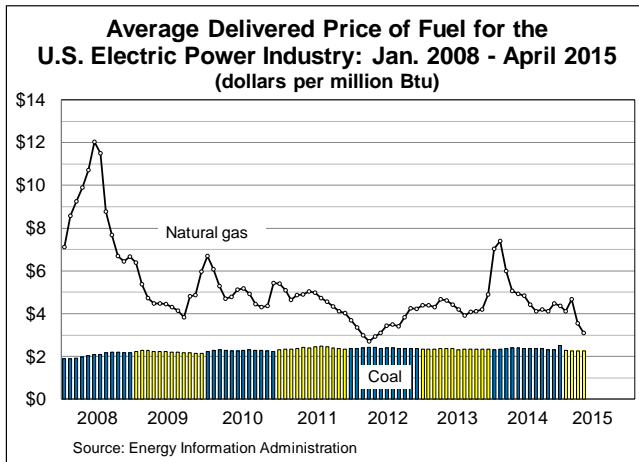
Different fuels dominate electricity generation in different states. For example, Indiana was the 11th largest electricity generator in 2014; coal accounted for 85 percent of its generation. California was the 5th largest electricity generator, but coal accounted for virtually none of its generation. Electricity generators in California, the Pacific Northwest, and New England use relatively little coal; generators in the Midwest, Southeast, and Southwest burn much more.

The decline in coal's share of electricity generation has accelerated in the past couple of years (see the charts below). Meanwhile, the natural gas share has been trending sharply upward. The renewable share has been rising too, though from a low base.





As noted earlier, there has been significant displacement of coal-fueled electricity with electricity generated from other sources, especially natural gas. Natural gas and, even more so, renewables like wind and solar are seen by many as more environmentally benign than coal, and that's certainly played a key role (and could play an even bigger role in the future), but in recent years economic issues have probably been even more important. Natural gas is much cheaper for electricity producers than it was just a few years ago thanks to sharply higher natural gas production brought about by technological advances in natural gas extraction, especially hydraulic fracturing or "fracking."



There is still an enormous amount of uncertainty regarding the future of the natural gas market. Some say very low natural gas prices are here to stay; others say they are bound to rise, possibly by a great deal, especially if natural gas exports become widespread. The more natural gas prices rise, everything else equal, the less competitive natural gas-based electricity generation will be compared with coal-based electricity generation. Some say fracking is perfectly safe, and they have the support of key policymakers who think it's a godsend for the economy. Others say fracking is an environmental catastrophe waiting to happen and want to ban it. Time will tell who's right and who's wrong, but there's no question that coal — and railroads that haul coal — will be greatly affected by what happens. Coal will have a major long-term place in America's energy supply, but how big that piece will end up being, and for how long, is unclear at this time.

Coal Transportation

U.S. coal production is focused in a relatively small number of states, but coal is consumed in large amounts all over the country. This is possible because the United States has the world's most efficient and comprehensive coal transportation system, led by railroads.

All major surface transportation modes carry large amounts of coal. According to the EIA, 68 percent of U.S. coal shipments were delivered to their final destinations by rail in 2013, followed by water (12 percent, mainly barges on inland waterways); truck (11 percent); and conveyor belts and tramways (8 percent, mainly at minemouth plants). The rail share is higher than it was 20 years ago largely because of the growth of Western coal that often moves long distances by train.

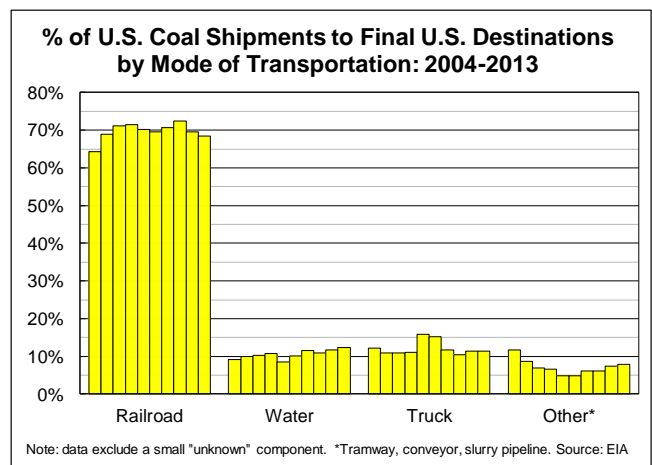
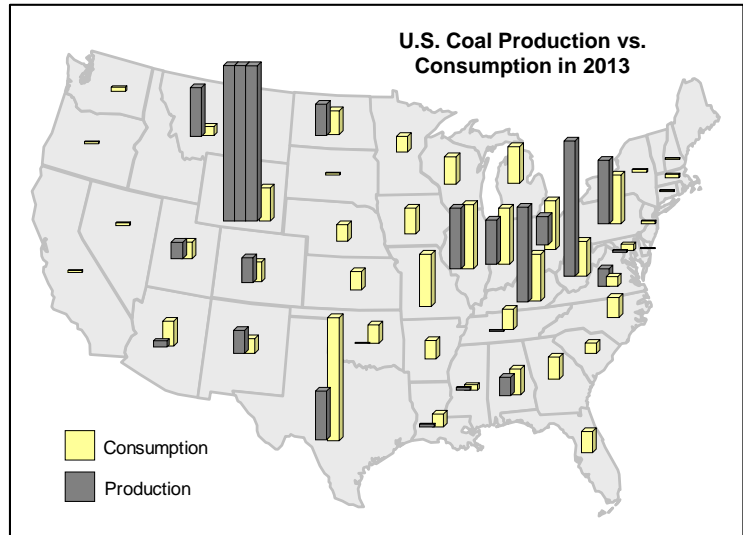
Railroad Coal Traffic

Coal is the most important single commodity carried by U.S. freight railroads. In 2014, it accounted for 38.8 percent of tonnage, 20.2 percent of carloads, and 18.8 percent of gross revenue for U.S. Class I railroads. Coal is also an important commodity for many non-Class I railroads.

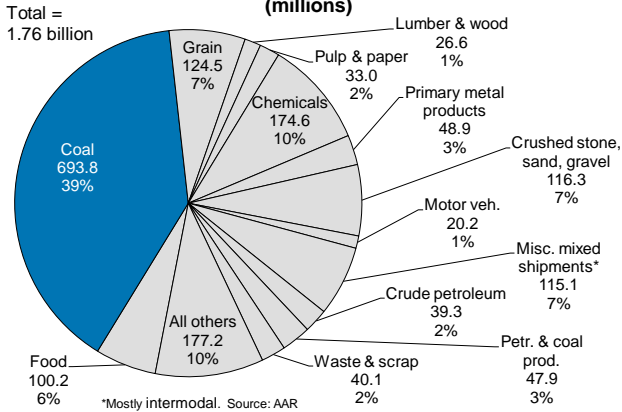
As noted above, coal's share of U.S. electricity generation has fallen sharply in recent years. Rail coal traffic has suffered accordingly. In 2008, the peak year for U.S. rail coal traffic, Class I railroads originated 7.71 million carloads of coal. In 2014, they originated 6.11 million carloads, down 22.8 percent from 2008's peak. Put another way, Class I railroads originated 1.6 million fewer carloads of coal in 2014 than in 2008. If you assume, for simplicity, 115 carloads per coal train, that's nearly 14,000 fewer trainloads of coal in 2014 than in 2008. Carloads of coal were up 2.7 percent in 2014 from 2013's 5.95 million carloads. However, in the first few months of 2015, coal carloads were down sharply from 2014.

Class I railroads originated 713.2 million tons of coal in 2014, down 18.8 percent from 2008's peak of 878.6 million tons. The decline in rail coal tonnage in 2014 from 2008 was 165.4 million tons. Coal tonnage in 2014 was up 2.8 percent over 2013's 693.8 million tons.

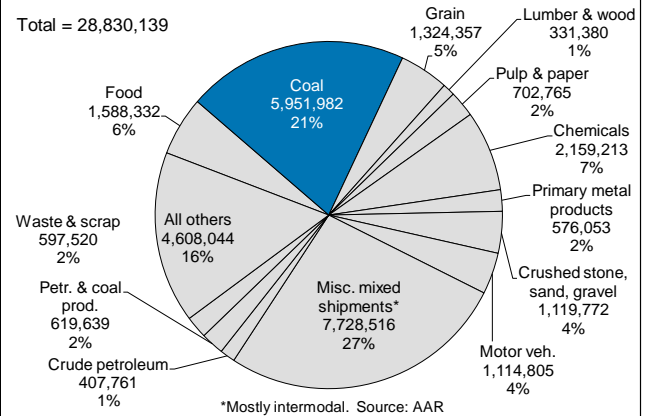
Railroads have typically derived more revenue from coal than from any other commodity (though the broad "intermodal" category accounted for more revenue than coal from 2003 to 2007 and again in 2013 and 2014). Class I railroad gross revenue from coal was \$14.3 billion in 2014, equal to 2013 and down from a peak of \$16.4 billion in 2011.



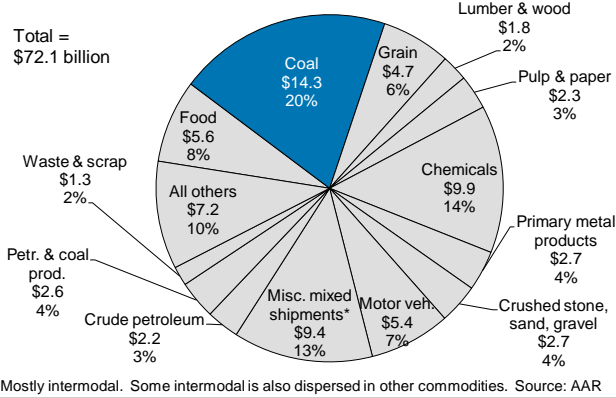
Originated Tons by Class I RRs by Commodity: 2013
(millions)



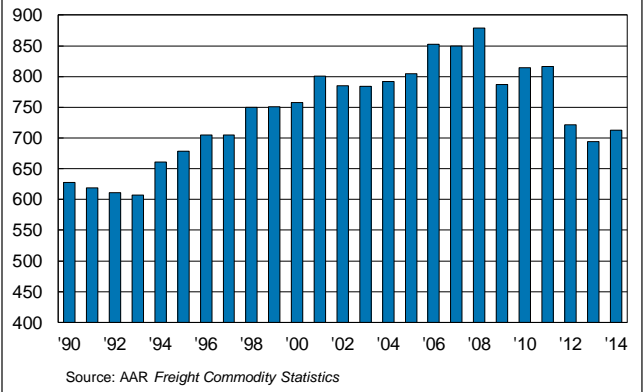
Originated Carloads by Class I RRs by Commodity: 2013



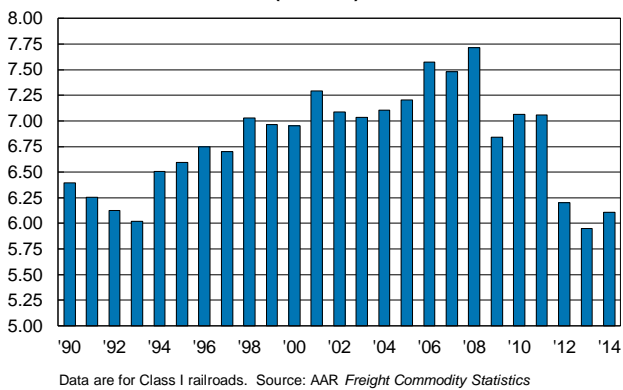
U.S. Class I RR Gross Revenue by Commodity: 2013
(\$ billions)



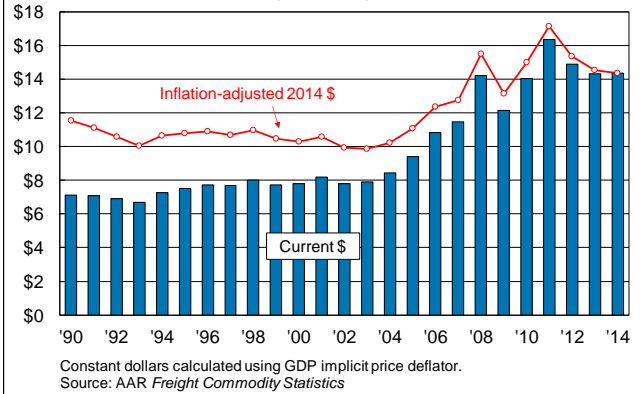
Originated Tons of Coal by U.S. Class I Railroads
(millions)

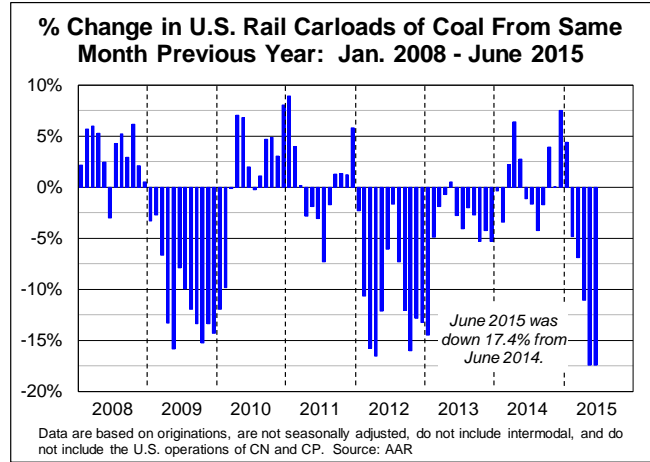
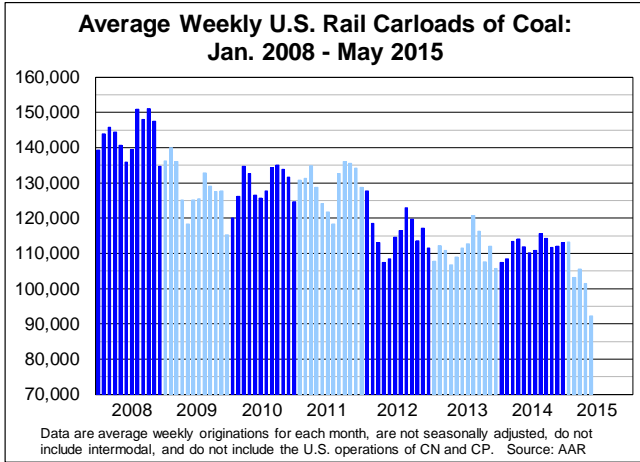


Originated Carloads of Coal by U.S. Class I Railroads
(millions)



U.S. Class I Railroad Gross Revenue From Coal
(\$ billions)





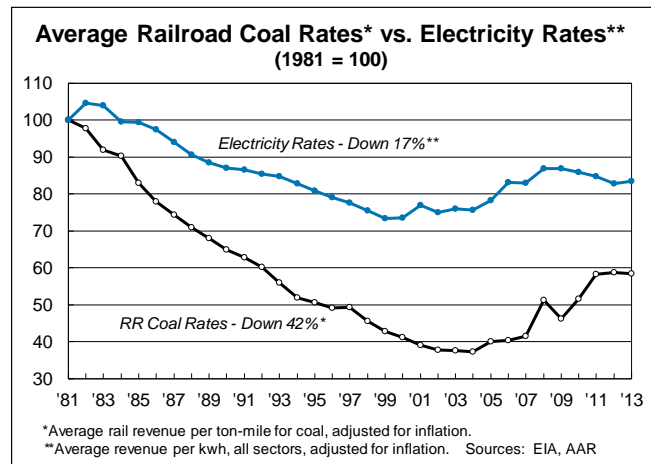
Thanks to huge productivity gains — including the use of lighter weight aluminum freight cars — railroads have dramatically increased their coal-carrying efficiency. In 2014, the average coal car carried 116.7 tons, up 19 percent from the 98.2 tons in 1990. Approximately 58 percent of coal is carried in gondolas; the rest is carried in hopper cars. Nearly all coal transported by rail moves in highly productive unit trains, which operate around the clock, use dedicated equipment, and generally follow direct shipping routes.

Due in part to the high consumption of low-sulfur Western coal by utilities throughout the country, the average length of haul for rail coal movements has trended upward over the years, reaching 842 miles in 2012, which is close to an all-time high. Rail coal movements exceeding 1,500 miles are not uncommon.

Coal dominates rail traffic in major coal producing states. In Kentucky, West Virginia and Wyoming, for example, coal accounted for 80 percent, 92 percent, and 95 percent, respectively, of total originated rail tonnage in 2013. Due to its widespread use in generating electricity, coal also accounts for a major share of terminated rail tons for many states. For example, in 2013 coal accounted for 41 percent of rail tons terminated in North Carolina, 60 percent in Wisconsin, and 27 percent in Georgia.

Rail Rates for Coal

There is no question that the vast majority of rail rates — including rail rates for transporting coal — are driven by competition. Since it incorporates both distance and weight, revenue per ton-mile (RPTM) is a useful surrogate for rail rates. In 2013, average RPTM for coal was 2.98 cents, by far the lowest such figure among major commodities carried by railroads. Average RPTM in 2013 for all commodities other than coal was 6.14 cents, more than double the comparable coal figure.

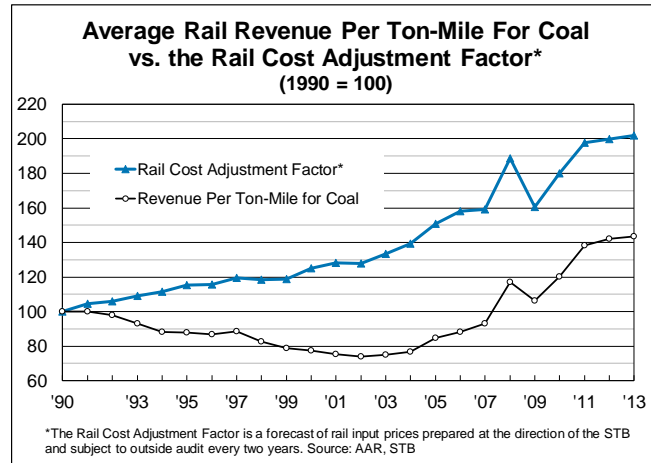


Adjusted for inflation, coal RPTM was 42 percent lower in 2013 than in 1981. This means a typical coal shipper can ship close to twice as much coal today for close to what he paid

more than 30 years ago. The average decline in rail coal rates is much greater than the average decline in the price of electricity.

In recent years, average rail rates for coal have increased. Generally speaking, railroads, like other competitive industries in the United States, set their prices based on the value they provide to their customers, not on their input costs. This market-based approach to pricing allows railroads to balance the desire of each customer to pay the lowest possible rate with the requirement that railroads be able to attract capital and pay for all the things needed to keep their networks functioning now and growing in the future.

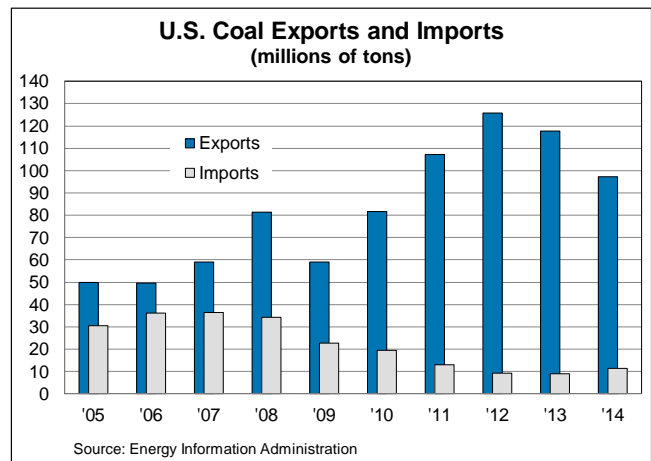
That said, increases in rail rates over the years have closely tracked increases in the costs of inputs to rail operations. The chart at right compares average rail rates for coal (measured by revenue per ton-mile) and the Rail Cost Adjustment Factor (RCAF) since 1990. The RCAF is an index that measures rail inflation in much the same way that the consumer price index measures inflation in the overall economy. The RCAF is prepared by the Association of American Railroads under the direction of the Surface Transportation Board and is subject to independent outside audit every two years. The chart shows that, since 1990, average rail coal rates have risen far less rapidly than rail input costs.



Another way to look at rail coal rates is in the context of utility revenue from electricity sales. According to data from the Energy Information Administration, total U.S. electricity retail sales in 2014 were \$389.1 billion, more than ever before. Class I rail gross revenue from hauling coal in 2014 was \$14.3 billion, equal to just 3.7 percent of the value of electricity sales.

U.S. Coal Foreign Trade

U.S. coal exports were 97.3 million tons in 2014, the second straight year-over-year decline from the peak year of 125.7 million tons in 2012. A large portion of U.S. coal exports travels by rail, so a decline in coal exports has a clear negative effect on railroads. In 2014, the top recipients of U.S. coal exports were the Netherlands, the United Kingdom, South Korea, and Brazil. Over the past ten years, metallurgical coal has accounted for 59 percent of U.S. coal exports, and steam coal for 41 percent.



U.S. coal producers are hopeful that coal exports will grow in the future, with Asia — especially China and India — seen as key potential markets. Today, China consumes close to as much coal as the rest of the world combined. In 2014, U.S. coal exports to China were just 1.6 million tons, a miniscule fraction of China’s coal consumption.

Environmental Challenges

Over the years, the affordability of coal-based electricity has been a major factor behind America's economic growth and global competitiveness. In the years ahead, coal will continue to be needed to meet America's electricity demands. That said, coal and coal-fueled electricity generation face serious environmental challenges, including challenges related to emissions (greenhouse gases, mercury, particulates, etc.), coal ash disposal, effluents, and other issues.

Some current and potential future EPA regulations risk drastic cuts in coal use. Electric utilities need both reasonable standards and adequate compliance deadlines to avoid disruptions that could raise electricity costs and potentially threaten electricity reliability.

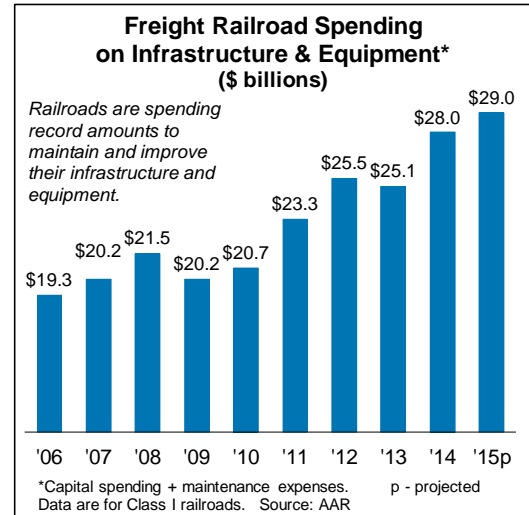
In addition to reasonable EPA regulations, railroads support the development of advanced carbon capture and storage and other clean coal technologies. By developing these technologies, America would continue to produce affordable electricity from its abundant domestic coal, energy independence would be promoted, and the environment would be protected — a win-win-win situation for all parties involved.

Continued Spending Back Into the Rail Network

Over the long term, transportation demand will grow and new rail capacity will be needed. Recent forecasts from the Federal Highway Administration found that total U.S. freight shipments will rise from an estimated 19.7 billion tons in 2012 to 28.5 billion tons in 2040 — a 45 percent increase. Freight railroads are the best way to meet much of this demand.

Freight railroads are preparing for this future demand today. Unlike trucks, barges, and airlines, which travel mainly on infrastructure that the government provides and pays for, America's privately owned freight railroads operate almost exclusively on infrastructure that they own, build, maintain, and pay for themselves. In recent years, America's freight railroads have been putting more money back into their networks than ever before. From 1980 through 2014, they spent \$575 billion — their own funds, not taxpayer funds — on renewal, maintenance, and expansion of their infrastructure and equipment. That's more than 40 cents out of every rail revenue dollar.

In the years to come, railroads will be asked to continue to grow capacity for coal and other current and potential customers. Additional spending on capacity can only be made if rail earnings are robust enough to attract the capital needed to pay for it.



Conclusion

How rail coal traffic behaves in the months and years ahead will depend on the same factors that have affected coal recently, including the competitiveness of fuels other than coal for electricity generation, weather, coal exports, and environmental laws and regulations. Through technological advances, innovative service, competitive rates, and aggressive reinvestment programs, railroads have shown their willingness and ability to provide high value transportation service to coal shippers throughout the country.