Deliveries of Coal from the Powder River Basin: Events and Trends 2005-2007

Infrastructure Security and Energy Restoration

Office of Electricity Delivery and Energy Reliability

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For Further Information

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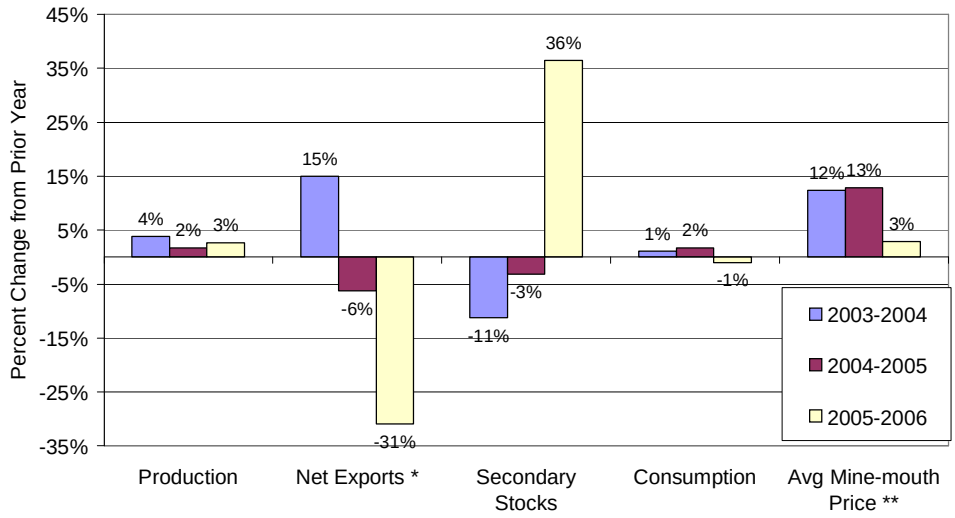
Executive Summary

The U.S. Department of Energy's Office of Electricity Delivery and Energy Reliability first conducted an assessment of coal inventories in the Midwest in July 2005 after two railroads had accidents that resulted in the stoppage of coal shipments from the Powder River Basin (PRB). As a follow-up to the 2005 assessment, the Office of Electricity Delivery and Energy Reliability re-examined the situation in April-May 2006 and August-September 2007 to further review the impact of coal deliveries and to assess electric utility coal stocks. During this time, a number of federal agencies – the Department of Transportation, Federal Railroad Administration (FRA) and Surface Transportation Board (STB); Department of Interior, Bureau of Land Management; and Federal Energy Regulatory Commission (FERC) -- have performed investigations or held meetings concerning coal deliveries from the PRB. This latest assessment documents the demand and supply conditions facing electric utilities and railroad companies, and the steps taken to ameliorate electricity reliability issues.

The situation facing coal-fired electric utilities is the result of imbalances in coal supply and demand starting in 2003-2004. Coal production in Wyoming was below normal levels from second quarter 2005 through fourth quarter 2005; however, by second quarter 2006, the situation improved with significant coal stock builds and reduced net exports. In fact, secondary stocks returned to levels last seen at year end 2002 (see Figure ES-1 for a summary of the changing coal situation from 2003 through 2006).

Figure ES-1. Changing U.S. Coal Situation



Notes: * Net Exports are exports minus imports
** Mine-mouth coal prices averaged for U.S. in constant 2004 dollars
Source: Calculated from EIA, Quarterly Coal Report and Short Term Energy Outlook

Coal production in the United States is driven by the PRB, which is the largest coal-producing region, accounting for approximately 40 percent of all coal mined in the country. PRB coal is low in sulfur and heat content. PRB coal is 40 percent less expensive than other western coals and up to 85 percent less expensive than eastern coal at the mine. PRB is the source of

reasonably-priced, low-sulfur coal for all electric utilities. Many of the electric utilities that reported problems are located far from the mine-mouth, and receive several hundred cars of coal a week by train.

After the train derailments in May 2005, PRB coal production in Wyoming and Montana was curtailed for a couple of months, returning to pre-derailment levels by July 2005. Although production began increasing after this date; electric utilities in the Midwest continued to experience problems with deliveries through Spring 2006.

Over the past decade, electric utilities have made cost-cutting improvements, such as reducing their coal stockpiles and compensating with just-in-time inventories. By April 2004, as electric utilities realized that there were coal distribution issues driving prices up, many tried to increase stocks but were unable to do so. In addition, U.S. electric utilities with coal-fired generators have been facing continual increases in the delivered price of coal.

Increased demand for coal-fired electricity generation in 2005, due in part to a large increase in cooling degree days, resulted in significant draw downs of coal stocks at electric utilities. In early 2006, due to continued train delays, coal inventories at some electric utilities dropped to six days supply or below. In response to the loss of PRB coal, electric utilities obtained other sources of coal, used other fuels for generation, and bought electricity from suppliers when needed. Although cooling demand was significant in 2006, electric utilities were able to avoid serious electricity emergencies related to reduced coal shipments. By the end of the summer, coal stocks had recovered.

Two railroads – Burlington Northern Santa Fe (BNSF) and Union Pacific (UP) – move all of the coal out of the PRB. They operate the PRB Joint Line, which was severely damaged in May 2005 and has since undergone significant maintenance, repair, and expansion.

Union Pacific declared *Force Majeure* in 2005 and failed to make promised deliveries to electric utilities as far away as Arkansas. Following the incident, the railroad companies performed several studies and prepared a plan for repairs and maintenance. These plans have since been implemented.

The railroads were sued by some electric utilities that had to reduce plant output and/or purchase spot supplies of coal and electricity, at significant expense. Alternate electricity generation fuels – natural gas and fuel oil – experienced price increases as demand from electricity generators and other sectors increased.

Since late spring 2006, PRB coal deliveries to electric utilities improved. Electric utilities, coal suppliers, rail-car producers, and railroads collaborated to resolve potential problems. New coal cars are being produced but order backlogs continue. However, limited rail capacity serving the PRB market caused railroads to fail to deliver the contracted amount of coal to some consumers in 2006. The challenges of getting coal to all consumers exist even when there are no disruptions in the production and distribution systems. Other railroads are considering building new PRB

branch lines but these are many years off.[1] The federal government engaged the railroad companies and electric utilities industry, first in a hearing at FERC in June 2006, and then in July 2007, inviting them to participate in the Rail Energy Transportation Advisory Committee (RETAC).[2]

From the assessments and sources reviewed for this follow-up study, tightness in the PRB coal market continued through 2007 as coal competed with other freight for priority along the rail lines. Flexibility is essential to avoid continuing bottlenecks and reliability concerns. Major milestones since May 2005 are summarized in Table ES-1.

Table ES-1. PRB Chronology, 2005-2007

Date	Event
May 2005	BNSF & UP train derailments on the Joint Line, temporarily halting coal shipments
July 2005	UP declares Force Majeure, reducing Joint Line deliveries by 15-20 percent
October 2005	CANAC begins study of Joint Line production & infrastructure needs
December 2005	Repairs halted due to weather until Spring 2006
April 2006	Undercutting gang begins track work through June 2006
May 2006	BNSF & UP announce $100 MM capacity expansion plan, including 40 miles of 3rd & 4th rails
June 2006	FERC holds hearing on coal supplies and railroad deliveries to electric utilities
August 2006	FRA publishes a Federal Register Notice citing the Environmental Impact Statement and Supplemental for the proposed Powder River Basin Expansion Project
September 2006	Ohio River barge companies declare *Force Majeure*, with shipments likely affected for months[3]
December 2006	U.S. Court of Appeals 8th Circuit rejects arguments against proposed alternate line to PRB
March-April 2007	UP lifts Southern PRB Joint Line embargo on new service (in effect since 7/18/05). Blizzard results in severe flooding, shut-in facilities and170 lost train loadings
July 2007	STB holds a public hearing on the reliability of rail transportation of energy resources, resulting in creation of RETAC in September
October 2007	RETAC holds first meeting

The railroads, coal mine operators, electric utilities, and federal agencies have taken a number of actions to address reliability. Private industry actions include: railroad maintenance and build-out projects for UP and BNSF, new freight rail car deliveries, avoiding missed rail loadings, careful rail operation at reduced speeds to avoid train derailments, coordinated inter-modal coal transportation, new rail projects to access PRB coal, increased coal inventories for electric utilities, and enhanced fuel switching capability at electric utilities.

The Federal government has also taken a number of actions, including: proposed rail reliability standards, greater federal agency oversight, and creation of the Rail Energy Transportation Advisory Committee.

[1] Dakota, Minnesota & Eastern (DM&E) pursued building an alternate rail line to the PRB from the Midwest, but was unable to secure the necessary financing and has since been acquired by Canadian Pacific Railway in September 2007.
[2] RETAC provides advice and guidance to the Surface Transportation Board, and serve as a forum for discussion of emerging issues, regarding the transportation by rail of, coal, ethanol and other biofuels. Representatives from the railroads, coal producers, electric utilities, biofuel and railcar industries are voting members. The Assistant Secretary of the Department of Energy's Office of Electricity Delivery and Energy Reliability and a FERC Commissioner serve as ex officio members.
[3] Ohio River barge problems impact deliveries of Eastern coal into the Midwest, which have a ripple effect on PRB coal.

Background

The U.S. Department of Energy, Office of Electricity Delivery and Energy Reliability first conducted an assessment of coal inventories in the Midwest in July 2005 after two railroads had accidents that resulted in a temporary stoppage of coal shipments from the Powder River Basin (PRB). Predictions of a warmer-than-normal summer threatened to augment electric utility demand for coal exactly when coal deliveries were being restricted. The Office of Electricity Delivery and Energy Reliability performed follow-up assessments in April-May 2006 and August-September 2007, examining in further detail the reasons for continuing tightness of PRB coal supplies for electric utilities. A number of federal agencies – the Department of Transportation, Federal Railroad Administration (FRA) and Surface Transportation Board (STB); Department of Interior, Bureau of Land Management; and Federal Energy Regulatory Commission (FERC) -- have performed investigations and held hearings. This latest assessment documents the demand and supply conditions facing electric utilities and railroad companies, and the steps taken to ameliorate the situation.

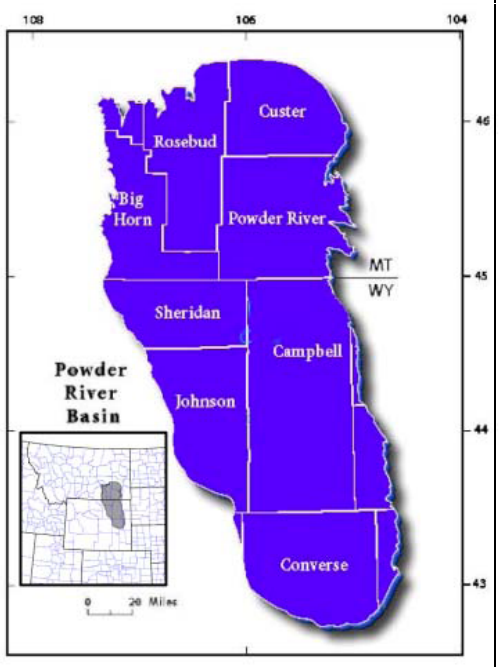
Coal Supply

The supply of coal in the United States is primarily domestic, with companies in 26 states mining coal deposits. In addition to domestic production, coal is supplied to consumers from imports and stock draw downs.

Coal Production

According to EIA, U.S. coal production averaged one billion tons[4] per year during the 1990s. Since the late 1990s, coal production has increased to approximately 1.1 billion tons per year. Coal production increased by 3.8 percent in 2004, by 1.9 percent in 2005, and by 2.6 percent in 2006, reaching new records of 1,133.3 million tons in 2005 and 1,161.4 million tons in 2006.

Figure 1. Powder River Basin Location



Source: U.S. Department of Energy.

Approximately 40 percent of all U.S. coal production is mined in the PRB fields in Wyoming and Montana.[5] The PRB is an intermountain valley that is 120 miles wide and 200 miles long (see Figure 1). The elevation of the basin itself is 3,000 feet. The coal seams are very thick – PRB seams average 100 feet – and permit surface mining techniques in the Nation's largest and fastest growing coal-producing region. PRB coal production is dominated by a small number of large surface mines.

[4] All tons referenced in this study are short tons, as opposed to metric tons.
[5] Based on EIA data, as are most values referenced in this study.

Production from PRB fields in Wyoming and Montana reached 400 million tons in 2003. It increased by more than 20 million tons in 2004, and another 10 million tons in 2005. PRB production (430 million tons) in 2005 was short of targeted levels because of derailments and damage to tracks that stopped freight trains from picking up the coal at the mines. Production of coal in Wyoming (which produces about 90 percent of PRB coal) was down from second quarter 2005 through fourth quarter 2005. In 2006, coal production in Wyoming showed marked improvement, increasing by 42.4 million tons (see Table 1). Production levels in other states shrunk or registered no change to accommodate this growth in Wyoming.

Table 1. Changes in Coal Production, 2005-2006
(Million Tons)

State	Change
Wyoming	42.4
Virginia	2.0
Utah	1.5
Kentucky	0
Other States	-16.0
U.S. Total	**29.9**

Source: Calculated from EIA, Quarterly Coal Report.

While coal production was up in 2006, a number of states had decreases in production. Mine operators in Arizona and Colorado reduced coal production by 3.9 and 2.2 million tons, respectively, during 2006. Arizona's significant decrease in production is explained by the December 2005 closure of a coal-fired power plant that exceeded environmental emissions limits. There were only two active coal mines in Arizona, and one of the mines was entirely dedicated to the now-closed power plant. Arizona has no railroads to move coal and must rely on slurry pipelines.

Net Exports of Coal

The U.S. is a net exporter of coal to Canada, Japan, South Korea, Belgium, Italy, and the United Kingdom. Over half of the coal exported is metallurgical in quality and not suited for combustion in electricity generators. The U.S. also imports coal primarily from Colombia, Venezuela, Indonesia, and Canada. Over the next two years, EIA has forecast coal imports to increase while exports stay relatively constant. As a result, net exports of coal are predicted to shrink from 13.4 million tons in 2006 to 11 million tons in 2007 and then to 9 million tons in 2008. Net exports are shrinking because gross imports are growing (reaching 36 million tons in 2006) while gross exports are holding constant at 50 million tons.

Coal Stocks

In the late 1980s, electric utilities began significantly reducing normal stocks on hand, according to EIA. Average stocks declined further until the early to mid-1990s when the stockpiles began to stabilize, but at substantially lower levels than in the late 1980s. Most of the lower stocks at electric utilities were by design to lower operating costs. This strategy is called "just-in-time" inventory.

In recent history, the highest level for secondary (consumer) stocks of U.S. coal was 159 million tons on June 30, 2002. Prior to and since then, secondary stocks of coal have fluctuated between 120 and 150 million tons. In 2003, stocks began a continual withdrawal, finishing the year at 127.2 million tons, or 21.6 millions tons below year end 2002. Stocks fell 14.3 million tons in 2004, and in 2005 another 3.5 million tons were withdrawn from U.S. consumer stockpiles. In 2006, stocks were rebuilt, finishing the year at 149.1 million tons (see Table 2).

Table 2. Year End Coal Stocks, 2001-2006
(Million Short Tons)

End-Use Sector	2001	2002	2003	2004	2005	2006
Electric Power	138.5	141.7	121.6	106.7	101.2	139.7
Coke Plants	1.5	1.4	0.9	1.3	2.6	2.9
Other Industrial Plants	6.0	5.8	4.7	4.8	5.6	6.5
Total Secondary Stocks	146.0	148.9	127.2	112.9	109.4	149.1
Primary Stocks	35.9	43.3	38.3	41.2	35.0	35.1
Total Stocks	181.9	192.1	165.5	154.0	144.4	184.2

Source: EIA, the Coal website, Quarterly Coal Report Table 29, http://www.eia.doe.gov/cneaf/coal/quarterly/html/t29p01p1.html

Electric utilities are the majority owners of coal stockpiles. By early 2004, most power producers were trying to add coal to their inventories but at that time, rail distribution systems had become overstressed and some mines were in bankruptcy or offline because of low-priced contracts and rising costs of materials, oil, and electricity.

While coal stockpiles at electricity generators dwindled in 2004 and 2005, coke plants and other industrial facilities increased their holdings. The decrease of electric power coal stocks (reductions of 14.9 million tons in 2004 and 5.5 million tons in 2005) created challenges for an industry that had come to depend on just-in-time inventories. Without freight trains available to load and deliver PRB coal to power plants, electric utilities and independent power producers were forced to seek alternate supplies on the open market at significant cost penalty. This continuing stock reduction increased the probability of adverse effects from any disruption in the coal production or supply systems. According to Energy Publishing LLC's *Coal and Energy Price Report* of March 9, 2006, "any problem with production, processing or transportation (rail or barge) of coal can quickly cause supply shortages since stocks are low."

The Office of Electricity Delivery and Energy Reliability held discussions with states in May 2006, which found first quarter 2006 stocks at electric utilities to be below normal. The stockbuilds during the second and fourth quarters of 2006 were significant. Secondary stocks have since returned to 2002 levels, according to EIA. Most of the coal stocks were built up by electric utilities (38.5 million tons in 2006).

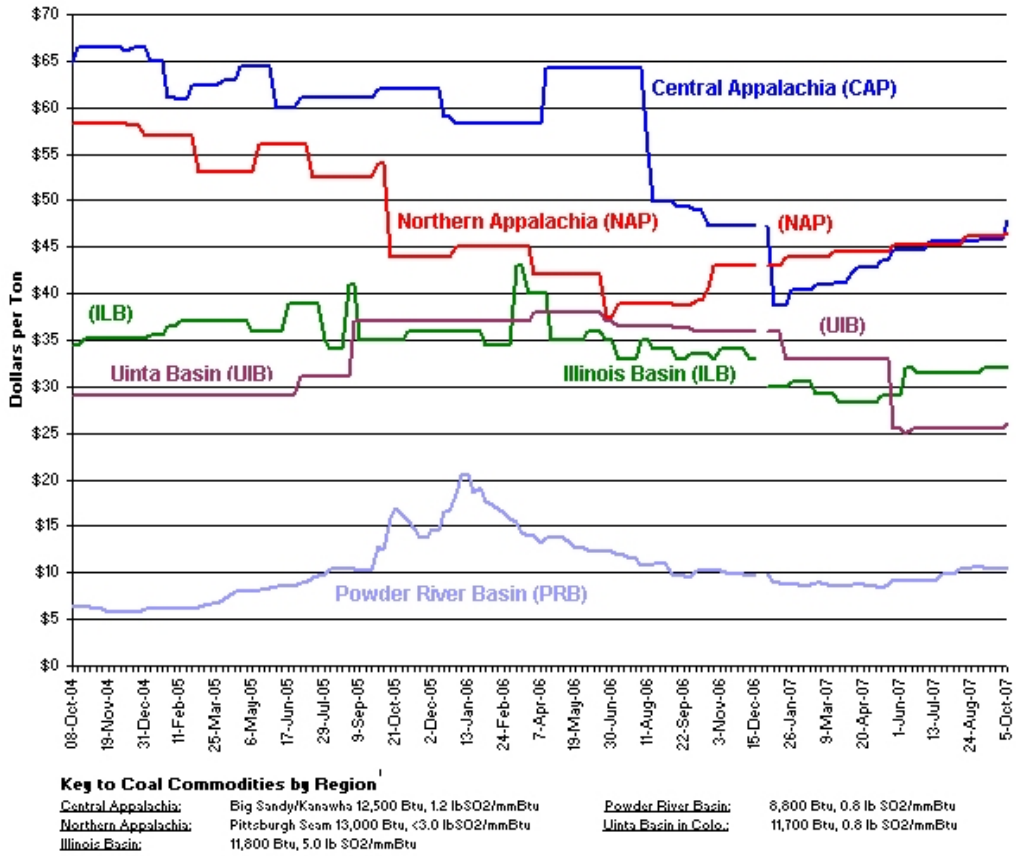
Coal Quality and Costs

Coal is mined via a variety of underground and surface techniques, depending on the thickness and depth of the coal seam. In the western U.S., coal seams are very thick (PRB seams average 100 feet). Surface mining is very efficient, requires the least amount of investment, and can help keep the mine-mouth price of coal low.

There are a variety of coal qualities mined throughout the U.S. Wyoming coal is sub-bituminous, low in ash, and low in sulfur (compared with other U.S. coals, particularly those in the Appalachian region). The Btu content (heat value) of Wyoming coal is low, ranging from 8,000 to 11,000 with PRB coal averaging 8,800 Btu per ton. The ash ranges from 4.5 percent to 9 percent averaging around 5 percent. The sulfur content of Wyoming coal ranges from 0.2 percent to 0.7 percent, averaging around 0.3 percent.

PRB coal quality and ease of mining keep the price low (see Figure 2). In 1997, the mine-mouth price for PRB coal was $5.40 per ton. By 2005, PRB mine-mouth prices had risen to only $7.71 per ton. This is considerably less than the U.S. average mine-mouth price of $23.59 per ton. Tight stocks and distribution issues contribute to higher open market prices for coal. PRB open market prices exceeded $20 per ton in February 2006 for a brief time. As stocks have grown, PRB prices have fallen. For the week of October 5, 2007, the average spot prices for PRB coal were $10.50 per ton, whereas Central Appalachian coal was offered at $47.90 per ton.[6]

Figure 2. Weekly Mine-Mouth Price Comparison



Source: EIA, Coal News & Markets, October 9, 2007, http://www.eia.doe.gov/cneaf/coal/page/coalnews/coalmar.html.

[6] EIA, Coal News & Markets, October 9, 2007, http://www.eia.doe.gov/cneaf/coal/page/coalnews/coalmar.html.

Coal Demand

Coal is mainly delivered by train and barge to electric utilities and industrial facilities. These intermediate consumers use coal to produce another more valuable product demanded by end users: electricity and consumer products. The seasonal considerations of electric utility customers and the manufactured products are what drive the demand for coal nationwide.

Coal Consumption

Coal was first used to power the coal-fired steam engines of the transcontinental railroads. In the early 1950s, trains shifted to diesel engines and many coal mines closed. In the late 1960s, the demand for cheap coal for coal-fired electric utilities grew rapidly. Today, virtually all U.S. coal (92 percent) is consumed by the electric power sector (see Table 3).[7]

Table 3. U.S. Coal Consumption by End-Use Sector 2001-2006

(Million Short Tons)

End-Use Sector	2001	2002	2003	2004	2005	2006
Electric Power	964.4	977.5	1,005.1	1,016.3	1,037.5	1026.5
Coke Plants	26.1	23.7	24.2	23.7	23.4	23.0
Other Industrial Plants	65.3	60.7	61.3	62.2	60.3	60.5
Residential & Commercial	4.4	4.4	4.2	5.1	4.2	4.2
Total	1,060.2	1,066.3	1,094.8	1,107.3	1,125.5	1,114.2

Source: EIA, the Coal website, Quarterly Coal Report Table 25, http://www.eia.doe.gov/cneaf/coal/quarterly/html/t25p01p1.html

Coal-fired electricity generators are typically base-loaded, i.e., they run continuously at the highest capacity factor possible. Demand for electricity generation is seasonal, with customers requiring more electricity during the summer months. Normally, there is a 30-40 million ton third quarter (late summer) run-up in coal demand by electric utilities.

Residential and commercial customer demand for heat and air conditioning are the marginal determinants of the magnitude of the swing in electricity demand. Heating degree days offer a measure of how cold a location is over a period of time relative to a base temperature and serve as an indicator of space heating energy requirements or use.[8] Likewise, cooling degree days offer a measure of how warm a location is, and serve as an indicator of air conditioning energy requirements or use.[9] There are other sources of heat such as natural gas and distillate fuel, but electricity is the only source for air conditioning. As a result, cooling degree days can drive electricity demand and the subsequent demand for coal.

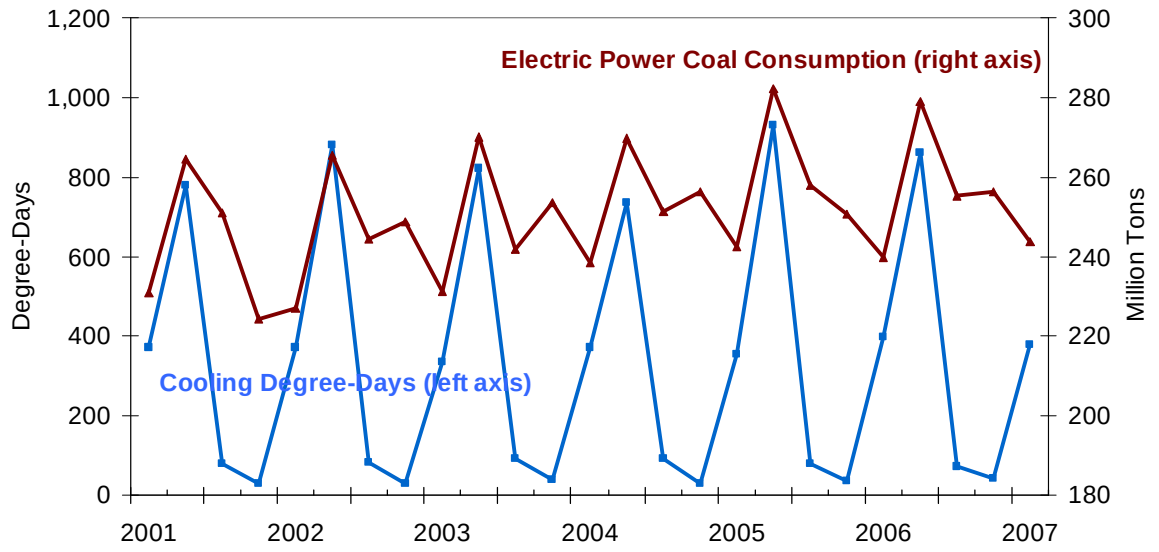
[7] The electric power sector (electric utilities and independent power producers) comprises electricity-only and combined-heat-and-power (CHP) plants whose primary business is to sell electricity, or electricity and heat, to the public -- i.e., NAICS 22 plants. The reported coal consumption is the total for producing electricity and useful thermal output.

[8] The measure is computed for each day by subtracting the average of the day's high and low temperatures from the base temperature (65°F), with negative values set equal to zero. Each day's heating degree-days are summed to create a heating degree-day measure for a specified reference period.

[9] The measure is computed for each day by subtracting the base temperature (65°F) from the average of the day's high and low temperatures, with negative values set equal to zero. Each day's cooling degree-days are summed to create a cooling degree-day measure for a specified reference period.

Above normal temperatures during the third quarter of 2005 contributed to increased electricity demand throughout the country (see Figure 3). In fact, cooling degree days reached 935 for the U.S. on average, well above the 770 cooling degree days normally predicted for the summer months. Limitations on PRB coal supplies may have resulted in increased gas fired generation which could have adversely impacted natural gas storage levels for the 2006 heating season. However, due to the absence of hurricanes in the Gulf of Mexico, natural gas inventories were above normal levels at the beginning of the heating season in the fall of 2006.

Figure 3. Electric Power Coal Demand Tracks Cooling Degree-Days



Source: EIA, Short Term Energy Outlook.

During the summer of 2006, U.S. demand for electricity again reached an all-time record amid a punishing national heat wave. During the week ending July 22, 2006, electric utilities delivered 96,314 gigawatt hours, surpassing by more than 1 percent the 2005 record of 95,259 gigawatt hours.[10] Utilities in the upper Midwest and Northeast urged customers to conserve electricity in early August 2006 as a major heat wave continued to stress the electric grid by reducing reserve margins.[11] Nuclear power plants along the Mississippi River were forced to reduce their operation due to high water temperatures. Distribution line failures resulted in power outages in some areas of the Midwest.[12]

In 2005, PRB coal was delivered to electric utilities and independent power producers in 36 states, including Wyoming. Coal-fired generators are relatively old, with most built decades ago. Few coal-fired generators have the equipment to burn fuels other than coal. Of the 313,380

[10] "US Breaks All-Time Weekly Demand Record for Electricity During National Heat Wave," Clean Edge News, July 27, 2006, http://www.cleanedge.com/story.php?nID=4224.
[11] http://www.chillicothegazette.com/apps/pbcs.dll/article?AID=/20060803/NEWS01/608030319; http://www.redorbit.com/news/general/600631/ny_set_for_3rd_day_of_record_power_demand/index.html?source=r_general.
[12] "Distribution Failures Knock Out Power to 41,000 Customers in Chicago Area July 31," Bloomberg News, 16:28 July 31, 2006.

megawatts of coal-fired summer net capacity, only 20,221 megawatts, or 6 percent of the generation capacity has the ability to fuel switch.[13]

Coal Prices

Electric utilities have traditionally procured coal with a mix of long and short-term contracts as well as spot purchases. Large amounts of coal have traditionally been purchased under long-term contracts, some of which exceeded 30 years. However, as coal prices have fallen, electric utilities have increasingly turned to short-term contracts of less than 10 years.

Delivered price of coal to electric utilities is significantly more than the mine-mouth price. In 2005, the average price of coal delivered to electric utilities was $31.22 per ton (as compared to an average price of $7.71 per ton for PRB coal at the mine mouth). Transportation charges account for the vast majority (75 percent) of the delivered price of PRB coal. The further the coal is shipped, the higher the delivered price. In 2005, coal delivered to Wyoming electric utilities was twice the price of the PRB mine-mouth price. PRB coal delivered to Ohio utilities was almost five times higher than the PRB mine-mouth price at $37.00 per ton. Coal shipments to Florida were over seven times higher than the PRB mine-mouth price, $55.76 per ton.[14]

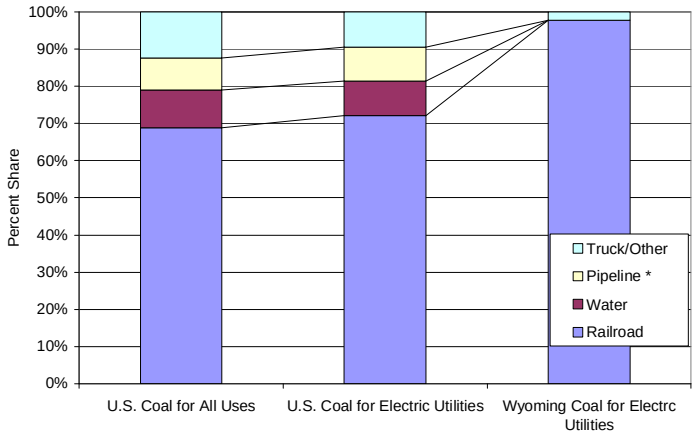
Rail transportation charges have not always been climbing. Rail rates fell from 1984 to 2003, due in part to deregulation and offloading of shortlines which had higher costs relative to traffic. However since 2003, rail rates escalated as demand grew and excess rail capacity shrunk.[15] Increases over the past few years are due to increased demand for the movement of products by rail, particularly for inter-modal transport of goods. A quarterly Bear Stearns survey of more than 1,000 shippers confirmed that rail transportation rates are expected to continue rising through 2007, driven by "ongoing tight rail capacity and expectations for continued strong rail freight demand."[16]

[13] According to data from EIA's Electric Power Annual, 2005, November 9, 2006.
[14] Calculated from EIA, Annual Coal Report, Table 34, http://www.eia.doe.gov/cneaf/coal/page/acr/table34.html
[15] Energy Venture Analysis, "Western Coal Transportation: Why Can't We All Just Get Along," September 12, 2006, presented at National Coal Transportation Association annual meeting.
[16] EIA, Coal News and Markets, March 29, 2007, http://tonto.eia.doe.gov/FTPROOT/coal/newsmarket/coalmar070329.html.

Coal Distribution

Coal moves from mines to consumers via barge, truck, conveyor, tramway, slurry pipeline and/or train. Freight trains are the primary transportation mode. Freight trains move 72 percent of all coal in the U.S., the entire distance from the mine to the power plant (see Figure 4).[17] The PRB is the most significant coal-producing region in the U.S, and 96 percent of its coal is moved to electric utilities by rail. PRB coal is shipped as far west as Oregon, throughout the entire Midwest, and as far south as Florida. PRB coal is not transported to the Mid-Atlantic and Northeast states due to the distance and to California for lack of demand.

Figure 4. Coal Transportation by Mode, 2005



Note: * Slurry pipeline & tramway conveyor.
Source: EIA, Coal Distribution Report, Form 6A, http://www.eia.doe.gov/cneaf/coal/page/coaldistrib/distro_us.html.

Because of differences in shipping distance and transportation mode, transportation costs vary greatly among different sources of coal. Eastern coal is costlier at the mine mouth, but its transportation costs are lower, involving relatively shorter hauls to consumers by rail and low-cost barge. Low-cost western coal is shipped primarily by rail over great distances, thus involving a larger transportation cost.

Electric utilities have worked closely with coal companies and railroads to ensure that they receive adequate coal supplies.[18] Major disruptions in the production or distribution of coal greatly affect an electric utility's bottom line. Disruptions may force utilities to buy expensive electricity on the spot market or fire up more costly gas- or oil-fired generators.

Railroad Infrastructure

Consolidation has left the rail industry with just a half-dozen major operators, who have been cutting rail routes and costs since the industry was deregulated by the Staggers Act in 1980. There were 41 Class 1 railroads in 1980. In 2006, only five U.S. and two Canadian companies moved freight in the U.S. Downsizing and increasing demand for freight movements have left the rail industry with less track space as well as railcar and locomotive capacity. Many areas of the country are served by only one or two railroads, meaning limited or no competition. In most

[17] EIA data collected on Form 6A avoids double counting tons moved by multiple modes. If coal is moved by water or truck, that mode is entered in the response instead of rail if all modes are employed.

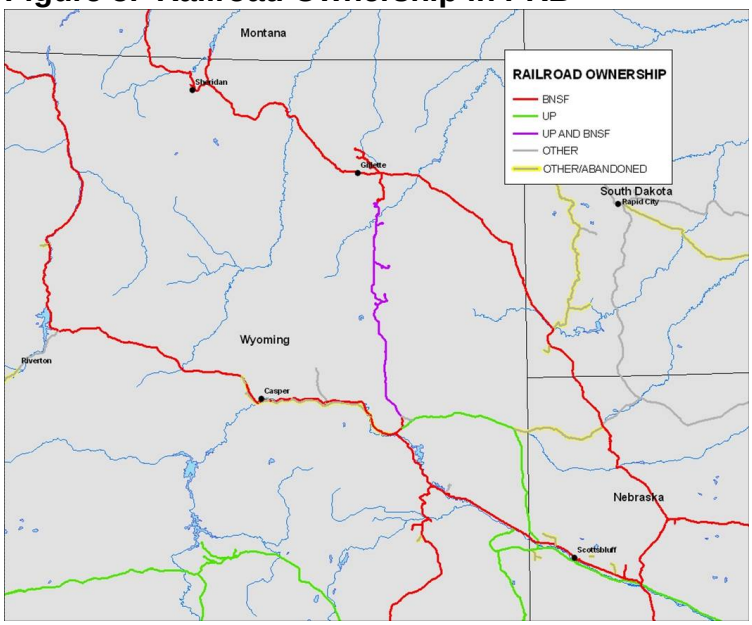
[18] Eight years ago, the western railroads, the mines, and the utilities collaboratively developed a monthly forecasting system for coal. The process is a disciplined method for matching coal production by month with utility and industrial user demand, managed under the sponsorship of the National Coal Transportation Association. Both UP and BNSF utilize the forecast for short-term planning, as well as for train "slotting" by mine and customer on a daily basis. The system requires refinement to handle record levels of PRB coal demand and capacity constraints. The railroads made further improvements in 2007 to the forecasting process, aligning mine production, rail operations, and delivery expectations.

cases, the railroads contend they have sufficient infrastructure and blame the lack of spare capacity for significant delays in the system.[19] Because of limited infrastructure, railroads have difficulty running more cars or trains to compensate for lost deliveries after a disruption has ended. In addition, a coal consumer may not be able to acquire the coal cars needed to move additional coal.

Shippers must often lease or buy their own cars. It should be noted that even if a shipper makes arrangements to use cars owned by the railroad, U.S. Department of Transportation regulations make the shipper responsible for ensuring that cars are safe to load and suitable for the material being shipped.

BNSF and UP run coal trains out of the PRB on the Joint Line connecting Caballo Junction, WY and Shawnee Junction, WY (shown in purple on Figure 5). The Joint Line is the busiest and highest density freight railroad in the world as measured by gross ton-miles. It is 103 miles long according to BNSF, with 295 track miles installed. Approximately 130 trains, whether loaded or empty, move on the Joint Line on a normal day. Loaded trains can weigh as much as 19,000 tons.

Figure 5. Railroad Ownership in PRB



Source: U.S. Department of Energy.

Although BNSF and UP are the only two railroads that directly move coal out of PRB, many other railroads transport PRB coal from railroad interconnections throughout the West and Midwest. Norfolk Southern Corp., for example, transports PRB coal into the South.

UP is working with the mining companies to fine-tune some of the mining operations. Some mines have abruptly ceased production for several days due to collapses of overburden (the strata of dirt and rock above the coal) into the mine. This has led to situations in which empty trains sit idle. The companies estimate that total deliveries of PRB coal have been reduced by perhaps 5 percent in 2006 due to this problem.

Some electric utilities have raised concerns that the railroads are not delivering coal to them when needed. Others have noted that in order to do business with the local railroad, they must

[19] In some areas of the country, and in particular the PRB, the railroads have not had adequate infrastructure to meet demand for shipping coal to market under normal operating conditions. That is why railroads, after 25 years of shrinking, have actually been adding more double and triple track in these high volume corridors.

either agree to take unneeded or unwanted deliveries or risk being cut off completely. Companies noted that the railroads have raised their rates and the electric generators have little flexibility in obtaining coal purchases.

Train Derailments & Coal Delivery Impacts

Train derailments occur along main lines, in switch yards, and at industry loading facilities. Derailments occur for a number of reasons, including human error, weather, faulty equipment, track bed issues, and speed. The Federal Railroad Administration maintains an electronic database of accidents and incidents reported by rail operators throughout the U.S. A review of major derailments reported along the PRB lines from May 2005 through July 2007 revealed a significant number of accidents estimated to cost UP and BNSF over $11 million (see Table 4). These estimates do not include the value of lost revenue to the railroad.

Table 4. Major Derailments along PRB Main Lines, 2005-2007

Date	Railroad	Damage Estimates	
		Equipment	Track
5/14/2005	BNSF	$462,140	$188,190
5/15/2005	UP	$685,307	-
5/15/2005	BNSF	-	$237,000
9/18/2005	BNSF	$994,837	$521,600
10/8/2005	BNSF	-	$248,000
1/26/2006	BNSF	$5,000	$390,000
2/3/2006	BNSF	$710	$201,268
3/19/2006	BNSF	$210,000	$8,000
4/22/2006	UP	$473,432	$152,335
5/5/2006	UP	$3,441	$126,982
5/27/2006	UP	$6,194	$318,488
5/28/2006	UP	$82,925	$186,870
8/1/2006	BNSF	$460,516	$7,810
9/2/2006	UP	$101,961	$470,392
11/13/2006	BNSP	$14,500	$426,032
12/17/2006	UP	$110,000	-
2/11/2007	BNSF	$1,374,927	$412,000
2/11/2007	BNSF	$368,402	-
4/25/2007	BSNF	$1,090,197	$125,000
7/9/2007	BNSF	$2,139	$773,812
	Total	**$6,446,628**	**$4,793,779**

Source: Federal Railroad Administration, Office of Safety Analysis, Accident/Incident Reports, http://safetydata.fra.dot.gov/OfficeofSafety/Query/default.asp?page=incabbr.asp

In May 2005, three train derailments occurred on the Joint Line, resulting in significant damage to equipment and track. These accidents required repair work, forcing operators to reduce anticipated deliveries. On May 14, 2005 a BNSF train derailed 15 cars approximately 6 miles

north of Bill, Wyoming, on the South PRB Joint Line. On May 15, 2005 a UP coal train derailed 28 cars approximately 19 miles north of Bill, Wyoming, also on the Joint Line. The derailments damaged all three main lines on what is the busiest rail transportation corridor in the world, in terms of tonnage moved. All coal shipments were halted temporarily. Since that time, rail shipments of coal to electric utilities have been reduced throughout most of the Midwest, Southern Plains and Rocky Mountain regions. The railroads embargoed new customers on the Joint Line in order to keep volumes down. UP, for example, did not make offers for new PRB coal customers, thereby reducing competition for expiring contracts, until almost two years later when UP lifted its embargo on new customers along the Joint Line on March 27, 2007.

The damaged track along the Joint Line ran from Reno Junction in Campbell County, Wyoming, to Bill in Converse County, Wyoming. The accumulation of coal dust in the Joint Line roadbed, in combination with greater than normal rainfall and aging tracks, was suspected to have created instability in the railway structure. Beneath railroad ties lies material that serves both as a shock absorber for the rigid axle-to-frame railcars and as a drainage mechanism for rainfall, to avoid standing water. The railroads operate an undercutting maintenance program to avoid material degradation. In 2005, as higher records of coal movement were set on the Joint Line, the railroads were unable to keep pace with the magnitude of coal dust falling into the material, and the roadbed degraded.

During the first two phases of the track rebuilding effort, coal shipments were reduced to about 85 percent of normal capacity. Since UP does not have alternate tracks to move PRB coal to markets, the railroad was forced to declare *Force Majeure* on contracted deliveries of PRB coal. Wisconsin Electric Power Company received a letter from UP on July 6, 2005, notifying it that a *Force Majeure* condition requiring maintenance on UP's rail lines was expected to result in a 15-20 percent reduction in the amount of contracted deliveries of PRB coal to certain coal generating facilities from June 2005 through November 2005.

According to EIA, repairs on the Joint Line were halted in December 2005 due to weather, but resumed again in the spring of 2006. Operators repaired damaged tracks and undertook tests to reduce coal dust on the tracks that was partly responsible for some of the damage to the track beds last year. The two railroads expanded the movement of coal out of the PRB with significant investments in 2006 that equaled the value of their coal capacity investments during the prior five years.

Railcar Deliveries

Rail Theory Forecasts, a market analysis and railroad industry forecasting company, reported 2006 as a strong year for railcar deliveries. New freight railcar deliveries in 2006 reached 74,729 cars, 9 percent more than the 68,687 freight cars delivered in 2005. The 2005 total was the highest since 1999, according to data from the Railway Supply Institute's American Railway Car Institute committee. Orders continued to exceed freight car and locomotive production, resulting in a growing backlog of undelivered freight cars for Trinity Industries and RailPower Technologies.[20]

[20] "Car sales help propel Trinity to strong quarter," Coal & Energy Price Report, August 10, 2006, and "RailPower losses persist as backlog doubles," Coal & Energy Price Report, August 16, 2006.

According to the Progressive Railroading publication, deliveries of new coal cars have not been able to keep up with orders. The article noted about 9,500 coal cars were to be delivered by railcar manufacturers in 2005, leaving a backlog of about 21,000 cars that already existed at the end of third quarter 2005.[21] Since demand for coal cars continues to increase, the backlog remained through 2006 and 2007.

The number of open-hopper cars (which can carry coal or other similar bulk commodities such as stone or gravel) operated by UP has increased from 59,348 in October 2005 to 61,841 in September 2006 and 62,491 in September 2007. BNSF has increased its number of open hopper cars by three times as much as UP, from 53,537 in October 2005 to 60,738 in September 2006 and 64,844 in September 2007.[22]

Railcar Speed

The railroads have reduced their speeds significantly since 2003. According to Rail Theory Forecasts, the average speed of UP trains has decreased about 16 percent from the fourth quarter of 2002 to the fourth quarter of 2005. The average speed of BNSF trains has decreased about 18 percent during that same period.[23]

According to UP performance statistics, the train speed of its coal units decreased from 2005 to 2006. In September 2005 the average speed of UP coal units was 21.0 mph, reducing to 20.3 mph on September 22, 2006. The train speed of BNSF coal units also decreased from 19.1 mph in September 2005 to 18.0 mph on September 22, 2006.[24]

In 2007, railcar speeds continue to increase. UP coal units averaged 20.8 mph on October 5, 2007 while the speed of BNSF coal units averaged 20.0 mph for the same week.

The average train cycle time (time for the train to leave the plant empty and return to the plant loaded with coal) in 2004 was 4.5 days. The average train cycle time increased to 5.5 days in 2005 - about a 25 percent increase. In early 2006, the average cycle time crept above 5.5 days. Longer cycle times mean fewer tons delivered during the year. This statistic is no longer regularly reported.

Train Loadings

According to BNSF, total PRB rail-delivered coal was about 415 million tons in 2005, up 2 percent from the 406.8 million tons moved out of PRB in 2004.[25] In 2006, PRB coal deliveries increased 10 percent, reaching 457.5 million tons. Coal deliveries in 2007 were expected to grow another 3 percent to 472 million tons.

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[21] Progressive Railroading, December 12, 2005.
[22] All info on hopper car deliveries are from performance reports at: http://www.railroadpm.org/.
[23] http://www.railtheoryforecasts.com/new.html.
[24] All info on train speeds are from performance reports at: http://www.railroadpm.org/
[25] Will Cunningham, BNSF Railway, NCTA Logistics, February 13, 2007, http://www.nationalcoaltransportation.org/events/Cunningham_2_13_07.pdf

In 2006, BNSF loaded a total daily average of 49.7 trains in the PRB, up 10.4 percent from the 45.0 average daily PRB coal train loadings in 2005. Average BNSF train loadings for PRB continue to increase, setting new records each month. September 2007 average daily loadings of 52.4 coal trains exceeded the previous monthly record of 51.8 trains per day set in December 2006. [26]

UP reported that Joint Line loadings (UP and BNSF combined) for 2006 were 23,875, an increase of 8 percent over 2005. Many planned loadings were missed in 2006 and 2007 due to a variety of railroad, mine, and weather problems. Missed loadings vary significantly by month. UP reported that 139 of its Southern PRB loadings were missed in September 2006. In July, UP missed 50 of its Southern PRB loadings due to various mechanical issues at the mines. UP also reported that 110 of its Southern PRB loadings were missed in February and 46 were missed in January due to a variety of railroad and mine issues.

During the first quarter 2007, several winter storms impacted the mines, UP's coal train operations and the utilities. The greatest impact on coal train loadings occurred during the last week of March, when a fast moving winter storm forced the closure of Highway 59 that parallels the Joint Line and runs from Gillette to Lusk, Wyoming. This road closure forced all of the coal producers to cease mining operations on the Joint Line for almost two days. The lack of coal production compelled UP to store empty coal trains throughout its network. On March 31, 2007, UP had 160 empty train sets in storage awaiting the mines to return to normal production. The blizzard conditions resulted in the loss of about 170 coal train loadings in the PRB by BNSF between March 27 and April 4.[27]

[26] Data on missed loadings for UP and BNSF on the Joint Line are from http://www.uprr.com/customers/energy/sprb/updates.shtml. and http://newdomino.bnsf.com/website/updates.nsf/updates-service-coal/4D5B66AC102AF5C286257369006ABEB2?Open.

[27] http://www.uprr.com/customers/energy/sprb/weekly.shtml; http://www.uprr.com/customers/energy/sprb/index.shtml, and BNSF Press Release, April 5, 2007.

Plans for Improvement & Current Actions

The railroads, coal mine operators, electric utilities, and federal agencies have undertaken a number of actions to address reliability. Private industry actions include:

- Railroad maintenance and build-out projects for UP and BNSF
- New freight rail car deliveries
- Avoiding missed rail loadings
- Careful rail operation at reduced speeds to avoid train derailments
- Coordinated inter-modal coal transportation
- New rail projects to access PRB coal
- Increased coal inventories for electric utilities
- Enhanced fuel switching capability at electric utilities

Federal government actions include:

- Proposed rail reliability standards
- Greater federal agency oversight
- Rail Energy Transportation Advisory Committee

In late 2005, Canadian rail engineering firm CANAC began a new study of the Joint Line and presented preliminary findings to UP and BNSF in early 2006. CANAC's recommendations served as the basis of the new construction and maintenance plan set forth by UP and BNSF.

In January 2006, BNSF announced it would expand its Lincoln, Nebraska, yard and add 50 miles of double- and triple-track on the PRB Joint Line and on other coal routes elsewhere in Nebraska. The improvements were part of BNSF's $2.4 billion capital commitment program for 2006 to increase reliability and maintainability, and handle more volume. BNSF and UP developed a 2006 maintenance plan for the Joint Line. The plan included 270 track miles of surfacing, 90 track miles of undercutting, 75 miles of shoulder ballast cleaning, and new construction of third and fourth track in a three-phase expansion:[28]

- 14 miles of third rail at southern end (Shawnee Junction) in service June 2005
- 19 miles of third rail by Reno Junction in service September 2006
- 39 miles of third rail to northern end (Donkey Creek) and 15 miles of fourth rail by Logan Hill/Bill in service October/November 2007

According to BNSF and UP, total PRB coal finished the year 2006 with 354.8 million tons, up 29.5 million tons, or 9.1 percent over 2005.[29]

From the second quarter of 2006 to present, more coal from PRB than ever before is being produced, loaded on trains, and delivered to utility customers. UP and BNSF, the two major

[28] Will Cunningham, "BNSF Railway, "NCTA Logistics and Planning Committee, July 31, 2007, http://www.nationalcoaltransportation.org/events/BNSFPresentation073107.pdf
[29] http://newdomino.bnsf.com/website/updates.nsf/updates-service-coal/874F5EEE0E04D71B862571490070C653?Open

PRB coal distributors, have repaired damaged track, added track to the Joint Line, and have been adding railcars to their inventory to move more coal. Concerns existed over the continued large number of missed train loadings out of PRB and the likelihood that accidents or damage to the Joint Line would halt coal shipments. Since movement by rail on the Joint Line is the only way coal moves out of PRB, it has been vitally important for utilities to get reliable shipments of coal to make certain that they can continue to produce electricity at their coal-fired plants.

While most of the coal moved by barge on the Ohio River System is from sources close to the river, there is a growing amount of PRB coal moving in this mode. In September 2006, the Ohio River Lock 52 was closed for maintenance through November 11, 2006. Analysts expected water levels and river lock maintenance to have ripple effects for three electric utilities with coal-fired generators located there.[30]

Alternatives to the Joint Line have been pursued for a number of years. One is the proposed plan by the Dakota Minnesota & Eastern (DM&E) Railroad to add a third railroad option to the PRB coal-producing region. This plan, first proposed in 1997, aimed to create a new railroad both by purchasing and upgrading existing track and by investing in new track. The proposed rail line would have provided an alternate route to move coal out of PRB east without requiring the use of the Joint Line.[31] DM&E Railroad applied for a $2.5 billion loan package from the Federal Railroad Administration in November 2005, but the loan request was denied in February 2007.[32] DM&E was unsuccessful in securing private funds for the proposed rail line; and instead announced their merger with Canadian Pacific in September 2007.

In 2005, 14 percent of train accidents on all mainline tracks were caused by human error involving improper train handling or misuse of automatic braking systems.[33] Current problems such as derailments caused by sudden emergency brake applications, and runaway trains caused by loss of brake air pressure, could be eliminated using Electronically Controlled Pneumatic (ECP) brakes.[34] ECP brakes could prevent many derailments and shorten train-stopping distances, giving locomotive engineers better control over their trains. In September 2007, the Federal Railroad Administration proposed revising federal rail safety regulations governing freight power brakes and equipment; the regulations are designed to encourage railroads to install ECP brake systems.[35]

Electric utilities and independent power producers are examining ways to enhance fuel switching capability. There are many local potential constraints on the expansion of backup fuel use at coal-fired electricity generators, including air quality regulations, water protection rules, zoning and building codes, transportation codes and infrastructure, and power market structure. Methods to encourage fuel switching include:

- Requesting pre-approval of waivers of local truck traffic restrictions during designated emergency events

[30] US Coal Review, Sept. 18, 2006.
[31] "Industry Reacts Cautiously to DM&E Project," *Coal Transportation* (June 16, 1997).
[32] Peter Harriman, "Denial of federal loan doesn't doom plans," Argus Leader, March 4, 2007.
[33] http://www.progressiverailroading.com/freightnews/article.asp?id=9337
[34] "FRA to Revise Rail Safety Rules to Support Deployment of Improved Train Braking Technology," 2006-08-22, http://www.bnsf.com/employees/communications/bnsf_today/2006/08/2006-08-22-c.html.
[35] http://a257.g.akamaitech.net/7/257/2422/01jan20071800/edocket.access.gpo.gov/2007/07-4297.htm

- Assessing regional liquid fuel transport capabilities and developing facility-specific backup fuel storage volumes with these considerations
- Developing agreements with adjacent regions for provision of fuel trucks during emergency periods with increased fuel oil transport demand.

In May 2006, the Association of American Railroads urged the Federal Energy Regulatory Commission to hold a public workshop to look at the supply chain that produces transports and receives the coal used to generate electricity at utility plants across the nation.[36] The Federal Energy Regulatory Commission invited electric utility and railroad representatives to a hearing on June 15, 2006, to discuss electricity reliability issues. At this June 2006 meeting to discuss reliability of coal shipments by rail, some utility representatives argued that railroads did not meet their contractual commitments to deliver the agreed upon amount of coal to their customers in 2005 and were still not meeting all of their commitments in 2006.[37] The railroad industry representatives at the hearing denied these allegations (see Table 5 below).

Table 5. Participant Positions at FERC Hearing, June 15, 2006[38]

Electric utility position	Railroad position
• Coal stocks are too low at some electric utilities • Railroads over the past couple of years have become unreliable and some railroads are not meeting contractual commitments to deliver coal to electric utilities • Some electric utilities have had to import coal to make up for inadequate deliveries of domestic coal by the railroads • Some electric utilities have had to buy expensive power or natural gas to fulfill their customers' needs • Railroads do not have the capacity to meet coal demand • Railroads are monopolies in some markets and are giving some captive electric utilities "take it or leave it" offers to move coal • Prices to move coal have skyrocketed over the past couple of years.	• Electric utilities lowered their stocks by design and the railroads are not at fault for this • Railroads are now meeting their contractual commitments for PRB coal deliveries • Imports of coal are minor • Supply and demand controls the market • Railroads are building more capacity, but they can't build it just because someone like the electric utilities may need it • Contracts are negotiated with customers and the railroads are happy and confident that their coal business will continue to grow.

Several utility industry associations and the National Association of Regulatory Utility Commissioners (NARUC) have called for railroad reliability standards to ensure that coal is delivered to customers as required. They have asked the Administration and Congress to consider mandatory action. NARUC, for example, passed a resolution on February 15, 2006, entitled "Urging Legal and Regulatory Reform to Improve Railroad Shipper Rates and Quality of Service." Other associations have suggested that the railroad industry be subject to the same reliability standards as those imposed on electric utilities.

[36] "Railroads Urge FERC to Examine Electricity Supply Chain Reliability," 2006-05-03, http://www.bnsf.com/employees/communications/bnsf_today/2006/05/2006-05-03-d.html

[37] Many utilities have only one railroad that can deliver coal to them, leaving them no recourse when the prices of fuels and transportation increase dramatically and freight cars are unavailable.

[38] http://www.ferc.gov/EventCalendar/EventDetails.aspx?ID=2678&CalType=%20&CalendarID=116&Date=6/28/2006&View=List

On July 26, 2006, U.S. Senator Trent Lott from Mississippi sponsored a bill (co-sponsored by eight other U.S. Senators) called the Freight Rail Infrastructure Capacity Expansion Act, (S. 3742) which would provide a 25 percent tax credit for any business investing in new rail track, intermodal facilities, rail yards, locomotives or other rail infrastructure expansion projects. The bill did not pass.

In July 2007, the Surface Transportation Board created the Rail Energy Transportation Advisory Committee (RETAC). RETAC provides advice and guidance to the Board, and serves as a forum for discussion of emerging issues regarding the transportation by rail of energy resources, particularly, but not necessarily limited to, coal, ethanol, and other biofuels. Representatives from the railroads, coal producers, electric utilities, biofuel refiners, processors, distributors, feedstock growers/providers, and railcar owners/lessors/manufacturers are voting members.[39] The Assistant Secretary of the Department of Energy's Office of Electricity Delivery and Energy Reliability and a Commissioner from the Federal Energy Regulatory Commission serve as ex officio members.[40] The first meeting was held October 24, 2007 in Washington, DC, with meetings scheduled twice a year.

The U.S. Department of Energy's Office of Electricity Delivery and Energy Reliability will continue to monitor the situation since it considers the events occurring in the PRB since May 2005 to be sufficiently serious for the reliability of electricity supply. Flexibility is essential to avoid continuing bottlenecks and enhance resiliency. The Office will prepare updates or reports as circumstances warrant.

[39] http://www.stb.dot.gov/decisions/readingroom.nsf/WebDecisionID/38412?OpenDocument.
[40] http://www.ferc.gov/news/news-releases/2007/2007-4/10-18-07.pdf.