North America Equity Research
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Coal 101

Fuel of the Past, Present and Future

Coal

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- It isn't over till the large lady sings! For coal we're not sure the lady is in the building yet, let alone at the microphone. Coal equity performance could be volatile as the markets come to terms with continuing credit problems. However, the developed world is grudgingly rediscovering (clean) coal as a domestic fuel, and China is building a coal fired power plant every 10 days.

- Carbon controls have a high profile, but perversely they seem to be helping support coal prices at present. The BP energy report shows global coal reserves at 133 years or about 3 times the energy equivalent of oil, but we believe it will be very difficult to confidently build significant new coal mining capacity until global leadership agree on what limits (or penalties) are put on coal usage.

- MIT in a study feels that coal's abundance and the likely availability of consumers of carbon dioxide (CO_2) and/or sequestration opportunities will allow coal usage to continue in most emission scenarios.

- In this note we have outlined the key factors we see affecting the coal market and thus the coal equities. Coal is more complicated than it looks. Mining and then turning this fossil fuel into electricity for immediate sale seems simple. However, coal miners operate in a highly regulated environment with carbon rules likely to be the next hurdle. They compete with other energy sources and in the coking coal market must zig and zag with the steel cycle. Coal itself varies in quality and location and its value is often driven by the availability of effective infrastructure.

- Commodity prices (including coal) are being lifted as two billion people in the BRIC countries are industrializing their economies. The closest equivalent to this was when the US and Europe rebuilt after the WWII, though this probably only affected about half a billion people. We estimate commodity prices have risen to levels comparable to the range seen in the 1950s through the 1970s, so far.

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See page 79 for analyst certification and important disclosures, including investment banking relationships.

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Key Investment Points

- **Although the current supply side disruptions are slowly being resolved, we believe the supply deficit is likely to prevail due to constraints on new production.** The recent supply side constraints highlight the port infrastructure failures (especially in Australia) and little spare capacity in the system to compensate for unexpected coal outage. Bad weather, constrained ports and flooded mines in Australia, widespread power outage in South Africa and heavy snowfall in China have all hit the supply hard in 2008. And now with little real capacity addition globally and with key exporters like China and Indonesia likely to hold back more of their coal for domestic consumption, we expect global coal markets to remain tight in the foreseeable future.

"The global market is going to be dictating supply/demand fundamentals in the US relative to the US economic or energy policy for next 5 years", CONSOL Energy

- **Demand stronger, supply weaker and prices higher.** With coal demand clearly outrunning the lagging supply on account of aggressive buying in Asian countries and given the limited availability of ships leading to higher freight rates, the delivered cost is substantially higher. In South Africa, a leading thermal coal exporter, industry is restricted to 90-95% of normal power consumption. In our opinion, the power shortages in South Africa are likely to take up to five years to resolve and Australia, a leading met coal exporter, is still reeling from the floods in the Bowen basin – source of 40% of world's seaborne coking coal.

Perversely, the carbon debate is probably a net positive for coal prices

- **Carbon Dioxide is here to stay but economy of coal and its abundance will, in our opinion, help overcome the carbon obstacle.** We believe it's not the emission cost but the uncertainty about the possible emission costs that is keeping the new coal fired power plants and investment in new coal mines from coming up. Perversely, the carbon debate is probably a net positive for coal prices and will continue to be so until governments commit to carbon controls that allow new investment.

- **MIT said that coal's abundance in the US and the likely availability of places to store CO_2 make coal attractive in all but the most aggressive carbon limitation scenarios.** In the MIT study the authors plead with Washington to rapidly authorize studies of carbon sequestration to speed up the development of new age emission limited power plants. Note a number of power generation regions in the US are due to fall below the 15% reserve margin in the next few years.

- **Coking coal contracts at 200% premium to 2007 levels but still, no supply reaction in sight.** The tightness in the global coal market was highlighted earlier this year when the steel companies entered into met coal contracts at prices more than 3x 2007's levels. The *force majeure* declared by the likes of Xstrata brought to light the lack of flexibility in the current coal market to compensate for any coal supply outage. While we believe that worst is over for supply side disruptions, replenishing the severely depleted coal stockpiles across the globe, will take some time. At the same time, we expect increasing demand for both steam and met coal, arising from new power plants and steel capacity planned in Asia, will provide support to coal prices going forward.

Peabody points out that US utilities are now competing with utilities globally for US coal

- **Changing fortunes of the US coal industry: Emphasis likely on coal exports now.** The US has about 247bn tons of coal reserves (2006), which is 27.1% of the world coal reserves. The US produced 1,146mn tons of coal in 2007 but only exported 59.2mt (5.2%) and imported 36.3mt (3.2%). Changing dynamics of global coal trade and vast coal reserves in the country have helped open new markets for US coal. Historically, US had been a significant swing supplier of thermal and coking coal into the north Atlantic basin but recently more than 90% of coal was consumed by the US utilities, which are now finding the competition for the home produced coal from the countries on the other side of the world and that too when shipping costs are at their peaks. We expect exports from the US to increase since it has the reserves and spare port capacity.

- **Do we have any 'Alternative'?** Both cleaner sources of energy, namely nuclear and biofuel, have their own challenges. Nuclear plants are highly capital intensive and are unlikely to be built quickly enough and in sufficient number to make a difference in the medium term. The growth of biofuel in the global energy mix looks questionable as well, amid the fear of global food crisis.

  Even though at their all time highs, the current coal prices are still attractive when compared to less reliable renewable energy sources or traditional fuel like oil or natural gas. Additionally it's difficult to see enough growth in renewables to satisfy growing power demand.

"While the developed world talks about expanding renewables in the magnitude of megawatts, the developing nations are talking of growing coal fired power capacity in gigawatts" – IEA Chief Economist

- **Things look quite different for coal this time**. Wary investors remember the prolonged periods when coal prices remained flat and even when they increased, excess of supply brought the price back down. However, the current unprecedented supply side disruption triggered by unconnected events and the ever increasing Asian demand for coal, makes us believe that we are in a multi year positive run for coal.

Conclusion

We believe the global resource industry (including the coal sector) is scaled to supply the Americas, Europe and Japan only. We believe burgeoning demand from the BRIC countries is being satisfied by higher utilization of mine assets, but this leaves little flexibility for outages. Little additional capacity and overstretched infrastructure makes the system vulnerable to outages or failures. Figure 1 shows the CRB metals index as a proxy for traded commodities. It shows how prices traded at a high plateau in the 1950s through 1970s as the western world rebuilt after WWII, then the 1970s oil shocks pushed the commodity business into what will probably be called in future the 1980/90s commodity depression. For those without an appreciation of history, current commodity prices are shocking, but what the chart below shows is that in inflation adjusted terms prices are back to the range seen when serious industrialization is underway.

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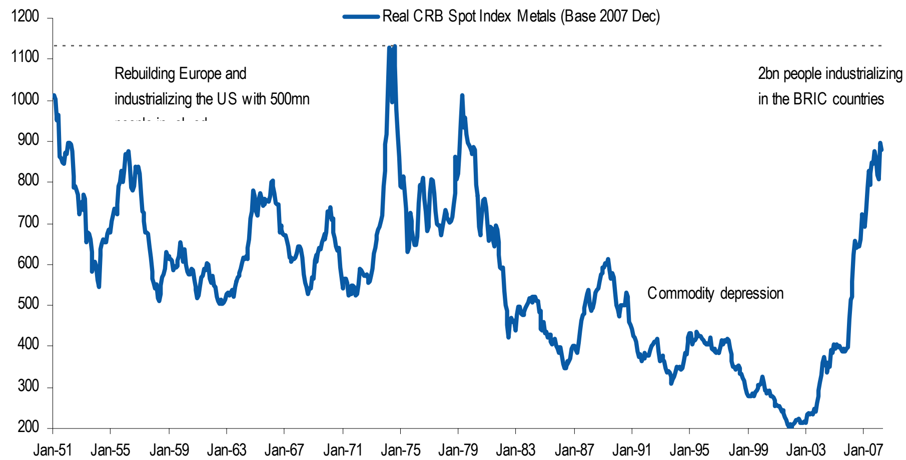
Figure 1: CRB Metals Index (in Real terms)



Source: DataStream

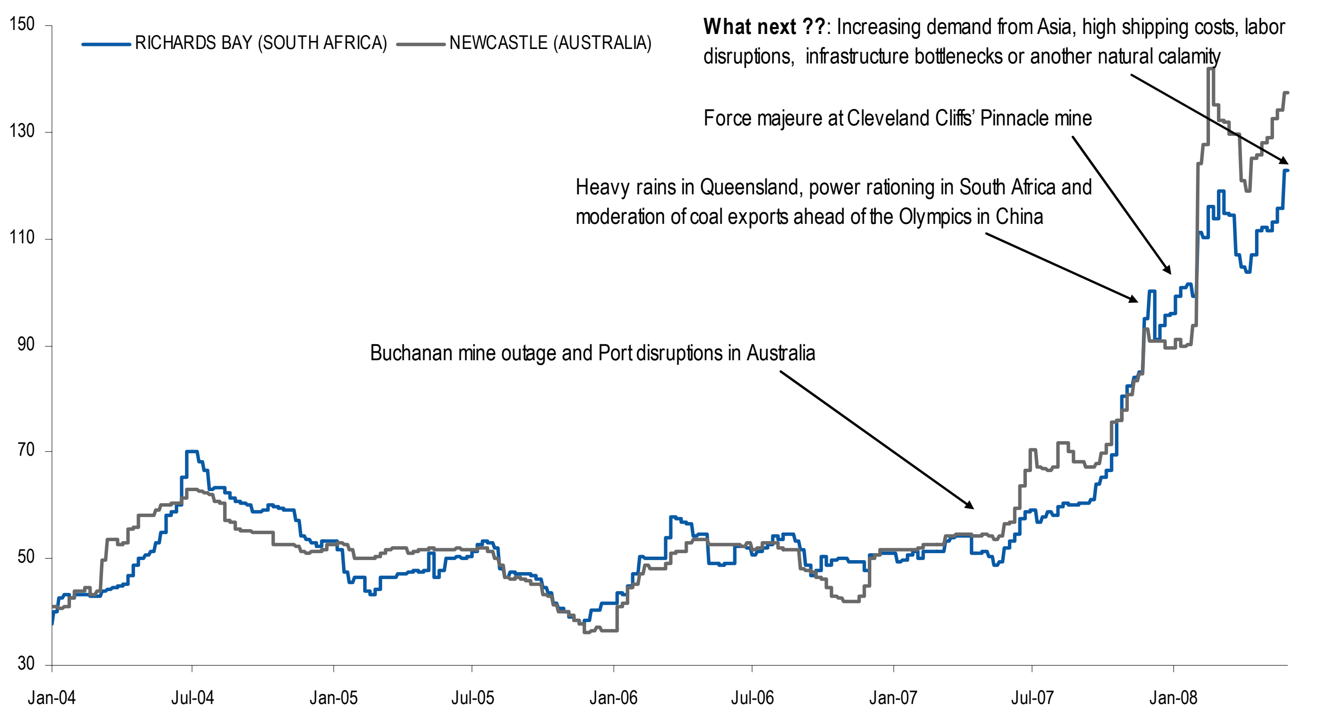
We suspect mining companies will be unwilling to build large new capacity until governments decide on carbon rules. In our view, the US is best suited to help solve this dilemma by scaling up its exports as it is the only large coal producer with large reserves and scope for increase in export capacity; however US miners will be unwilling to expand capacity without longer term contracts. Though much overused, the global coal sector seems to be well into “perfect storm” territory and this augurs well for the US coal industry for the years to come. Equity investors may see volatility as the general markets try to understand which innings of the credit crisis the markets are in.

Immediate Concern: Burning coal in hand

The perfect storm: Series of events that changed the global coal markets

In Figure 2, we have illustrated the perfect storm of supply side hits and its impact on the coal prices in the international market. Although initially US utilities stood back from the market hoping for a pullback, we understand many are beginning to contract at the current high levels. Logically, it is more likely for things to get better than worse. However, concern remains as to what could be the next disruptor – infrastructure unable to keep up pace with demand/supply dynamics, unreasonable shipping costs, labor cost pressures or disruption or another natural calamity. We have highlighted some of these points later in the report, but first let's understand the changing dynamics of world coal trade, which has opened up new frontiers for US coal.

Figure 2: What could be the next disruptor?



Source: Bloomberg and JPMorgan

World Coal Trade

The supply of coal has been constrained by national interest, as countries are holding back to their energy resources to meet growing domestic demand. For instance, Russia curtailing the supply of Natural Gas to Europe; China and Indonesia deciding to go slow on coal exports, Indian government contemplating opening up the domestic coal mining sector but initially looking to increase imports and uncertainty around carbon emission as countries are preparing for whatever carbon controls are mandated (Kyoto Protocol expires in 2012).

The weaker dollar is distorting the impact of higher commodity prices. Even though coal prices have risen substantially, the miners in key countries like Australia and South Africa are not benefiting as much due to rising input costs and limited access to export markets on account of port and rail constraints.

Key coal suppliers to the international market are Australia South Africa, Indonesia and Columbia, followed by Poland, Russia. Key export destinations are India, China and Europe, as shown below. This is followed by our forecast on International thermal and met coal prices. We see the coal markets tight for several years, the market might ease as new port capacity comes on stream in Australia in 2010/11. However given the limited opportunities for new production we still see a market which is likely to remain vulnerable to supply interruptions while the BRIC countries maintain their economic growth.

Table 1: Global Coal Imports

Million metric tonnes

	2005	2006	2007E	2008E	2009E	2010E
Japan	**180.8**	**177.0**	**186.1**	**185.1**	**187.3**	**188.6**
Met	*62.8*	*61.6*	*63.0*	*64.0*	*64.4*	*65.0*
Thermal	*118.0*	*115.4*	*123.1*	*121.1*	*122.9*	*123.6*
USA	**27.5**	**32.7**	**33.0**	**28.5**	**26.5**	**24.5**
Met	*1.7*	*1.5*	*1.4*	*1.5*	*1.5*	*1.5*
Thermal	*25.8*	*31.2*	*31.6*	*27.0*	*25.0*	*23.0*
China	**25.7**	**37.8**	**51.0**	**58.0**	**63.0**	**63.0**
Met	*7.2*	*4.7*	*6.2*	*7.0*	*8.0*	*8.0*
Thermal	*5.6*	*22.6*	*28.4*	*36.0*	*40.0*	*40.0*
Anthracite & Other	*12.9*	*10.5*	*16.4*	*15.0*	*15.0*	*15.0*
India	**44.0**	**47.7**	**54.7**	**65.0**	**75.0**	**85.0**
Met	*21.0*	*21.2*	*24.8*	*30.0*	*35.0*	*40.0*
Thermal	*23.0*	*26.5*	*29.9*	*35.0*	*40.0*	*45.0*
Total Europe	**237.5**	**251.0**	**250.4**	**258.6**	**266.1**	**276.1**
Met	*64.5*	*67.5*	*72.7*	*74.1*	*75.1*	*76.1*
Thermal	*173.0*	*183.5*	*177.7*	*184.5*	*191.0*	*200.0*
South Korea	**76.8**	**79.7**	**88.1**	**92.8**	**96.9**	**99.1**
Met	*19.0*	*20.0*	*20.3*	*20.7*	*20.9*	*21.6*
Thermal	*57.8*	*59.7*	*67.8*	*72.1*	*76.0*	*77.5*
Brazil	**14.4**	**13.6**	**15.6**	**16.4**	**18.7**	**20.6**
Met	*14.4*	*13.6*	*15.6*	*16.4*	*18.7*	*20.6*
Thermal	*na*	*na*	*na*	*na*	*na*	*na*
Russia	**22.4**	**25.7**	**23.4**	**26.2**	**28.2**	**28.2**
Met	*3.1*	*3.2*	*3.4*	*4.2*	*4.2*	*4.2*
Thermal	*19.3*	*22.5*	*20.0*	*22.0*	*24.0*	*24.0*
Others	**177.6**	**186.8**	**193.5**	**200.7**	**214.2**	**227.6**
Met	*33.5*	*30.0*	*31.7*	*34.1*	*38.0*	*40.8*
Thermal	*144.1*	*156.8*	*161.8*	*166.6*	*176.2*	*186.8*
Total Coal Imports	**806.7**	**852.0**	**895.8**	**931.3**	**975.9**	**1012.7**
Total Met Imports	*227.2*	*223.3*	*239.1*	*252.0*	*265.8*	*277.8*
Total Thermal Imports	*573.9*	*606.1*	*628.3*	*643.3*	*670.1*	*694.9*

Source: AME Historic, JPMorgan estimates.

Table 2: Global Coal Exports

Million metric tonnes

	2005	2006	2007E	2008E	2009E	2010E
Australia	**233.7**	**237.2**	**250.6**	**252.7**	**272.1**	**283.5**
Met	*124.9*	*124.4*	*137.7*	*140.7*	*152.1*	*158.5*
Thermal	*108.8*	*112.8*	*112.9*	*112.0*	*120.0*	*125.0*
USA	**45.1**	**44.8**	**52.2**	**68.0**	**77.0**	**87.0**
Met	*26.0*	*24.9*	*29.2*	*32.0*	*32.0*	*32.0*
Thermal	*19.1*	*19.9*	*23.0*	*36.0*	*45.0*	*55.0*
Canada	**28.2**	**27.4**	**30.1**	**31.8**	**33.0**	**34.9**
Met	*26.7*	*24.6*	*25.9*	*27.0*	*27.5*	*28.9*
Thermal	*1.5*	*2.8*	*4.2*	*4.8*	*5.5*	*6.0*
Russia	**78.9**	**92.1**	**98.0**	**94.0**	**95.1**	**97.5**
Met	*15.3*	*13.6*	*13.5*	*15.0*	*15.1*	*16.5*
Thermal	*63.6*	*78.5*	*84.5*	*79.0*	*80.0*	*81.0*
Kazakhstan	**25.2**	**25.8**	**23.8**	**24.1**	**25.1**	**25.6**
Met	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*
Thermal	*25.1*	*25.7*	*23.7*	*24.0*	*25.0*	*25.5*
Indonesia	**129.0**	**160.8**	**180.9**	**197.6**	**207.9**	**215.0**
Met	*5.2*	*6.1*	*6.5*	*7.6*	*9.9*	*11.0*
Thermal	*123.8*	*154.7*	*174.4*	*190.0*	*198.0*	*204.0*
China	**71.7**	**63.3**	**53.1**	**53.0**	**48.0**	**48.0**
Met	*5.3*	*4.4*	*5.3*	*5.0*	*5.0*	*5.0*
Thermal	*60.8*	*53.7*	*45.3*	*46.0*	*42.0*	*42.0*
Anthracite & Other	*5.6*	*5.2*	*2.5*	*2.0*	*1.0*	*1.0*
Colombia	**55.4**	**60.1**	**65.8**	**72.0**	**79.0**	**83.5**
Met	*1.9*	*2.3*	*2.8*	*3.0*	*3.0*	*3.5*
Thermal	*53.5*	*57.8*	*63.0*	*69.0*	*76.0*	*80.0*
South Africa	**75.4**	**67.8**	**65.5**	**66.5**	**73.5**	**80.7**
Met	*2.6*	*2.4*	*2.3*	*2.5*	*2.5*	*2.7*
Thermal	*72.8*	*65.4*	*63.2*	*64.0*	*71.0*	*78.0*
Poland	**20.8**	**20.2**	**12.7**	**11.9**	**11.2**	**10.6**
Met	*3.2*	*3.6*	*2.2*	*2.4*	*2.2*	*2.1*
Thermal	*17.6*	*16.6*	*10.5*	*9.5*	*9.0*	*8.5*
Vietnam	**14.0**	**24.1**	**32.2**	**17.3**	**5.3**	**3.5**
Met	*0.9*	*1.1*	*1.3*	*1.3*	*1.3*	*1.5*
Thermal (Anthracite)	*13.1*	*23.0*	*30.9*	*16.0*	*4.0*	*2.0*
Others	**29.7**	**28.9**	**30.5**	**35.7**	**38.9**	**41.9**
Met	*10.1*	*11.9*	*13.2*	*16.3*	*17.3*	*18.5*
Thermal	*19.6*	*17.0*	*17.3*	*19.4*	*21.6*	*23.4*
Total Coal Exports	**807.1**	**852.5**	**895.4**	**924.6**	**966.1**	**1011.7**
Total Met Exports	*222.2*	*219.4*	*240.0*	*252.9*	*268.0*	*280.3*
Total Thermal Exports	*524.1*	*579.4*	*610.1*	*625.7*	*656.1*	*689.4*
TOTAL COAL DEFICIT	**-0.4**	**-0.5**	**0.4**	**6.7**	**9.8**	**1.0**
China Net Exports	**46.0**	**25.5**	**2.1**	**-5.0**	**-15.0**	**-15.0**
USA Net Exports	**17.6**	**12.1**	**19.2**	**39.5**	**50.5**	**62.5**

Source: AME Historic, JPMorgan estimates.

Table 3: International Coal Price Forecasts

US$ per metric tonne

	2007	2008E	2009E	2010E	2011E	Long Term
Hard Coking	**98.4**	**300**	**300**	**250**	**175**	**100**
Semi-soft Coking	**62.0**	**250**	**200**	**150**	**120**	**80**
Thermal	**55.7**	**125**	**150**	**125**	**100**	**70**

Source: JPMorgan estimates.

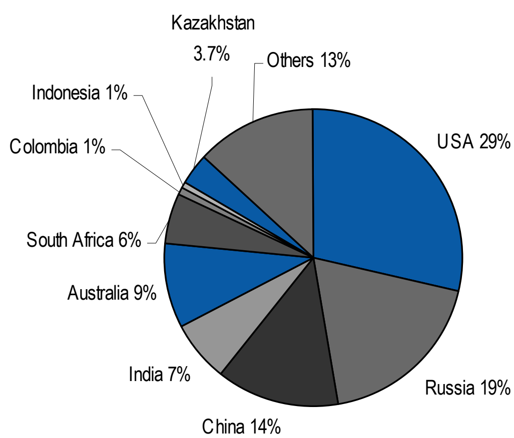
Note: Long Term Real price in 2008 nominal dollars. Prices stated above are FOB Australia. FOB prices in the Atlantic basin may differ. Pricing is for financial year starting April 1.

Where would the additional supply come from?

In the short term we expect additional coal supply to come from the US, Indonesia and Columbia , though US exports can only grow at the rate the US power generating utilities are able to switch from the more exportable Appalachian to PRB coal. Once there is more clarity on BRIC country coal needs and carbon legislation, it is likely that the emerging coal fields in Mongolia and Mozambique will be developed, but this is a long term project. In the medium term Australia is likely to maintain its position as the world's largest exporter to the seaborne coal trade and Indian production for domestic consumption is likely to grow as the effect of the nationalization of domestic reserves is reversed.

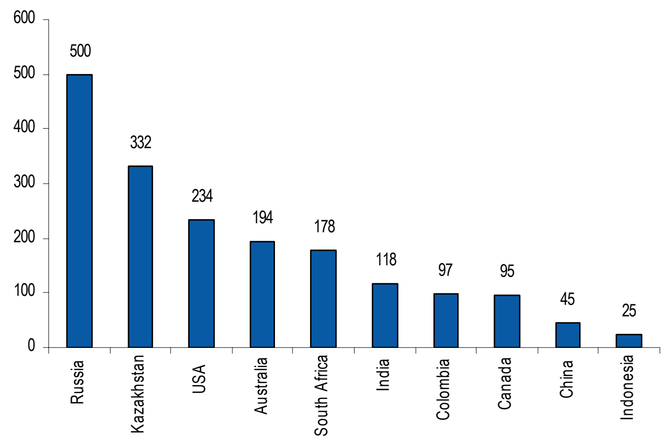
Figure 3 below shows the country wise breakdown of coal reserves and Figure 4, the number of years this reserve is expected to last at the current rate of production. Note that these figures can not be considered in isolation as the ability to consume the coal depends on the degree of economic activity in the country and the ability to export could be limited by the political will, infrastructure constraints and geographical location. Russia and the US seem to be the supply wild-cards in the following figures.

Figure 3: Global production reserve



Source: Statistical Review of World Energy 2008 - BP Global

Figure 4: Years of coal in the ground (based on current production)



Source: Statistical Review of World Energy 2008 - BP Global

Infrastructure view: It's not JUST coal availability but the ability to move and load the coal

Figure 5 shows various infrastructure constraints and development for key countries. If the freight and coal movement infrastructure improves by 2010-2012, as expected, we believe the next level of issues would likely come up at the mining front in terms of rising strip ratio at older mines. In our opinion, similar to what has happened in the copper industry, labor unrest and disruptions could become another issue as global coal pricing continues to rise.

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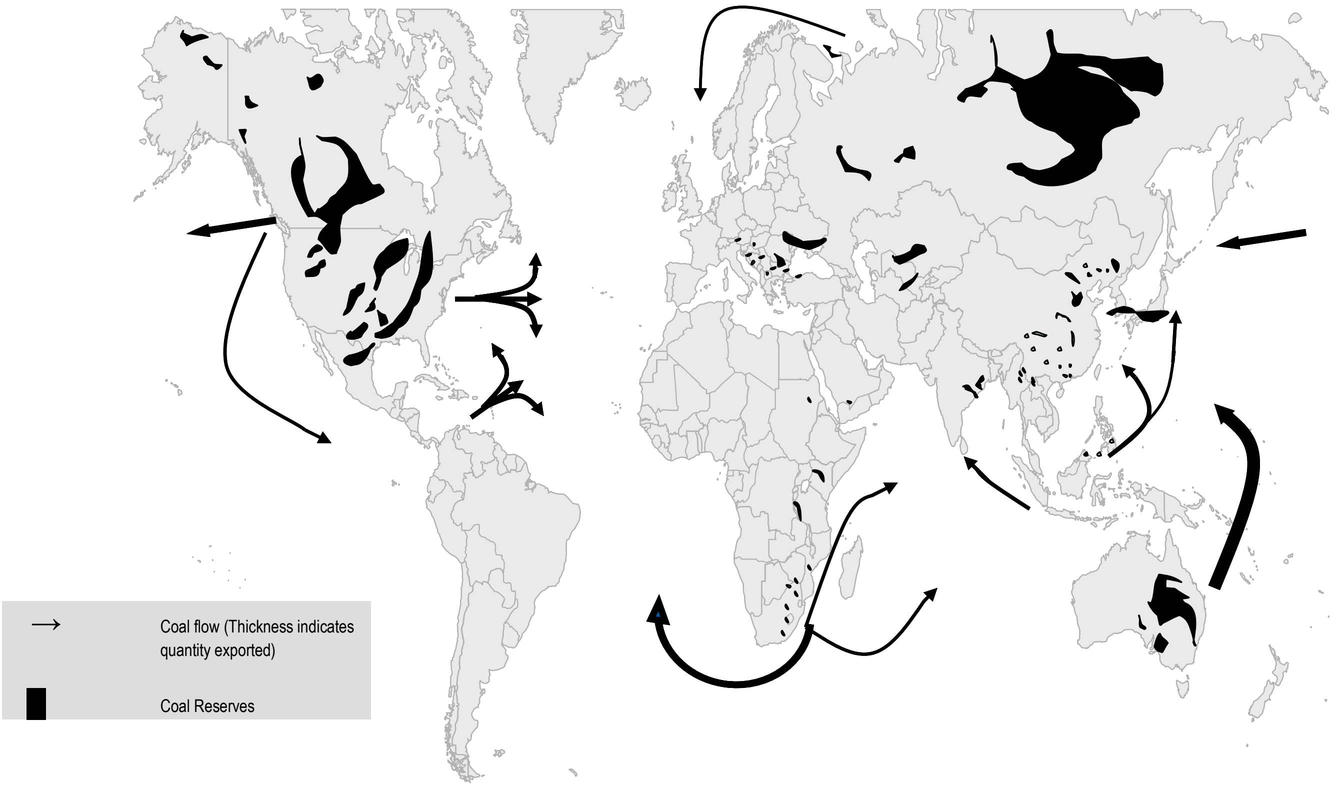
Figure 5: Glimpse of global infrastructure constraints/developments

Source: JPMorgan

Figure 6: World Coal Flow



Source: JPMorgan

Thus, we would reiterate that US remains the only country with spare installed capacity and most of the necessary infrastructure to participate in the stronger global coal market. Of note, Table 4 shows that there is unutilized export capacities at the North American ports. In the sections to follow, we turn our focus on the US coal industry in the light of its broadened role in world coal trade.

Table 4: North America export capabilities

Million Short Tons

State	Port	2007	Estimated Theoretical Capacity	Estimated Practical Capacity
Maryland	Port of Baltimore (CNX Terminal)	5	12	12
	Chesapeake	5	4	4
Virginia	Lamberts Point	1	20	10
	Pier IX	10	18	10
	DTA	12	10	12
Mississippi	Gulf Port (barge in)		40	20
	Gulf Port (rail in)	5	40	20
Louisiana	International Marine Terminal	6.5	18	10
	TECO Electrocoal	10	25	15
	IC Marine	3.5	4	4
Alabama	McDuffie	9	9	9
Sub-total USA		**67**	**200**	**126**
British Columbia	Vancouver: Westshore	20	20	20
	Vancouver: Neptune	4.5	8	8
	Prince Rupert	5.5	16	10
Total USA & Canada		**97**	**244**	**164**

Source: JPMorgan

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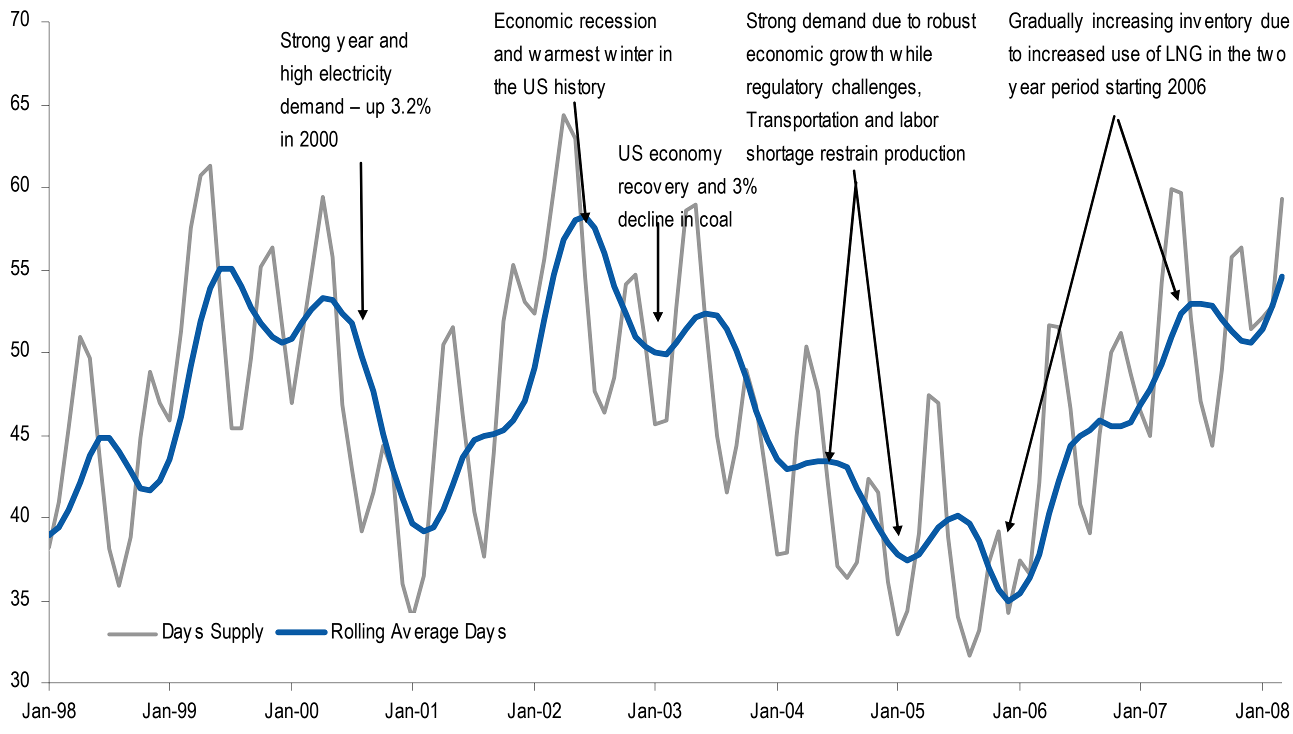
Short to Medium Term Outlook

Utility inventory seems to have peaked

Coal inventory at power generators protect the operators and their customers from surprises such as an extreme summer or an extreme winter. Rising coal inventories dampen coal pricing and demand. As can be seen in Figure 7, the coal inventory is at close to peak levels. Coal inventories at the utilities situated in the Eastern region are low compared to their Western counterparts. And this is mainly due to the high demand for Appalachian coal in the international market and difficulty faced by eastern utilities in replacing Central Appalachian (CAPP) coal with PRB coal. In the first quarter 2008 earnings call CONSOL Energy stated that the utilities are more concerned about locking in volumes with the reliability of supply, as the coal miners now weigh longer term relationship with domestic utilities vis-à-vis higher margin coal exports.

Figure 7: Utility coal inventory



Source: Energy Information Administration and JPMorgan

Coking coal is to remain king for sometime now

Coking coal prices are running at their all time highs driven by strong steel demand and the supply issues in Australia. A limit on Australian coal exports (the major coking coal exporter) has put upward pressure on the price of premium coal. We expect this upward pressure to continue in 2008 and 2009. The International Iron and Steel Institute expects the steel demand to grow by 13% in the next 2 years. Hence, Central Appalachian mines that have the capacity to produce premium coking coal should remain busy in 2008/2009. Although most coking coal business is done in the annual contracts; one-off contracts for smaller tonnages are being signed at higher levels than the $305/t contract level for 2008.

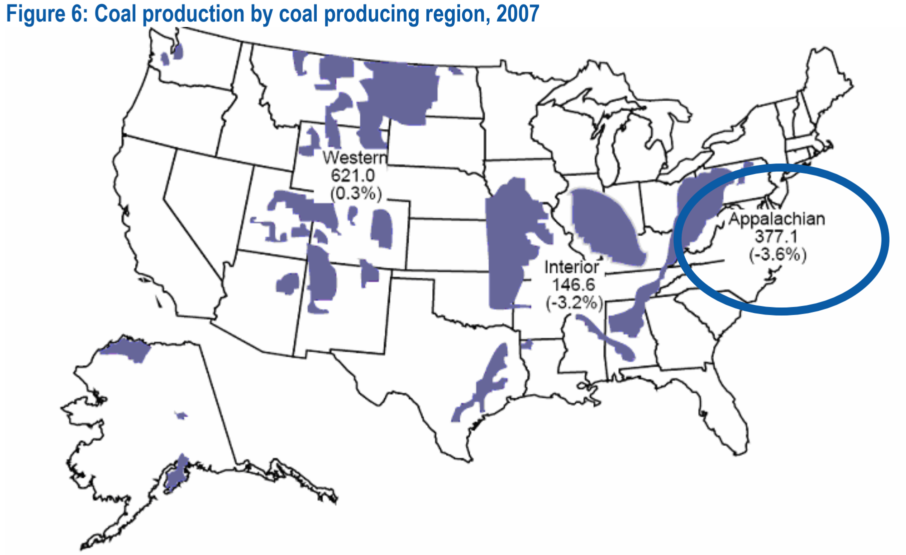
All time high shipping rates

The Baltic Dry Index has reached its historic highs driven by unprecedented Chinese demand for iron ore for making steel. This index tracks the shipping costs for commodities. Of note, China now makes more than a third of global steel. For coal, the demand supply equation looks so unbalanced that the Asian countries like India have still continued to import from the US, uninhibited by the exorbitant shipping rates. Even if supply eases later this year, high shipping rates will favor short hauls from the US to Europe.

CAPP question marks over permits

While the demand for high quality Appalachian coal has increased dramatically, production in CAPP has been subdued due to declining reserves, tougher safety rules and permitting challenges against mountaintop removal mining. The ongoing lawsuits, mainly in the CAPP region, concerning 404 permits (federal permits for mining) have slowed down the pace of issuing new permits and production expansion in the region.

Figure 6: Coal production by coal producing region, 2007



Source: Energy Information Administration

Note: Percentage denotes change year-over-year

Can utilities use PRB coal rather than CAPP coal?

Power utilities are the prime users of domestic US coal, consuming nearly 93% of total coal consumed in the US and thus historically in case of any demand supply mismatch, coal companies would adjust their production to fill up the gap. The conundrum for the utilities is that their coal fired power plants were designed to use CAPP coal and the plant operators prefer to use this material due to its high heat value (12,500btu/lb compared to 8,800btu/lb of PRB coal) and low ash content and better ash qualities.

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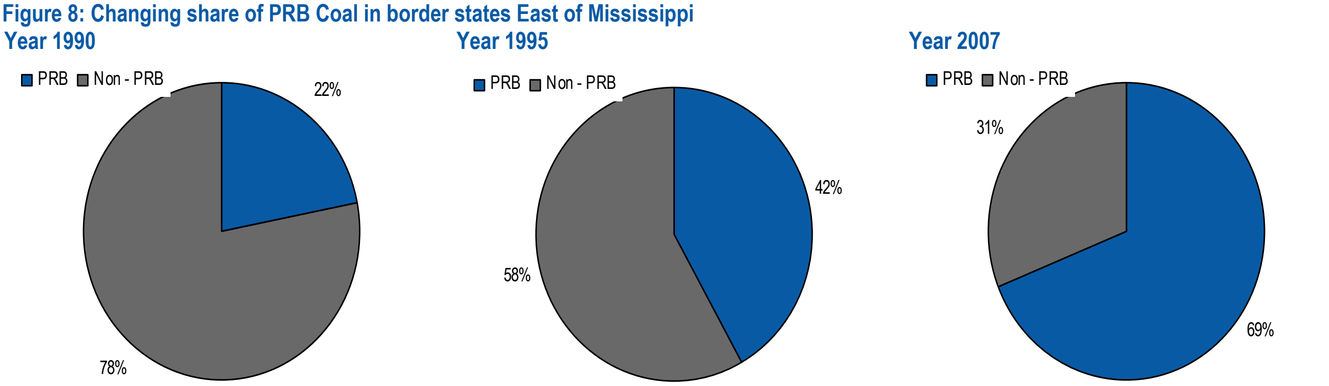
Until about 3-4 years ago, the utilities in the East were primarily burning the Appalachian coal. Now with CAPP coal reserves running down, prices reaching all time highs and many utilities installing scrubbers, they have the flexibility to switch away from the CAPP coal. The earlier plan was to use more higher sulfur coal from the Northern Appalachian (NAPP) and/or Illinois. However the economics of PRB coal is now more attractive as NAPP coal prices have advanced. While the Eastern utilities are a little apprehensive about switching over completely to the PRB coal as their boilers are designed to burn the Appalachian coal, the utilities have started blending PRB with the Appalachian coal and continue to do test burns in order to increase the PRB proportion. Apart from the utilities' reluctance to switch over to PRB quickly, another factor that would limit the pace of the switchover is, in our opinion, the availability of the spare rail capacity.

Figure 8 shows that the PRB coal has gained significant market share in border states East of Mississippi river in last 17 years.

Figure 8: Changing share of PRB Coal in border states East of Mississippi



Source: Arch Coal

PRB coal producers are unsurprisingly promoting more use of this coal. However, we suspect that the level (and rate) of substitution of PRB coal for CAPP coal as exports of this material increase, is likely to seriously stretch the abilities of the utilities to convert and that of rails to handle the extra tons. The high prices the utilities are willing to pay for CAPP coal seems to support this concern. Hence we believe that this transition will be the critical factor in the growth of US coal exports and is likely to limit growth to about 10mt pa.

Figure 9 shows that most mid-western utilities have already switched to PRB coal. The question now is how soon will the far eastern utilities switch?

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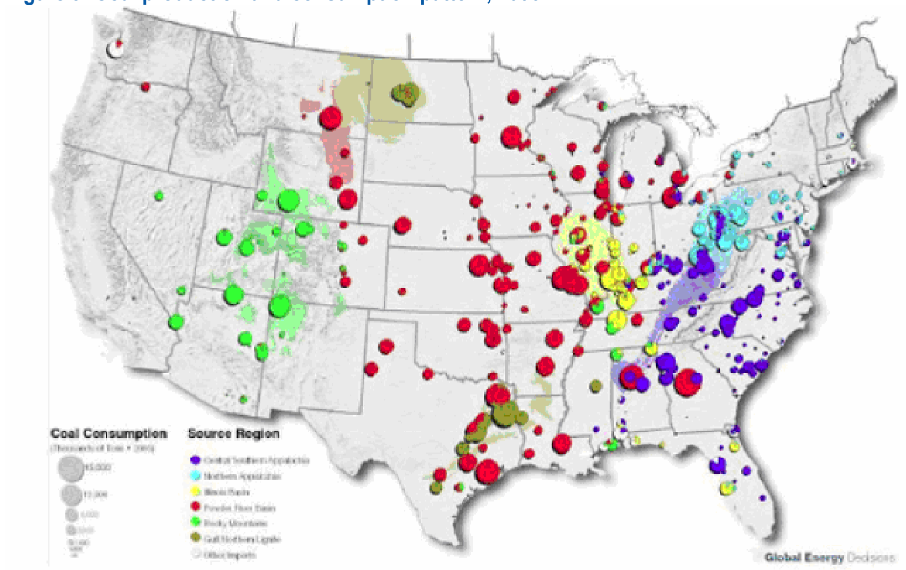
Figure 9: Coal production and consumption pattern, 2006



Source: Rio Tinto Energy

In our view, the transportation capacity and the technical ease (or difficulty) in switching from CAPP coal to PRB coal holds the key instead of the prices of coal. Full implementation of clean air standards (since January 1, 2000) requires all power generators to reduce emissions. The choice facing power generators today is whether to use low-sulfur, low-BTU PRB coal or to invest in a scrubber and burn higher sulfur and higher BTU NAPP or Illinois coal. With the help of scrubbers, utilities can reengineer their boilers to use multiple fuels – higher sulfur NAPP coal and higher ash PRB coal. 2008 is the year when maximum incremental capacity is going to get scrubbed till date and hence we expect to see more consumption of PRB coal to east.

Reducing dependence on imported gas

Natural gas is the cleanest of the fossil fuels, and natural gas co-gen plants were envisaged as the clean solution to the United States' growing electricity needs with planned increase in LNG imports to replace some of the unscrubbed coal fired generation. These highly efficient co-gen plants were economically competitive compared to the coal plants until gas prices rose in 2006. Gas plants were also much easier to permit and finance. Now even though the economics of gas plants has deteriorated, the utilities have built 302GW of natural gas capacity and just 1GW of coal capacity in the five year period from 2001 to 2006. There is spare capacity in natural gas generating capacity as shown in Figure 10.

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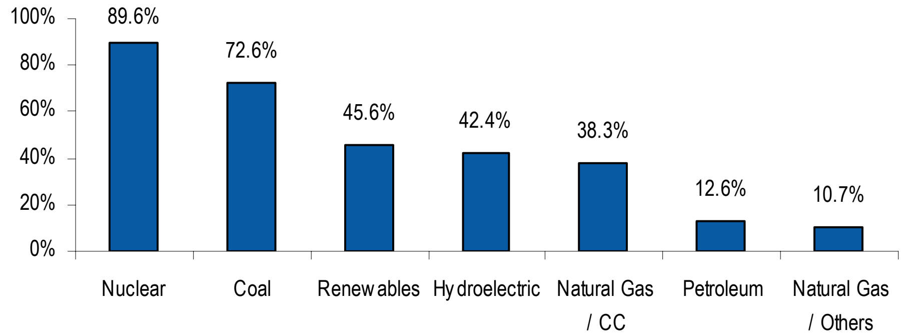
Figure 10: Utilization rates for different power generators



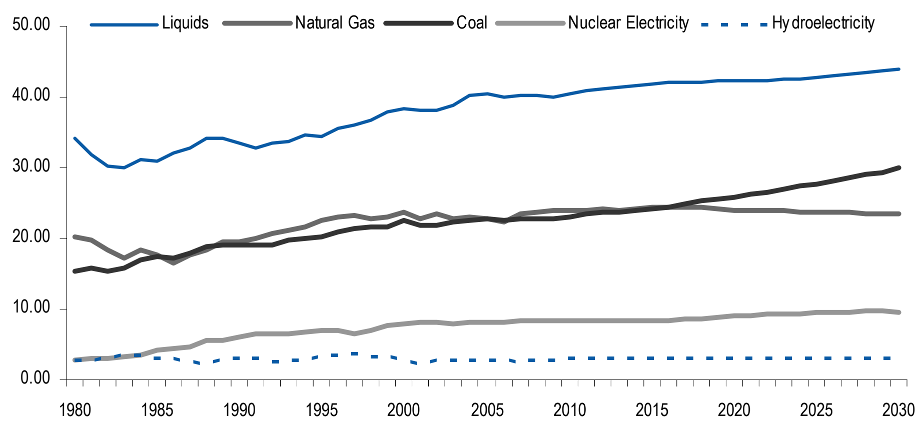
Source: Energy Information Administration

The plan to use more imported natural gas made sense when Europe's natural gas needs were to be supplied from a supportive Russia and before economic growth (and power demand) rates grew in the BRIC countries. After Russia imposed its political will on Ukraine by restricting gas supplies, rising dependence on Russian gas imports looked less attractive to Western Europe. China is also becoming a growing buyer of LNG for its needs. Consequently, we suspect that growing supplies of imported LNG can no longer be relied upon by US utilities. After five years of strong uptrend, US imports of LNG have fallen substantially in 2008 so far.

This is further illustrated in Figure 11, wherein as per the Annual Energy Outlook 2008, the electricity generation from natural gas fired power plants increases sharply till 2008, but in the longer term, remains stable as other fuel types displace gas fired generation, owning to lower economic growth and higher delivered prices on account of greater competition for supplies globally.

Figure 11: Energy Consumption by fuel, 1980 - 2030

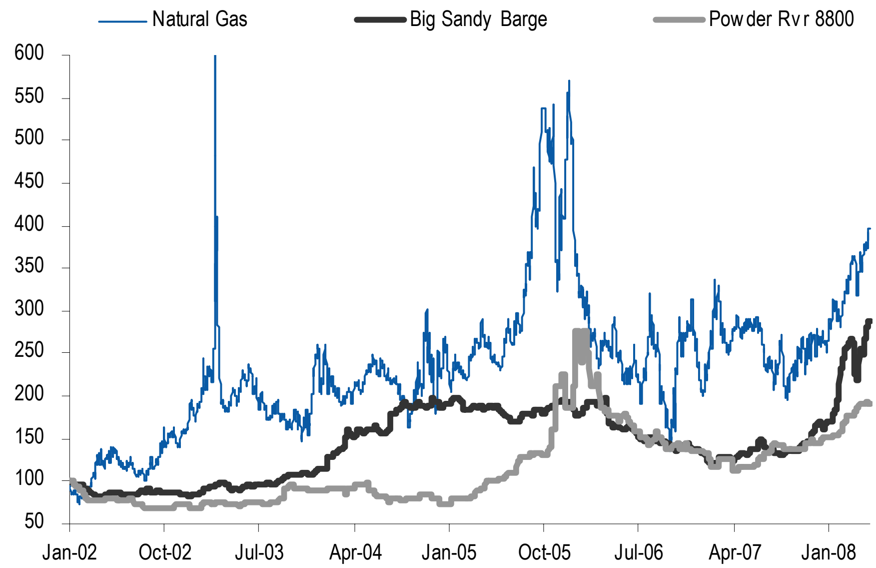
Quadrillion Btu



Source: Energy Information Administration

We explain the correlation between coal and LNG prices in Figure 12. Coal provides the base load for power utilities and peak demand is usually met by LNG. Since power generating capacity is turned on sequentially with the lowest cost source first, this typically means that nuclear and hydro capacity is used most of the time when it's available. Coal plants are next to be used with natural gas co-gen plant. The price paid to all power suppliers is that of the highest cost power supplier. Hence the higher the cost of gas or the more hours that gas plants are used, the better the prices paid to the other suppliers including the coal based power generators.

Figure 12: Indexed PRB coal price Vs. Natural gas price



Source: Bloomberg

Boosting the grid: An advantage of yesterday, a necessity of today

Coal-by-wire is a term the PRB producers have developed to describe power that is generated in the west using PRB coal, and is then transmitted eastwards to the major demand centers

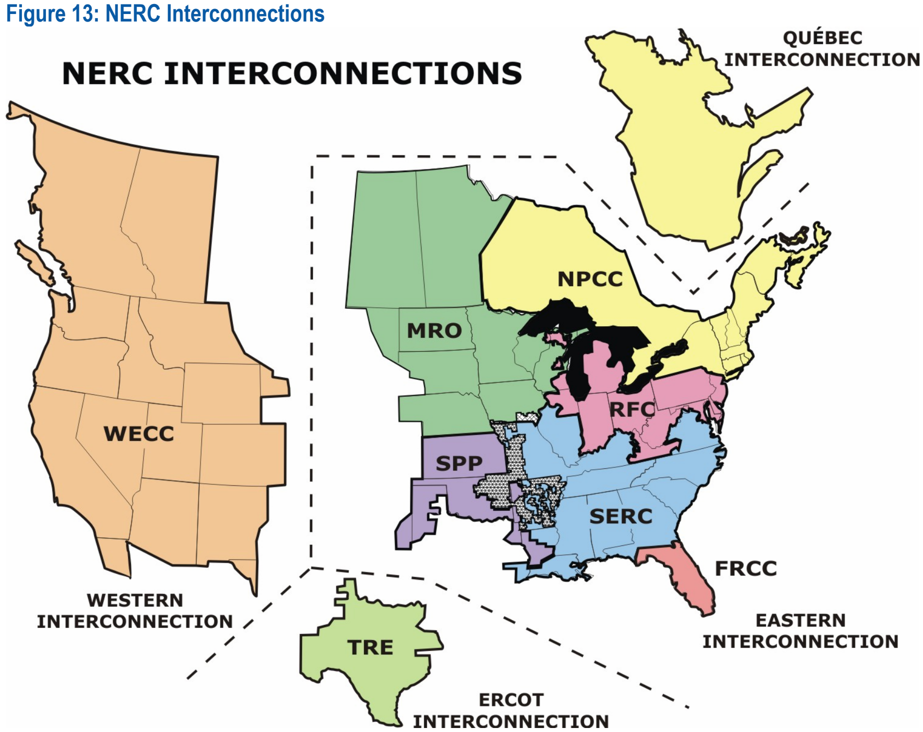
The US power grid has developed in a piece-meal fashion and is still managed by both state and federal authorities. Split authority and the threat to investment returns due to deregulation have restricted investment in the power distribution network in recent years. Improved connections between regional grids are needed to allow the current fleet of coal fired power plants to be used more efficiently and raise their utilization. In particular, better east-west power connections could help deliver coal-by-wire. Energy from the coal rich west could be transferred to the bigger eastern and Midwest power users by electrical cable, unfortunately we understand that at peak times there is little capacity in the existing grid. New coal fired power plants could be set up as mine-mouth plants in coal mining areas of PRB. This would have the added advantage of having more opportunities to sequester CO_2 in older oil fields than are available in the eastern US.

"America has long had one of the world's most reliable power systems. Without investment, that could soon change", Arch Coal

Interestingly, the North American power grid is broken into a number of smaller units with limited connections. A lack of investment in the last few decades has left some parts of the system stretched. Government generally agrees that investment in the grid is important but given that jurisdiction over the grid is split between state and federal authorities with different goals, decision making is difficult.

The generation and transmission components in the electricity flow constitute the Bulk Power System. North American Electric Reliability Corporation (NERC), a self-regulatory organization, is responsible for ensuring the reliability and security of the bulk power system in North America. For this, the organization relies on expertise of industry participants.

Figure 13: NERC Interconnections



Source: North American Electric Reliability Corporation

Clean coal

The Clean Air Act of 1990 required that sulfur and particulate emissions be reduced. This requirement was managed using the cap and trade route. To control sulfur, utilities were faced with a choice of learning how to burn the low sulfur, but low BTU and high moisture PRB coal from Wyoming, or to spend $200m to $300m per power unit on sulfur scrubbers. In most cases the utilities decided to use more PRB coal.

Low sulfur coal

Before the Clean Air Act (in the 1970s) only about 70mt pa of the PRB coal was produced. The Clean Air Act and uncertainty on how large investments (like scrubbers) would be paid for, made the economics of PRB coal very attractive and production has grown by CAGR of 5.4% to 497mt in 2007.

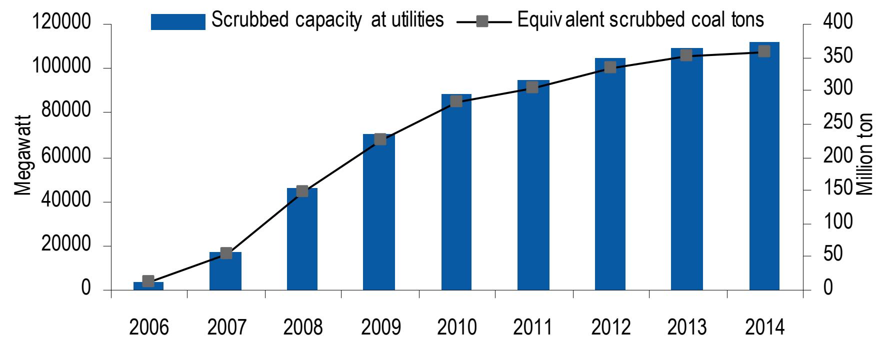
However the next phase of emission controls is tougher and requires the addition of more scrubbers to power plants to further reduce sulfur and also capture mercury. This will enable scrubber equipped power plants to use the higher sulfur coals that they used before the Clean Air Acts. The new rules are likely to lead to somewhat slower growth in production from the PRB with bigger supplies from the NAPP and

Illinois coal fields which are typically closer to the utilities' power plants but which had been out of favor with utilities trying to control sulfur emissions. However, the PRB region's very large coal reserves means it must remain a key energy source for the US.

Scrubbers

The Clean Air Act requires reduction of sulfur dioxide emissions from electric power generation plants to meet industry wide limits by using a cap-and-trade system between the states. With SO_2 emission allowance tightening to 0.4 lbs/mmBTU in 2015 from the current 1.2 lbs/mmBTU, the capacity scrubbed at utilities is likely to plateau around 2014, as can be seen in Figure 14.

Figure 14: Cumulative capacity scrubbed and corresponding tons of coal at the power plant



Source: SNL Financial

Note: Assumes 11,500 Btu coal, 80% plant factor, 10,500 heat rate

Carbon Control

Coal is primarily carbon and this is released as carbon dioxide when burned. Planned carbon regulation is likely to put a price on this carbon, like the programs in Europe. It's generally agreed that carbon emissions from fossil fuel usage have accumulated in the atmosphere. On the basis that use of coal as a fuel for power generation is a large emitter of carbon dioxide, and coal power plants are relatively good candidates for carbon capture; coal has become a target for parties seeking to reduce emissions.

Unfortunately coal is the single largest fuel source for electrical power generation; hence we don't believe replacing coal is a practical option for carbon control. What seems more likely is for carbon sequestration options to be investigated together with:

- Conservation to consume less energy
- Expanded nuclear programs to generate base load power eventually
- Increased use of renewable power

Transportation: No free home delivery

Effective transportation is very much crucial for coal especially when the transportation costs can form half or more of the delivered cost e.g. for PRB coal getting shipped to the South East, the rail transportation costs are about 70% of the delivered cost. Rising energy prices are elevating rail and ship transport and recent strong demand from Asian countries has led to record shipping freight rates owing to the limited availability of vessels.

To transport coal from mine to power plants, some coal producers have a choice of rail or barge transport, and road haulage can be effective over short distances. In the East, CSX and Norfolk Southern manage the railroads that haul the coal and in the West (including the PRB) it is Union Pacific and BNSF.

Users of rail transport are wary of further system consolidation that could limit competition. However, because consolidation is enhancing the financial strength of the rail companies, it is also leading to some innovation. For example, more efficient aluminum rail cars have been introduced and mixed rail barge routes are being used to minimize transportation costs.

In the eastern US, transport competition is still significant and contributes to lower cost. In the west, producers in the southern PRB typically have a choice of two rail companies whereas northern PRB producers are typically "captive shippers", able to access only the BNSF's rail system.

Could labor disruption be the next supply shock?

With mines across the globe running at a very high utilization rates, we believe labor disruption could deliver the next supply shock. Given the pressure on the resource industry from the growth in China and India, shortage of skilled personnel would likely give labor more leverage. Looking at the impact of organized labor after the copper price spike in 2005, we wonder if managements would be pressurized to part with a bigger slice of the pie, once contracts are signed at a higher price. Major US eastern union contracts run till 2011 perhaps protecting major miners and thus the labor pressure may be seen outside the US, benefiting the US miners.

Consolidation likely to be slow paced

Coal industry consolidation started in the 1960s and 1970s, when new safety and reclamation rules put extra cost pressures on marginal producers. This was followed in the 1980s by price pressure, which forced producers to seek economies of scale.

The top ten producers represented 64.4% of total coal production in 2006, compared with only 48% twelve years ago. Table 5 shows the composition of the top ten, then and now.

Table 5: Consolidation in the coal industry

U.S. Coal Production – 1994			U.S. Coal Production – 2006		
Company	MMTons	% of total	Company	MMTons	% of total
Peabody Holding Co.	119.3	11.5%	Peabody Coal Co.	208.0	17.9%
Cyprus AMAX Minerals	76.2	7.4%	Rio Tinto Energy America	134.4	11.6%
Consol Energy Inc.	70.5	6.8%	Arch Coal, Inc.	129.5	11.1%
Kennecott Energy Co.	44.8	4.3%	Foundation Coal Corp.	69.3	6.0%
Zeigler Coal Holding Co.	40.7	3.9%	CONSOL Energy, Inc.	63.2	5.4%
ARCO Coal Co.	38.4	3.7%	A.T. Massey Coal Co.	38.3	3.3%
Montana Power Co.	30.2	2.9%	North American Coal.	31.2	2.7%
North American Coal.	27.2	2.6%	Westmoreland Coal Co.	29.4	2.5%
Texas Utilities Co.	25.5	2.5%	Alliance Coal, LLC	23.2	2.0%
Kerr-McGee Coal Corp.	24.8	2.4%	Peter Kiewit Sons, Inc.	22.7	2.0%
Total Top 10	**497.6**	**48.1%**	**Total Top 10**	**749.2**	**64.4%**

Source: Energy Information Administration

Note: Energy Information Administration is expected to publish company wise production data for 2007 in August 2008.

In October 2006, Peabody acquired Excel Coal, an independent coal company in Australia, for a total acquisition price of approximately US$1.34 billion plus assumed debt of approximately US$190 million, making it the only major US coal company having resource base outside of US.

As per Australian Financial Review, the interest shown by Peabody Energy and Anglo Coal in purchasing coal companies in the flood stricken Bowen Basin in Australia may start a new wave of consolidation in the industry.

Recently, steelmaker ArcelorMittal bought 14.9% stake in Queensland based Macarthur Coal to vertically integrate its coking coal supply. Xstrata has been aggressively looking at buying smaller coal producers or their marketing agreements, a trend which is more likely to grow in the international markets, in our view.

Consolidation has contributed to more supply discipline in the US and this coupled with a rising export market for surplus domestic coal promises to improve the quality of coal company earnings. In our opinion, consolidation on a large scale is highly unlikely in US due to anti-trust regulations. Arch Coal had a tough time convincing the Federal Trade Commission in 2004 when it acquired Triton Coal. However, we do expect to see consolidation in the form of acquisition of smaller CAPP mines and unlisted companies by the majors or mid-sized producers. Even this type of consolidation will be slow due to the recent run up in coal prices as the valuations are running rich. Massey Energy recently pointed out that the strength in pricing has led to reduced opportunities for consolidation in the near term.

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Long term (more than 36 months)

Infrastructure struggling to keep pace

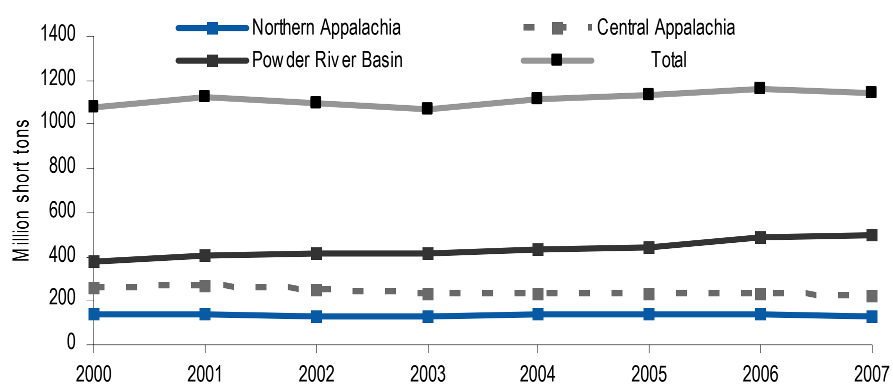
We believe installed coal industry infrastructure is insufficient for the growing needs of the BRIC countries. The port of Dalrymple bay is disappointing the Australian coal exporters. We believe that it would take another 3 to 4 years for the Australian coal producers to catch up with the international coal demand. South Africa, on the other hand, has the port capacity to export coal; however the movement of coal to the ports is constrained by the rail capacity. The tidal wave of new ship capacity is being delayed, thus freight rates look set to remain higher for longer.

We see infrastructure constraints limiting supplies for several years, this should support international prices and international demand for US coal exports.

Coal availability

With 234 years of reserves, US is the world's second largest coal producer after China and has the largest reserves. Coal's abundance keeps costs relatively low except in the case of mature CAPP coal fields. And thus, a critical difference between coal and any other form of energy is that coal is readily available. Unlike oil and natural gas, (where its reserve share is now small) US has more than 27% of global coal reserves. World coal reserves are large, with around 164 years of supply (when used at current rates), compared with only 63.3 years for natural gas and 48 years for oil. Of note, China, the largest coal producer in the world has only 48 years of coal reserves. Considering the huge coal reserves in the US, the production growth had been sluggish, as can be seen in Figure 15 and we believe it could take several years before new capacity is built, as producers are yet to commit capital based on these higher prices.

Figure 15: Coal production by region (2000 – 2007)
Million short tons



Source: Energy Information Administration

Sequestration: So close but so far

Carbon sequestration can broadly be understood as a clean coal methodology which captures and stores carbon dioxide in underground reservoirs away from the atmosphere and is thus one of the most promising Clean Coal Technology (CCT) to reduce the buildup of greenhouse gases. The carbon dioxide thus separated can also be captured, stored and transported for other industrial uses. Just as any CCT, sequestration requires advancement in technologies and test programs. The government over the past few years has shown financial support to the research as Office of Fuel Energy developed an array of technologies to reduce the level of greenhouse gases.

However, as a major setback to the clean coal implementation, the government recently withdrew its support from one of the coal gasification project, which had sequestration as a test program in Illinois. This is not all. New York Times reports that, utility projects in states like Florida, Minnesota, Ohio, Washington, West Virginia have also been canceled.

The progress around sequestration seems slow paced as years of concentrated governmental support will now mostly be substituted by distributed efforts of private companies undertaking small scale demonstrating projects. An MIT study argues that sequestration studies should be accelerated.

This is now a catch 22 situation for CCT development.

Firstly, there is no clear indication on carbon policy and now government is evaluating whether to put taxpayers' money in supporting CCT development or transferring the project risk to utilities opening a new plant by providing them subsidies for developing CCT.

The longer a set of rules on carbon controls is delayed, the more coal usage post 2010 will be hurt, and US dependence on imported natural gas will increase.

Earlier this year, the US government turned its back on the much promised FutureGen project, which aimed to design, build and operate near zero emission coal plants, after cost escalation of almost 100%. In an attempt to revive the project, a restructured FutureGen draft as a cost-shared collaboration between the government and industry was proposed on May 7, 2008. Various private companies have sensed an opportunity and come forward to develop technologies through combined efforts. We, however see the commercialization of the complicated technologies required and associated costs as the key challenge to developing a CCT until the carbon policy is clearly indicated.

Regardless of this, we are confident that even with the extra costs of sequestration (if it materializes) the relative abundance and low costs of coal mean it will remain a key energy source for the future. US coal producers sell 93% of their product to the utility power producers. We are hopeful that progress with carbon sequestration will allow coal users to satisfy requirements for carbon capture, while remaining competitive with other increasingly sought after fuels.

Coal-to-liquids (CTL)

CTL represents another emerging market for coal. We refer to CTL as an old/new technology as it may be new to the US, but it is already being successfully used outside the US. These capital intensive plants have typically been developed with state help in a "failure is not an option" environment. The first use was to help fuel the German war machine in WW-II and more recently during the sanctions era in South Africa. We believe the technology is well suited to countries with large coal reserves but limited reserves of liquid fuels. While the building blocks of coal-to-liquids technology are well known and are being promoted by a number of companies, Sasol is the company with the most experience with the technology and it supplies +/-30% of South Africa's liquid fuel demand from its plants.

We have detailed in Table 6, many of the other new entrants into the coal gasification field. They use different versions of the technology, but have yet to make it work commercially.

Table 6: Various CTL techniques being planned in the US

Company	Technology
DKRW	Rentech's Technology
Headwaters (HW)	Patented GTL/CTL Fischer-Tropsch using patented iron-based catalyst
Rentech (RTK)	Patented GTL/CTL Fischer-Tropsch using patented iron-based catalyst
Sasol (SSL)	Various in-house Fischer-Tropsch technologies
Syntroleum (SYNM)	Patented GTL Fischer-Tropsch using patented cobalt catalyst
WMPI	Sasol's technology

Source: JPMorgan

Coal-to-liquids (CTL) also requires clarification of carbon sequestration rules and longer price protection on prices to support the large investment (together with the significant development risk). There are a number of small coal-to-liquids projects underway already which typically have plans to sell their CO_2 production. The coal miners and the EIA expects that CTL will become an increasingly important demand category after 2010, and will offer a strategic alternative to imported liquid fuels. Annual Energy Outlook 2008 sees some of the investments being diverted from CTL to BTL (Biomass to liquids) plants post 2020.

Coal to multiple products Poly-generation

Polygen with power production is a neat solution to the tight natural gas market as an equivalent "peaker"

We continue to like the poly-generation route on the basis that multiple products would tend to reduce risks by diversifying sales. We also see polygen as being a way to work around the reported reliability issues with gasification in a power generation function. One potential source of unreliability is the need to cycle up and down a non base load IGCC power facility through the daily load cycle. Polygen would allow the gasifier to operate at optimal efficiency 24/7, by switching its product to maximum power generation at peak hours, and to maximum production of other products during off hours.

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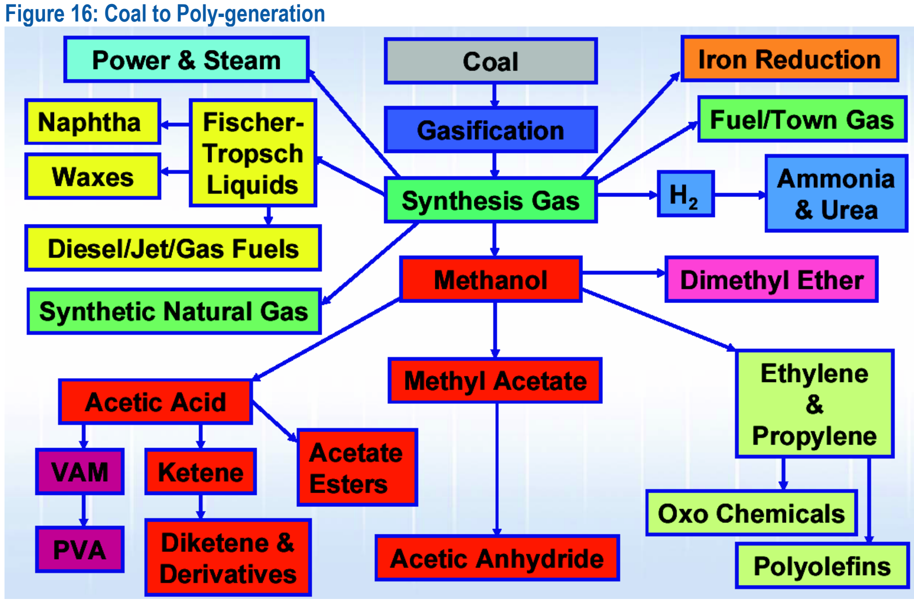
Figure 16: Coal to Poly-generation



Source: Eastman Chemicals

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Special Focus

Go west for replacement: Are PRB prices set to rise?

The Powder River Basin (PRB) is a region in southeast Montana and northeast Wyoming about 120 miles east to west and 200 miles north to south

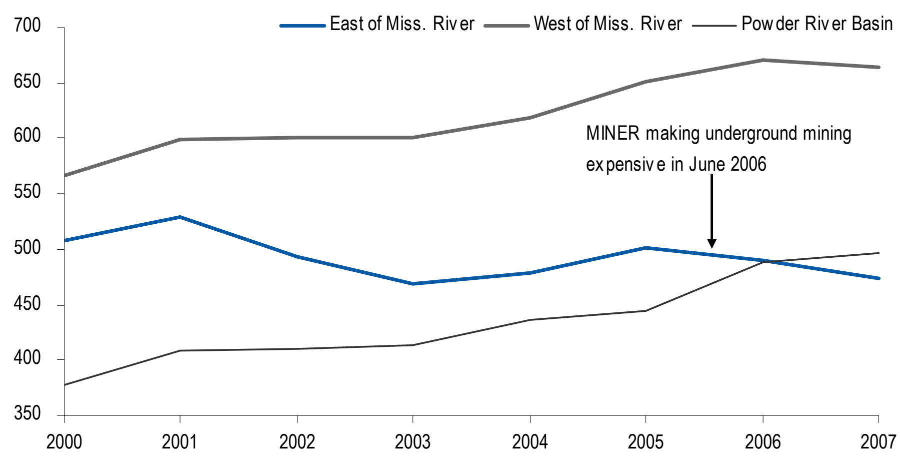
Powder River Basin has been the fastest growing coal producing region in the United States for the past two decades. Coal production in the PRB has increased dramatically, from about 316 million tons of coal annually in 1996 to nearly 497 million tons in 2007, growing at a compounded annual growth rate of about 4%.

As can be seen in Figure 17, there is a continuing shift in coal production from the Appalachian region to the PRB region, driven by a variety of reasons:

PRB coal seams can be +60 feet thick and lie close to the surface, allowing producers to use very large, highly efficient surface mining equipment to extract coal

- Increased regulatory pressures on power plants to reduce sulfur dioxide emission, leading to high-sulfur Appalachian coal being replaced by low-sulfur PRB coal.
- Increased difficulty in obtaining mining permits for mountaintop removal mining in CAPP region following the 404 permit ruling by Judge Chambers against the long-term viability of valley-fill mining.
- Mine Improvement and New Emergency Response Act (MINER) passed in June 2006 enforced new safety standards and increased the cost of underground mining, thereby making the principally underground mined Appalachian coal costlier to mine compared to PRB coal, which is mined majority on the surface.
- It is among the cheapest energy sources on a per-BTU basis as it can be mined efficiently and inexpensively.

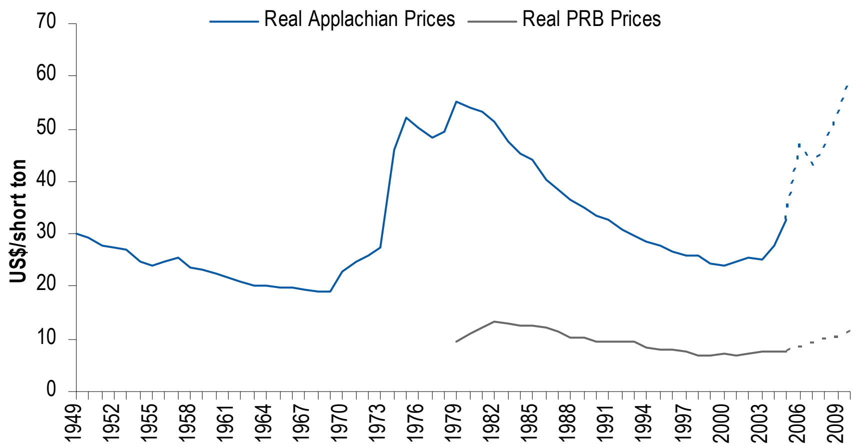
Figure 17: Production trend - Eastern and Western US
Million short tons



Source: Energy Information Administration

To illustrate further, Figure 18 shows that the real PRB prices paid by utilities are lagging as compared to the real Appalachian prices as the use of bigger and better equipment led to reduced surface mining costs in the PRB. At the same time the costs of mining Appalachian coal escalated at the underground mines where coal seams have become narrower.

Figure 18: Record Long term real coal prices paid by utilities in prospect



Source: Energy Information Administration and JPMorgan estimate (dotted line)

Note that coal-fired power plants consume nearly 99% of all PRB coal produced annually and given that the utility inventories are above the 3 year average, the price rise curve will not be as steep as Appalachian coal unless the production is limited or unless PRB coal finds a new market – both of which have happened for Appalachian coal. Scrutiny on mountaintop removal mining in CAPP region has kept the production under control and relentless growth in BRIC countries has helped find the Appalachian coal a new market.

With huge reserves and ease of surface mining, we believe as more and more Appalachian coal gets exported, PRB coal is needed to provide replacement to the domestic utilities. We would also not rule out PRB coal's export potential from Canada or the Gulf, if coal prices stay at elevated levels or further rise. A little PRB coal is already exported to Spain.

BTU (or British Thermal Unit) is defined as the amount of heat required to raise the temperature of one pound of water by one degree Fahrenheit

Many remote Indonesian mines are now being bought by Indian power generating companies to secure coal reserves. Could a similar thing happen for PRB too? In a tight market different coal qualities tend to be efficiently priced in terms of their delivered cost per mmBTU.

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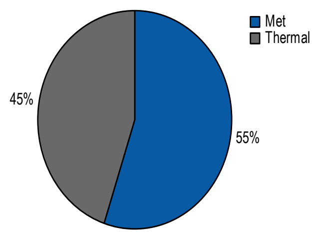
Key Country Profiles

(For our regional team list, please see last page)

Australia: Tight Infrastructure and volatile weather

Figure 19: Coal export break up 2007E



Source: JPMorgan estimates

Australia is a major global coal exporter with ~55% and ~17% share of global metallurgical and thermal coal exports respectively. Additionally, thermal coal prices at Australia's Newcastle port are used as a benchmark for the Asian market.

Following heavy rainfall in Queensland's Bowen Basin earlier this year, a majority of the metallurgical coal producers in the region declared *force majeure*. Estimates suggest that over 10 million metric tonnes of production could have been lost, but the full effect of the adverse weather conditions is still unfolding.

Added to this, supply-side complications have emerged in the possible delay of the Dalrymple Bay Coal Terminal expansion project. The A$1.2B expansion was originally scheduled for completion by 2008 year end but is now expected to be completed by late March 2009. Upon completion, the planned export capacity is expected to increase to ~85 million metric tones. Table 7 below shows the capacity and potential expansion at the Australian coal terminals.

Table 7 Australian Coal Terminals

Location	Coal Terminal	Operator	Coal Capacity (Mtpa)	Potential Expansion (Mtpa)	No. of Berths	No. of Shiploaders	Coal Dedicated?
New South Wales							
Newcastle	Carrington	Port Waratah Coal Services Ltd	25	-	2	3	Yes
Newcastle	Koorangang	Port Waratah Coal Services Ltd	52	120	3	2	Yes
Newcastle	"Third Terminal"	Newcastle Coal Infrastructure Group	-	66	-	-	
Port Kembla	Port Kembla	Port Kembla Coal Terminal Ltd	16	-	2	3	No
Queensland							
Abbot Point	Abbot Point	Abbot Point Bulkcoal Pty Ltd	15	50	1	1	Yes
Brisbane	Brisbane	Queensland Bulk Handling Pty Ltd	5	-	1	1	No
Gladstone	Barney Point	Gladstone Port Authority	5	7	1	1	Yes
Gladstone	R G Tanna	Gladstone Port Authority	45	62	2	2	Yes
Gladstone	Wiggins Island	Central Queensland Ports Authority	-	70	-	-	
Hay Point	Dalrymple Bay	Dalrymple Bay Coal Terminal Pty Ltd	56	85	2	2	Yes
Hay Point	Central Queensland Coal Associates	Hay Point Services Pty Ltd	35	57	2	2	Yes
Total:			**254**	**517**	**16**	**17**	

Source: Ports Corporation of Queensland, Department of Industry, Tourism and Resources

With a multitude of infrastructure and port expansion projects in the pipeline, we expect improvements in the logistics chain in the longer term. However, we expect Australian coal supply estimates to continue to have downside risk in the short term with continuing cost pressures and infrastructure constraints.

Indonesia: Domestic coal needs growing

Indonesia is the world's largest exporter of thermal coal and the second largest exporter of LNG with its key export market for coal being nearby Southern China.

Indonesia was expected to provide the bulk of incremental supply to the Asian region. However with the Indonesian government planning to put a cap on coal exports, incremental supply from the country seems more limited than consumers hoped for.

With elections scheduled next year, the government is planning the development of new roads and ports (PTBA is investing in railways, as its growth is hampered by rail transportation). This should help coal exports, in our view. However, at the same time the government is also under pressure to speed up the proposed 10GW crash power generation program and this should limit the outflow of coal from the country.

Our export forecasts for Indonesia could be higher, if the Indonesian coal producers are able to deliver on their coal production guidance over the next 2-3 years. However, increasing delays in the delivery of mining equipment, difficulty in procurement of capital and the constrained port capacities make us believe that it would be difficult for the miners to deliver on their guidance and our numbers are a little more conservative.

India: Limited opening of the coal sector on cards

The growing demand for imported coal into India could have the greatest impact on the global coal industry. Government of India, for instance, has an ambitious power addition target of 78,000 MW in five years (2007–2012). Most of this capacity is coal based and has been allocated to the coastal region to source imported seaborne coal.

Of this new capacity, nearly 40% will be provided by private companies through coal fired plants. State run Coal India Limited commands 80% of market share and thus the private players are now busy acquiring captive coal mines in the remote areas of Indonesia, USA and Australia to assure coal supplies. The country is expected to import approximately 100 million metric tonnes of thermal coal over a period of next 4 years.

Even though 100% FDI is allowed in the coal sector, there had been negligible investment in the sector due to regulatory control but now the government is keen on increasing private sector participation in coal mining. Coal Governance and Regulation Authority Bill drafted by the ministry of coal to set up an independent coal regulator and 10% merchant sale of coal produced by captive miners (under consideration) are key initiatives in this direction.

As for Indian steel companies, they are squeezed from both ends – inflation wary government headed for election next year would not allow them to increase the price of final product by putting a cap on selling price and imposing export duty of 5 to 15%. The domestic steel demand is growing at 11-12% whereas supply is lagging at about 5%.

China: Still the wild card

Coal fired power plants provide nearly 80% of China’s electricity needs. In recent times, margins and coal inventory at utilities have fallen due to unrestrained coal exports. At the same time pollution control checks to ensure a “green” Olympics have resulted in small polluting thermal power plants being shut down. Amid some of these factors and one of the harshest winters this year, the Chinese government has now put a cap on coal export. Note that China is self sufficient for met coal required for its steel industry.

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China is expected to be a net importer of coal for approximately 5 million metric tonnes for the year 2008 and 15 million metric tonnes for 2009 and 2010. Energy demand would continue to grow as China keeps growing at this pace. Thus it's quite unlikely that the Chinese demand for coal would fall or stabilize at current levels.

The risk to the Chinese growth story would only occur from the supply side constraints, in our opinion. Total Chinese demand is expected to rise by +/- 100 million metric tonnes per annum. Chemical industries, for instance, could consume around 80 million tonnes by 2010 and the country is planning to add 40% power generating capacity over the next three years.

While coal demand is expected to rise by about 120-150 mn tonnes pa, the rail capacity (to carry coal from the coal rich north to the markets in the south) is expected to increase by about 60 million metric tonnes in 2008 and by about 100-120 million metric tonnes in 2009.

China has a blocked artery: coal costs R200/t in the north and R700/t in the south

The ex-mine coal prices in China are about RMB 300 per metric tonne. The cost of transporting the coal to the main market in the south is approximately RMB 150 per metric tonne. However coal is sold in the local market at around RMB 800 per metric tonne. This suggests we should monitor growth in rail capacity since a de-bottlenecking of infrastructure could take pressure off the international coal market, or even add supplies.

For China, we believe it makes sense to get coal from Indonesia, as it's cheaper compared to moving coal from North of China to South of China.

South Africa: Constrained by rail

South Africa (SA) and Australia are traditionally the largest seaborne coal suppliers – the former exporting mostly thermal coal and the later exporting mainly met coal.

SA produces virtually all thermal coal (mostly of average quality) and exports from the Richards Bay coal terminal which is controlled by a group of coal producers that have export quotas. Current capacity of the terminal is 76 million metric tonnes (01 January 2008), which is expected to increase to 91 million metric tonnes by first half of 2009. However, due to limits on rail capacity, the port has never supplied more than 65 million tonnes. A growing percentage of the country's export is now reaching India, creating a supply gap in the Atlantic basin.

A stronger Australian dollar vis-à-vis the South African rand should make SA the more economic region for new coal supplies. The country also has the port capacity to export coal; however the movement of coal to the ports is constrained by the rail capacity. We believe that SA would not be able to keep up to the 2008 thermal coal export expectations. However, as the expansion of RBCT was intended to accommodate new (mostly Black Economic Empowerment) entrants, there is the potential for scheduling disputes if indeed the rolling stock is not available as we suspect may be the case. The result may be a considerable build up of coal stockpiles on the mines. This further illustrates the risk that if the logistic pipeline bottlenecks are sorted, then there could be a flood of material available to the market.

Nearly 90% of the electricity in the country is provided by state owned Eskom Holdings, which again generates nearly 90% of this power from coal fired plants.

The country now faces a severe power crisis after its reserve capacity was used up in 2007. The industry is restricted to only 90 to 95% of its electricity needs and consumers are suffering rolling blackouts during period of power station maintenance. With South Africa entering its winter (June to August), there is a real fear that the demand may again outstrip the supply and once again blackouts may be re-introduced. We believe that the long term strategy of Eskom's power generation has to revolve around the South African coal fields. South Africa currently produces some of the cheapest electricity in the world and if it wishes to remain competitive on cost basis, the country's vast coal resources offer it decades of low price (but also low quality) feedstock.

SA has traditionally had mines that either supplied either the export or the power station market. Only recently have new mines been opened up, that have been planned to sell to both markets from the onset of operations. However some of the large coal fired power stations are over 30 years old and the coal fields associated (or tied-mines) with the power station are struggling to meet the requirements in the way of tonnage. There is a growing market for coal to be sold to Eskom on a spot or short term contract basis.

That said, Ross Gardiner, our coal analyst in Johannesburg, does not believe that rising coal requirements from Eskom will take coal away significantly from the exports. The next large power station is due to come on line in 2013 and so in the meantime the coal requirements for Eskom have to be satisfied from the current operating base as well as from small operators that have sprung up to supply a "top-up" tonnage to power stations whose tied-mines are struggling to satisfy demand.

Europe: Revisiting coal

Coal is the source of about 30% of power supply in the 27 EU nations and is at record prices due to increased competition from India and China. Europe is the second largest destination for the US coal after Canada. This is mainly due to proximity with US eastern ports, though recently the strong Euro has made US coal more attractive, as well.

Other coal markets

"Some US utilities are seeking around 2 million tons each for late of 2008 and are looking seriously at Colombian imports" – IEA Chief Economist

Colombia – Colombia is the biggest coal exporter in Latin America and could double its production by early next decade subject to it getting its infrastructure in place. The production is expected to go up from current 56 million tonnes to over 100 million tonnes by 2010. The coal companies are likely to take several initiatives to develop rail and ports and thus securing export capacity while reducing transportation cost – the biggest cost for the Colombian coal industry.

"Coal will have to outpace the amount of gas, nuclear and the other types of fuel being used," – Chief Regulator, Coal Sector Russia

Russia -Russia probably has the highest potential of raising exports. However the increased coal supplies would likely only come at the earliest by 2011. The infrastructure is well in place, in our view although ports are constrained. Russia has access to the neighboring markets through road, this is useful when majority of coal basins are located in the central part of the country, far from the eastern ports – Baltic and Murmansk. The Russian steel companies, like their Chinese counterparts, do not procure steel from overseas. The country plans to add 41,000 MW of power generating capacity (mostly coal based) over next five years, as it targets to increase the share of coal in power generation to 37% from the current 28%.

Coal miners in Russia are now preferring to export coal to the eastern region as compared to the western region. This is primarily due to better realized prices in the east and the convenience of moving the coal on rail over longer hauls away from the politically sensitive hauls through adjoining eastern countries. Russia also plans to build a new port on eastern coast to support greater coal shipments to Korea, Taiwan and a small percentage to India.

Mining accounts for 30% of Mongolia's GDP and 78% of country's exports

Mongolia –The country exports coal only to China due to infrastructure issues but is now considering exporting coking coal to Japan on a trial basis. There could be increased coal supplies from Mongolia to Northern China also but this seems to be a longer term development. There is lack of infrastructure at the moment to support the coal. Complicating investment decisions in Mongolia, the government is considering a law which would give 51% of all 'strategic deposits' to the state, up from current 34%.

Vietnam – Vietnam's coal output in January-May 2008 is estimated to have risen 10.7% from a year ago to 18.86 million metric tonnes. However the coal exports in January-May are estimated to fall 15.7% from the same period last year to 11.4 million metric tonnes. Vietnam, which is expecting 18 to 20 percent annual growth in power demand, plans to slash coal exports this year by more than 32% to about 22 million metric tonnes to save more for new power plants.

Poland – Coal supplies to the European region are restricted as Poland is not exporting anymore to the European countries. On the contrary it is becoming a net importer for the first time. Polish utilities are also importing coal from Russia.

Coal Equities and Valuation

In the coal space, our preferred valuation metrics is **EV/EBIDTA** as against EV/Reserves or EV/ton, as a measure of relative valuation. Historically, coal companies have traded in range of 5x to 8x on a one year forward EV/EBITDA. However, this metric is sometimes affected by the high social liabilities for some of the coal companies. To better compare the coal companies on EV/EBITDA, an adjustment can be made where "Social Liabilities" are included in EV and "Social Costs" are added to the EBITDA. We feel that over the long term, social liabilities acta as additional costs that must be factored into the price of coal.

EV/Reserves is a difficult metric as standardization of coal reserves at the company level is difficult. This is because the reserves vary in quality. Even though different coal types can be standardized based on heat contents, other factors that affect valuation of reserves are volatility, ash, sulfur content, moisture content and distance from rail or barge.

A useful reality check for the coal companies is the **Price-to-NPV** ratio, where NPV is based on a DCF model. Coal companies seldom offer enough guidance to generate a high confidence financial model for +20 years but we still believe this method has value.

The most relied upon valuation metric in this space remains the one or two year forward EV/EBITDA.

Table 8 to Table 10 below show valuation comparisons for the major US coal producers on a wide range of various valuation metrics.

Table 8: Trading Multiples for major US and Non US Coal producers

	FV/ EBITDA			Price-to-Earnings			Price-to-Cash flow		
	2007	2008E	2009E	2007	2008E	2009E	2007	2008E	2009E
Producers spread-out throughout the US:									
Arch Coal	25.2x	13.9x	7.2x	58.4x	24.7x	10.5x	30.8x	15.6x	8.8x
CONSOL Energy	24.6x	13.8x	5.9x	70.3x	32.0x	10.0x	28.4x	18.1x	8.7x
Peabody Energy	25.7x	13.8x	7.5x	50.3x	23.7x	11.4x	67.0x	19.4x	9.6x
Foundation	13.2x	11.0x	6.6x	82.4x	58.0x	15.4x	14.8x	11.8x	7.0x
Fording Trust	23.0x	7.9x	5.9x	38.7x	9.0x	6.2x	31.0x	9.0x	6.6x
Alliance Resource	7.7x	7.3x	4.7x	12.9x	16.3x	11.2x	7.0x	12.1x	9.1x
Sub-sector Average	**23.8x**	**12.5x**	**6.7x**	**55.7x**	**25.3x**	**10.2x**	**40.8x**	**16.2x**	**8.6x**
Producers concentrated in Central Appalachia:									
Alpha	26.2x	15.0x	5.6x	203.5x	40.1x	10.3x	28.2x	18.8x	7.4x
ICG	31.9x	12.1x	5.8x	neg.	96.5x	12.4x	71.7x	17.2x	8.1x
James River	na	16.8x	4.7x	neg.	neg.	10.0x	na	19.8x	5.3x
Massey Energy	15.5x	10.2x	4.9x	62.9x	24.5x	9.0x	14.8x	10.7x	6.3x
Patriot Coal	neg.	17.8x	5.4x	neg.	74.2x	13.0x	647.5x	31.3x	19.7x
Sub-sector Average	**neg.**	**13.7x**	**5.3x**	**48.7x**	**42.1x**	**10.6x**	**142.7x**	**18.3x**	**9.3x**
North America Avg.	**4.8x**	**12.8x**	**6.4x**	**54.2x**	**28.8x**	**10.3x**	**62.1x**	**16.6x**	**8.7x**
Non US Producers									
Bumi Resources	32.2x	6.5x	3.8x	19.8x	15.4x	11.7x	na	na	na
Banpu Public	12.7x	5.5x	4.4x	20.1x	15.7x	11.9x	na	na	na
Centennial Coal	12.7x	7.2x	5.1x	235.4x	7.1x	8.6x	na	na	na
China Shenhua	0.2x	0.2x	neg.	25.9x	18.5x	14.9x	na	na	na
Exxaro Resources	19.0x	8.7x	10.6x	32.5x	11.3x	11.8x	na	na	na
Tambang Batubara Bukit Asam	32.6x	10.6x	7.2x	44.9x	15.9x	11.4x	na	na	na
Yanzhou Coal Mining – H	neg.	neg.	neg.	20.7x	12.9x	11.5x	na	na	na
Non US Average	**17.5x**	**4.9x**	**3.7x**	**32.1x**	**14.9x**	**11.6x**	na	na	na

Source: Company reports, JPMorgan Estimates, Firstcall and I/B/E/S.

Note: EPS, EBITDA & CFPS estimates for ACI, CNX, MEE, BTU, BUMI, BANP.BK, CEY.AX,117 HK, PTBA, EXX SJS, 1088 HK & ICO are JPM estimates and for all other companies are Firstcall (EPS) and I/B/E/S (EBITDA and CFPS) estimates. Share price as of 10 June 2008 close.

Table 9: Comparative Table of major US Coal producers

	Ticker	JPMorgan Rating	Share Price US$	Short Interest	Short Int. Ratio	M.Cap mn	Firm Value mn	Rsrvs mn tons	FV / Rsrv	1 Yr Fwd P/E	1 Yr Fwd P/CF	1 Yr Fwd FV / EBITDA
Arch Coal	ACI	Neutral	$71.69	11,937,040	2.784	10,263	11,877	2,213	$5.37	15.4x	11.6x	9.8x
CONSOL Energy	CNX	Overweight	$101.93	6,207,347	1.944	18,581	19,315	4,526	$4.27	16.1x	12.2x	8.6x
Peabody Energy	BTU	Neutral	$78.77	16,892,739	2.63	21,273	24,552	9,301	$2.64	16.0x	13.3x	10.1x
Massey Energy	MEE	Overweight	$73.40	8,408,983	3.111	5,868	6,581	2,283	$2.88	13.9x	8.1x	6.9x
ICG	ICO	Neutral	$10.43	24,196,280	9.737	1,596	1,953	965	$2.02	23.9x	11.5x	8.1x
Alpha	ANR	Not covered	$87.49	8,338,242	1.909	5,754	6,123	618	$9.92	17.5x	11.1x	8.5x
Foundation	FCL	Not covered	$72.47	2,594,444	2.303	3,261	3,838	1,585	$2.42	25.9x	9.1x	8.5x
James River	JRCC	Not covered	$43.19	2,447,687	1.879	946	1,089	268	$4.06	30.9x	8.9x	7.8x
Fording Trust	FDG-U	Not covered	$78.91	706,120	1.236	11,702	11,889	691	$17.21	7.5x	7.7x	6.9x
Alliance Resource	ARLP	Not covered	$48.95	283,960	2.487	1,789	1,949	713	$2.73	13.5x	10.5x	5.9x
Patriot Coal	PCX	Not covered	$135.10	1,356,752	1.612	3,615	3,639	1,200	$3.03	23.9x	24.8x	8.8x

Source: Company reports, JPMorgan Estimates, Firstcall.

Note: EPS, EBITDA & CFPS estimates for ACI, CNX, MEE, BTU & ICO are JPM estimates and for all other companies are Firstcall (EPS) and I/B/E/S (EBITDA and CFPS) estimates. Share price as of 10 June 2008 close.

Table 10: Price to NPV multiples for US coal companies under JP Morgan coverage

		NPV / share					Price-to-NPV				
	Price	0.0%	2.5%	5.0%	7.5%	10.0%	0.0%	2.5%	5.0%	7.5%	10.0%
Arch Coal	$71.69	$147	$106	$78	$59	$45	0.5x	0.7x	0.9x	1.2x	1.6x
CONSOL Energy	$101.93	$299	$220	$166	$129	$102	0.3x	0.5x	0.6x	0.8x	1.0x
Peabody Energy	$78.77	$108	$79	$60	$46	$36	0.7x	1.0x	1.3x	1.7x	2.2x
Massey Energy	$73.40	$274	$200	$150	$115	$90	0.3x	0.4x	0.5x	0.6x	0.8x
ICG	$10.43	$29	$21	$16	$12	$9	0.4x	0.5x	0.7x	0.9x	1.1x

Source: Company reports, JPMorgan Estimates.

Note: Share price as of 10 June 2008 close.

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Sensitivity Analysis

As we pointed out earlier, forward EV/EBIDTA remains the most practical valuation metric for coal companies and the underlying coal prices determine the earnings potential for the company, to the extent of uncontracted positions. In the the tables below, we analyze EV/EBIDTA and EPS sensitivity of US coal companies to changes in coal prices.

Table 11: EV/EBITDA Sensitivity for US coal companies under JP Morgan coverage

		FV/EBITDA		
		Current Coal Prices	10% higher App	10% higher PRB
Arch Coal	ACI	8.5x	8.3x	8.3x
Peabody Energy	BTU	8.7x	8.7x	8.7x
CONSOL Energy	CNX	8.3x	8.0x	8.3x
ICG	ICO	6.6x	6.3x	6.6x
Massey Energy	MEE	6.1x	5.9x	6.1x

Source: JPMorgan

Note: The sensitivity of earnings to change in coal prices is limited to the extent of uncontracted and unpriced coal production.

Table 12: EPS Sensitivity for US coal companies under JP Morgan coverage.

		2008 EPS			2009 EPS		
		Current Coal Price	10% higher App	10% higher PRB	Current Price	10% higher App	10% higher PRB
Arch Coal	ACI	$2.90	$2.92	$2.93	$6.81	$7.06	$7.11
Peabody Energy	BTU	$3.32	$3.32	$3.32	$6.90	$6.90	$6.97
CONSOL Energy	CNX	$3.18	$3.21	$3.18	$10.21	$10.88	$10.21
ICG	ICO	$0.11	$0.13	$0.11	$0.84	$0.95	$0.84
Massey Energy	MEE	$3.00	$3.09	$3.00	$8.14	$8.61	$8.14

Source: JPMorgan

Note: The sensitivity of earnings to change in coal prices is limited to the extent of uncontracted and unpriced coal production.

The Correlation with Oil

Our experience in the coal space has been that the coal company stocks not only tend to move together with each other but also with the entire energy space and especially crude oil. Table 13 shows the strong correlation between the major coal companies and the crude oil.

We have included the correlation table below to highlight to energy space investors, the trading patterns in this space.

Table 13: Correlation Table

	BTU	*ACI*	*CNX*	*ICO*	*MEE*	*Natural Gas*	*Crude Oil*	*CAPP*	*NAPP*	*PRB 8800*
Peabody Energy (BTU)	1.00									
Arch Coal (ACI)	0.93	1.00								
Consol Energy (CNX)	0.87	0.84	1.00							
International Coal Group (ICO)	-0.50	-0.27	-0.42	1.00						
Massey Energy (MEE)	0.10	0.33	0.23	0.74	1.00					
Natural Gas	0.19	0.38	0.26	0.40	0.61	1.00				
Crude Oil	0.83	0.80	0.95	-0.38	0.25	0.25	1.00			
CAPP coal	0.21	0.43	0.47	0.42	0.79	0.47	0.48	1.00		
NAPP coal	0.25	0.36	0.61	0.18	0.62	0.31	0.62	0.84	1.00	
PRB 8800 coal	0.61	0.72	0.42	-0.14	0.22	0.34	0.45	0.29	0.01	1.00

Source: DataStream

Note: Data range 11/15/2004 - 5/28/2008

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Coal Company Profiles

Arch Coal

Repricing met and Western Bit, waiting on PRB

Stock Information and Fundamentals

Symbol	ACI	Est. 2-Yr Sales Grth	85%
Exchange	NYSE	Est. 2-Yr EPS Grth	273%
JPMorgan Rating	Neutral	ROA (2008E)	10.4%
Avg. Daily Vol.	5,012,130	ROE (2008E)	22.3%
Price (6/10/08)	$71.69	Shares (MM)	144.6
52-Week Range	$28-76	Mkt. Cap ($MM)	$10,366

Source: Company reports, JPMorgan estimates and Reuters.

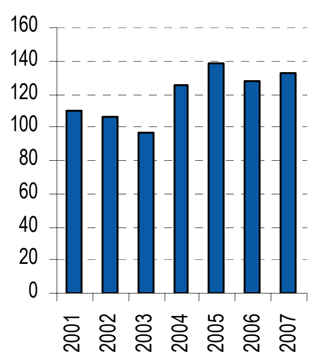
Earnings Estimates

EPS	2007	YoY Chg	2008E	YoY Chg	2009E	YoY Chg
1Q	$0.20	-51%	$0.56A	180%	$1.66	196%
2Q	$0.27	-46%	$0.74E	174%	$1.72	132%
3Q	$0.19	-46%	$0.79E	316%	$1.72	118%
4Q	$0.56	1%	$0.80E	43%	$1.71	114%
Year	$1.23	-33%	$2.90E	136%	$6.81	135%
FC Consensus	*$1.21*		*$2.66*		*$5.19*	
EBITDA ($mn)	472	-13%	856	81%	1,644	92%

Source: Company reports, JPMorgan estimates and First Call.

Figure 21: Production Trend

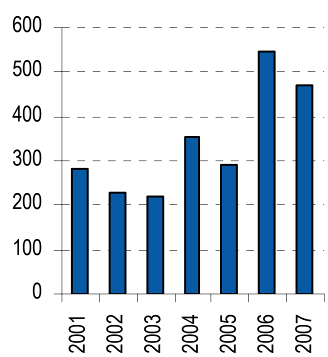
Million of short tons



Source: Company reports

Figure 20: EBITDA Trend

$ millions



Source: Company reports

Company Description

- 74% of 2007 coal production is in PRB, 15% in the Western Bituminous and 11% in Central Appalachia.
- Helped by the new Mt Laurel mine met coal production on the rise. Up from 2mt in 2007 to 4.5mt in 2008 and 5mt to 6mt in 2009.
- Purchased a 4.5% stake in the DTA coal export terminal, increasing its share to 22%.
- Contributes about 12% of America's coal supply.

Conclusion

Much stronger pricing of Arch's metallurgical coal and better prices for its Western bit production should give it a boost while it waits for a better reaction in PRB prices to the tighter market.

We feel that with the large diversified mining (and possibly the energy) companies being cash rich and looking for assets, there is some potential for Arch to attract M&A interest around current levels. Also, having a large PRB reserve is a positive for the company as PRB coal will act as a replacement in the USA or could well be exported from the eastern cost or through Gulf, in a high export market and in our view, Arch is best suited to gain from this.

Arch is now establishing its own trading capability in the coal market. The company has misread the market at times in the past and we feel the trading group within the company will give Arch a better ear to the marketplace and help the company make better decisions in future.

CONSOL Energy

In a Sweet Spot in Northern Appalachia

Stock Information and Fundamentals

Symbol	CNX	Est. 2-Yr Sales Grth	91%
Exchange	NYSE	Est. 2-Yr EPS Grth	604%
JPMorgan Rating	Overweight	ROA (2008E)	8.4%
Avg. Daily Vol.	3,571,180	ROE (2008E)	33.7%
Price (6/10/08)	$101.93	Shares (MM)	185.2
52-Week Range	$34-109	Mkt. Cap ($MM)	$18,877

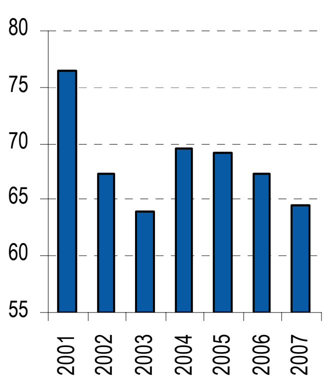
Source: Company reports, JPMorgan estimates and Reuters.

Earnings Estimates

EPS	2007	YoY Chg	2008E	YoY Chg	2009E	YoY Chg
1Q	$0.61	-15%	$0.41A	-33%	$2.55	522%
2Q	$0.83	45%	$0.82A	-1%	$2.58	215%
3Q	($0.03)	-110%	$0.92A	na	$2.51	173%
4Q	$0.04	-95%	$1.04E	2500%	$2.57	147%
Year	$1.45	-36%	$3.18E	119%	$10.21	221%
FC Consensus	*$1.45*		*$2.98*		*$7.47*	
EBITDA ($mn)	785	-11%	1,400	78%	3,200	129%

Source: Company reports, JPMorgan estimates and First Call.

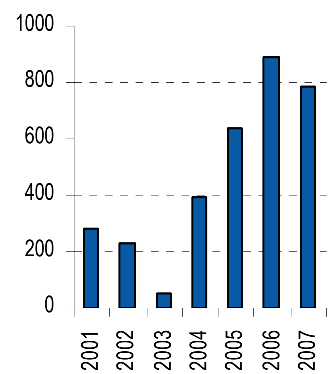
Figure 23: Production Trend Millions of short tons



Source: Company reports

Figure 22: EBITDA Trend

$ millions



Source: Company reports

Company Description

- 81% of 2007 coal production is in NAPP, 17% in CAPP and 2% in the western region.
- If the US utilities don't support the company's expansions, Consol is looking into expanding its 100% owned Baltimore port facility to export more coal.
- CONSOL has shown supply discipline in the NAPP region and has brought new production online only after it secured very long term contracts.
- CONSOL's coal bed methane operations had record results even while wells close to the Buchanan mine were underperforming. Consol owns 81.7% of CNX Gas (CXG).
- CEO Harvey feels that gas reserves could rise from the current 1.3tcf to between 3tcf and 4tcf.

Conclusions

Consol continues to occupy the catbird seat, in our opinion. Disciplined supply to the NAPP market has supported prices and its gas division promises continued volume growth. We see CONSOL as a core holding for investors seeking long term coal exposure. Disciplined production from Consol is allowing it to earn better returns for its shareholders. Its Baltimore port facility allows it to export coal that the Utilities don't want. The company's coal bed methane business gives it a hedge against any aggressive anti-carbon rules from Washington.

In our view, CONSOL remains in the coal sector's "sweet spot". The company retains control of its large natural gas business and with its own port it is capitalizing on export opportunities. We remain constructive on CONSOL and see CONSOL as a well managed way to participate in global economic growth but feel the valuations are fair given CONSOL's large social liabilities of about $2.8bn.

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International Coal Group

The Little Engine that Might

Stock Information and Fundamentals

Symbol	ICO	Est. 2-Yr Sales Grth	77%
Exchange	NYSE	Est. 2-Yr EPS Grth	na
JPMorgan Rating	Neutral	ROA (2008E)	1.2%
Avg. Daily Vol.	2,517,330	ROE (2008E)	3%
Price (6/10/08)	$10.43	Shares (MM)	152.4
52-Week Range	$4-11	Mkt. Cap ($MM)	$1,589

Source: Company reports, JPMorgan estimates and Reuters.

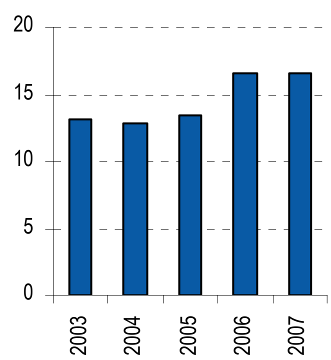
Earnings Estimates

EPS	2007	YoY Chg	2008E	YoY Chg	2009E	YoY Chg
1Q	($0.05)	na	($0.08)A	14%	$0.16	na
2Q	($0.07)	na	$0.05E	na	$0.25	400%
3Q	($0.01)	na	$0.09E	na	$0.23	156%
4Q	($0.11)	na	$0.04E	na	$0.21	425%
Year	($0.23)	na	$0.11E	na	$0.84	664%
FC Consensus	($0.23)		*$0.07*		*$0.74*	
EBITDA ($mn)	61	-15%	162	166%	337	108%

Source: Company reports, JPMorgan estimates and First Call.

Figure 24: Production Trend

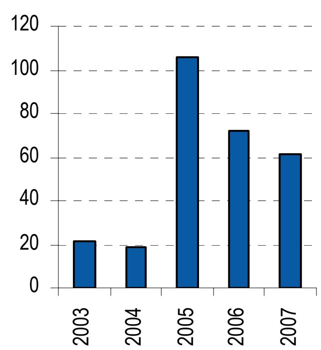
Millions of short tons



Source: Company reports

Figure 25: EBIDTA Trend

$ millions



Source: Company reports

Company Description

- 68% of 2007 coal production is in CAPP, 20% in NAPP and 12% in the Illinois region.
- Better prices in prospect for 2008, though some of the ICO coking coal is lower quality high sulfur higher ash coal.
- Growth in higher value product from Sentinel and Beckley should help later in 2008.

Conclusions

There are parallels between International Coal's CAPP mines and those of the market favorite Patriot Coal's. Both have relatively higher cost mines which are well positioned to benefit from the higher coal prices currently being seen.

However, the company has had a spotty operational record and this has made investors wary of the stock. With its new coking coal mines promising to boost revenues, the company could deliver better results assuming it can deliver on its tonnage projections.

Massey Energy

On the Rebound

Stock Information and Fundamentals

Symbol	MEE	Est. 2-Yr Sales Grth	75%
Exchange	NYSE	Est. 2-Yr EPS Grth	597%
JPMorgan Rating	Overweight	ROA (2008E)	7.6%
Avg. Daily Vol.	3,109,900	ROE (2008E)	23.5%
Price (6/10/08)	$73.4	Shares (MM)	80.6
52-Week Range	$16-76	Mkt. Cap ($MM)	$5,857

Source: Company reports, JPMorgan estimates and Reuters.

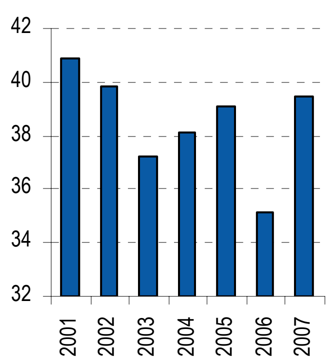
Earnings Estimates

EPS	2007	YoY Chg	2008E	YoY Chg	2009E	YoY Chg
1Q	$0.40	429%	$0.52A	30%	$1.18	127%
2Q	$0.43	977%	$0.89E	107%	$2.41	171%
3Q	$0.27	355%	$0.80E	196%	$2.22	178%
4Q	$0.06	-36%	$0.78E	1200%	$2.33	199%
Year	$1.17	326%	$3.00E	156%	$8.14	171%
FC Consensus	*$1.15*		*$2.97*		*$4.65*	
EBITDA ($mn)	426	32%	467	10%	1,344	188%

Source: Company reports, JPMorgan estimates and First Call.

Figure 26: Production Trend

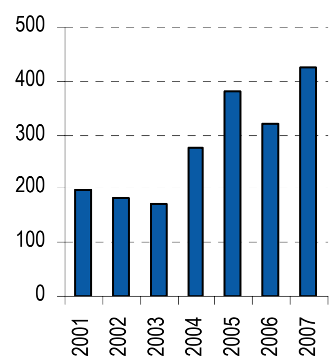
Million short tons



Source: Company reports

Figure 27: EBIDTA Trend

$ millions



Source: Company reports

Company Description

- Entire coal production is in the CAPP region.
- Massey has initiated an aggressive capex plan till 2010 to increase its production from 40mt in 2007 to about 50mt by 2010. MEE will incur about $550mn in capex in 2008.
- The company claims it has all the equipment it needs for its aggressive expansion plans.
- The company was acquired coal assets across different mining regions of Illinois Basin and Pittsburgh in 2007.
- Massey's labor retention plan seems to be working, but it will need to attract more labor for its expansion plans.
- The increased demand for rail cars is hurting rail transport. The biggest impact is on system cars MEE feels that unavailability of cars is unlikely to qualify as a *force majeure* impact on contracts.

Conclusions

Even with our conservative tonnage growth profile, Massey appears to be one of the best value coal stocks in our coverage list. While Massey does operate in the difficult CAPP region, we feel the combination of its low valuation multiples and its better quality reserves make Massey attractive. We reiterate our Overweight rating.

The company has aggressive expansion plans and has announced an additional $90 million capex spending in 2008 and expects to produce an additional 2-3mt each year in 2009 and 2010.Unlike its previous expansion we expect rising coal prices to help provide the capital required.

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Peabody Energy

Global Pure Coal Play

Stock Information and Fundamentals

Symbol	BTU	Est. 2-Yr Sales Grth	78%
Exchange	NYSE	Est. 2-Yr EPS Grth	340%
JPMorgan Rating	Neutral	ROA (2008E)	9%
Avg. Daily Vol.	6,357,050	ROE (2008E)	28%
Price (6/10/08)	$78.77	Shares (MM)	272.1
52-Week Range	$39-83	Mkt. Cap ($MM)	$21,433

Source: Company reports, JPMorgan estimates and Reuters.

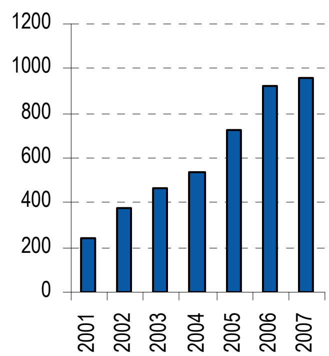
Earnings Estimates

EPS	2007	YoY Chg	2008E	YoY Chg	2009E	YoY Chg
1Q	$0.31	-11%	$0.26A	-16%	$1.68	546%
2Q	$0.36	9%	$0.82A	128%	$1.71	109%
3Q	$0.19	-55%	$1.06A	458%	$1.76	66%
4Q	$0.71	4%	$1.18E	66%	$1.76	49%
Year	$1.53	-27%	$3.32E	117%	$6.90	108%
FC Consensus	*$1.56*		*$2.53*		*$5.00*	
EBITDA ($mn)	956	6%	1,178	23%	3,259	177%

Source: Company reports, JPMorgan estimates and First Call.

Figure 28: Production Trend

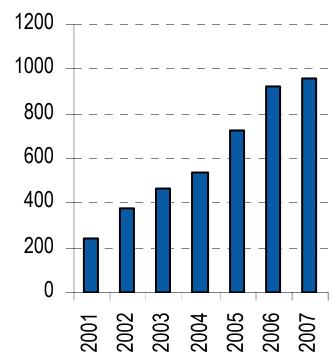
Million short tons



Source: Company reports

Figure 29: EBIDTA Trend

$ millions



Source: Company reports

Company Description

- Largest private sector coal company in the world and a leading global coal trader.
- 72% of 2007 coal production is in Western US, 18% in Eastern US and 21% in Australia.
- 9.3 billion tons of coal reserves.
- International EBITDA share grows to 50% in 2008 at around $1500-$1800 million due to Australian operations.
- One of largest U.S.-based met producers - +/- 10 million tons of metallurgical coal shipments.
- Exports coal from CAPP, NAPP, Illinois Basin, Colorado, PRB and Australia.

Conclusions

Peabody remains the industry's leading coal company with aggressive growth plans, however growth at its Excel assets in Australia have been slowed by the strong local currency and port capacity constraints.

With its strong balance sheet and superior market knowledge, Peabody is well placed to build new capacity in perhaps new prospective regions like Mongolia and Mozambique.

Peabody is the global coal pure play and its above average EV/EBITDA multiples reflect this.

Rio Tinto Energy America

Rio Tinto Energy America is the wholly owned US business unit of Rio Tinto Group and was formed in June 1993 after the acquisition of Spring Creek and Antelope mines in the PRB region. It is the world's largest producer of low-sulfur, sub bituminous PRB coal and the second largest US coal producer by tonnage. In 2007, Rio Tinto Energy shipped a record 134.4 million short tons out of its five coal mines in Colorado, Montana and Wyoming. All operations are surface mines and most of the sales are to power utilities in most regions of the United States.

China Shenhua Energy

It is the largest coal producer in China producing 158 million short tons of commercial coal in 2007.Of the total coal sales of 209 million short tons, the company exported 24 million short tons in 2007. It also has the largest coal reserves in the country, with 11.48 billion short tons at the end of 2007. The company targets the commercial coal production to reach 170 million short tons in 2008 and more than 200 million short tons by 2010.

BUMI Resources

BUMI Resources is the largest thermal coal producer in Indonesia, accounting for a third of Indonesia's total production. In 1998, the company decided to transform its core business to oil, natural gas and mining through a series of acquisitions. BUMI's coal-mining operations take place at 19 sites in the East Kalimantan province of Indonesia. Most of its production is exported. The coal products are marketed internationally through subsidiary Enercorp. To boost export, the company has set aside around $300-400 million for infrastructure development, which is crucial as the company exports most of its production.

In our view, BUMI is practically the only Indonesian company that has expansion prospects. It is planning to increase the capacity to around 100 million tonnes from the current 50-60 million tonnes.

Tambang Batubara Bukit Asam

Based in Indonesia, the company's principal activities include providing coal mining and coal production activities in the country. The company operates through its two subsidiaries PT Batubara Bukit Kendo and PT Bukit Asam Prima. The company sold 10.8 million tonnes of coal in 2007 and plans to sale 13 million tonnes in 2008.

Banpu Public Company Limited

Banpu is a Thailand based company having coal mining operations in Thailand, Indonesia and China. In 2007, the coal sales was 19.3 million tonnes. Also, over 40% of its coal was exported to Japan, Taiwan and South Korea. The company reported total revenue of THB 32,442 million, down 3% compared to previous year on account of decrease in coal sales and stronger Thai currency. With over 70% of coal sales contracted for the year 2008, the company is expecting an average selling price of above 50% compared to 2007.

Yanzhou Coal Mining – H

Yanzhou Coal Mining Company along with its subsidiaries sold 35.11 million tonnes coal in 2007. On a standalone basis, the company sold 32.49 million tonnes in 2007, of which 30.75 million tonnes were sold in the domestic market. The group exports the coal to East Asian countries such as Japan and Korea.

Centennial Coal Company

Centennial is Australia's largest independent coal producer. It sells approximately 25% of its coal to international market. The coal gets exported to utilities and steel companies in countries like Japan, Korea, India and Europe through Newcastle and Kembla port. In the domestic market, the company fuels approximately 47% of the New South Wales energy industry. For the year ended June 2007, the annual raw coal production reached a new record of 21.2 million tonnes. The company believes production expansion of 4.4 and 5 million tonnes in next 2 years at Mandalong combined with strong Western operations will drive profitability in coming years.

Exxaro Resources Limited

Exxaro is a South African company, formed as a result of merger between Kumba Coal and Eyesizewe Coal in November 2006. The company's operations are organized into three segments – coal, mineral sands and base metals. The company produced 41 million tonnes in 2007 and is the largest coal supplier to the state owned power utility Eskom holdings, selling 34 million tonnes to the company in 2007.

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The list of major coal producing companies contains a mix of public and private companies as well as subsidiaries of other major corporations that rely heavily on the use of coal such as the steel and aluminum industries

Table 14: Major U.S. Coal Producers, 2006

(Million short tons)

Rank	Company	Tonnage	%
1	Peabody Coal Co.	207,978	17.9%
2	Rio Tinto Energy America, Inc.	134,390	11.6%
3	Arch Coal, Inc.	129,458	11.1%
4	Foundation Coal Corp.	69,280	6.0%
5	CONSOL Energy, Inc.	63,243	5.4%
6	A.T. Massey Coal Co., Inc.	38,318	3.3%
7	North American Coal Corp.	31,168	2.7%
8	Westmoreland Coal Co.	29,408	2.5%
9	Alliance Coal, LLC	23,233	2.0%
10	Peter Kiewit Sons, Inc.	22,732	2.0%
11	TXU Corp.	22,656	1.9%
12	Robert Murray	20,426	1.8%
13	International Coal Group, Inc.	19,486	1.7%
14	BHP Minerals Group	18,508	1.6%
15	Alpha Natural Resources, LLC	18,356	1.6%
16	Magnum Coal Co.	11,260	1.0%
17	James River Coal Co.	11,237	1.0%
18	Energy Coal Resources, Inc.	10,002	0.9%
19	Pittsburg & Midway Coal Mining Co.	9,543	0.8%
20	PacifiCorp	9,162	0.8%
21	Peter Kiewit/Kennecott	7,044	0.6%
22	Alcoa, Inc.	6,725	0.6%
23	Andalex Resources, Inc.	6,482	0.6%
24	Western Fuels Association, Inc.	5,861	0.5%
25	TECO Energy, Inc.	5,736	0.5%
26	Wexford Capital LLC	5,358	0.5%
27	Oxbow Carbon & Minerals, Inc.	5,128	0.4%
	Subtotal	**942,178**	**81.0%**
	All Other Coal Producers	**220,572**	**19.0%**
	U.S. Total	**1,162,750**	**100.0%**

Source: Energy Information Administration

Note: Major coal producers are companies that produced more than 5 million short tons in 2006. A controlling company of a mine is defined as the company "controlling the coal, particularly the sale of the coal." Most often, but not always, this is the owner of the mine. 2007 data will be released by EIA in August 2008.

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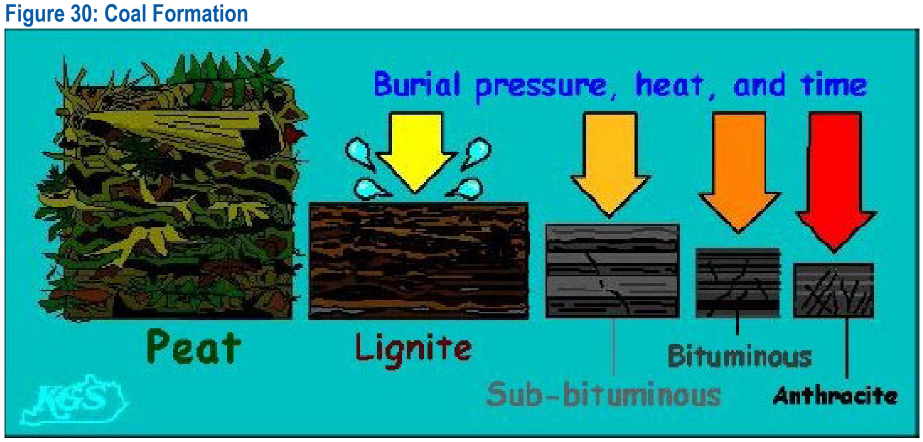
The Nuts and Bolts of the Coal Industry

Coal's origin and Ranks

Coal is formed when plant material is covered by a layer of sediment, preventing complete decomposition. The weight of the overlying layers produces various chemical changes that force out oxygen and hydrogen, leaving behind a layer of carbon-rich coal. Coal seams can be less than a millimeter thick to over 100 meters thick in some locations around the world. The term "coal" is used to describe a variety of fossilized plant materials, but no two coals are exactly alike. Heating value, ash-melting temperature, sulfur and other impurities, mechanical strength, and many other chemical and physical properties must be considered when matching specific coals to a particular application.

Coal is classified into four general categories or "ranks." They range from lignite through sub-bituminous and bituminous to anthracite, reflecting the progressive response of individual deposits of coal to increasing heat and pressure. The carbon content of coal supplies most of its heating value, but other factors also influence the amount of energy it contains per unit of weight. The amount of energy in coal is expressed in British Thermal Units (BTU) per pound.

Figure 30: Coal Formation



Source: Kentucky Geological Survey.

About 90 percent of the coal in the United States falls in the bituminous and sub-bituminous categories, which rank below anthracite and, for the most part, contain less energy per unit of weight. Bituminous coal predominates in the eastern and mid-continent coal fields, while sub-bituminous coal is generally found in the western states and Alaska.

Lignite ranks the lowest value and is the youngest of the coals. Most lignite is mined in Texas, but large deposits also are found in Montana, North Dakota, and some Gulf Coast states.

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The largest source of sub-bituminous coal is the PRB

There are four “ranks” of coal; coking coal is a subset of bituminous coal and is used primarily in the manufacture of steel; all other types are known as steam or thermal coal

Ranks of Coal

Lignite

Lignite is a geologically young coal that has the lowest carbon content (26-52%) and a heat value up to 8,300 BTUs per pound. Sometimes called brown coal, it is mainly used for electric power generation at mine mouth facilities. Germany used this “brown coal” for power generation.

Sub-bituminous

Ranking above lignite is sub-bituminous coal, with 37-56% carbon content and a heat value of 8,300-11,500 BTUs per pound. Reserves are located mainly in a half dozen western states and Alaska. Although its heat value is lower, this coal generally has a lower sulfur content than other ranks, which makes it attractive for use because it is cleaner burning.

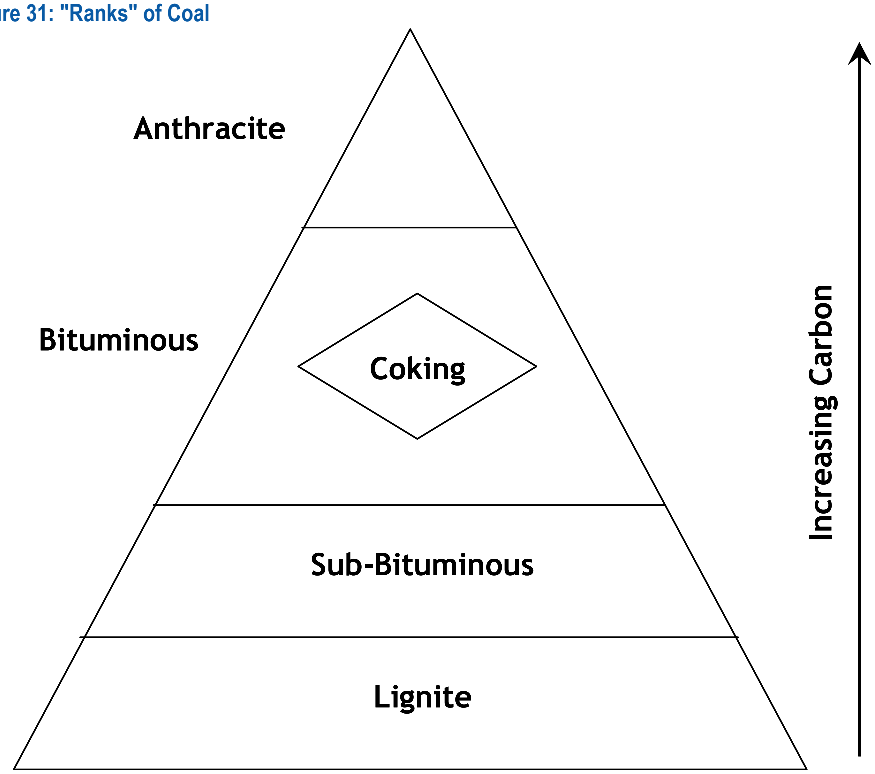
Bituminous

Bituminous coal is used primarily to generate electricity and make coke for the steel industry. Bituminous coal has a carbon content ranging from 45% to 86% and a heat value of 10,500-15,400 BTUs per pound.

Anthracite

Anthracite (“hard coal”) is coal with the highest carbon content (81-98%) and a heat value of 13,500-15,300 BTUs per pound. Most frequently associated with home heating, anthracite is a very small segment of the U.S. coal market. The major Anthracite reserves are found mostly in 11 northeastern counties in Pennsylvania.

Figure 31: "Ranks" of Coal



Source: JPMorgan

Sulfur Content

Sulfur in coal is of special interest because when burned, it forms sulfur dioxide (the source of acid rain). It occurs in coal in two ways. First, organic sulfur is chemically bonded to the carbon atoms in the coal. The organic sulfur content of most coals ranges from 0.5% to about 2% and is difficult to extract before burning. On the other hand, pyritic sulfur occurs in coal as grains of the mineral pyrite. The amount of pyritic sulfur in coal is highly variable, depending on the local geologic circumstances.

Since pyrite is held in coal simply by mechanical incorporation or physical mixing with the organic part of the coal, much of it can be removed by grinding the coal to liberate the pyrite grains, followed by relatively simple physical methods to separate the pyrite grains from the coal particles.

Moisture Content

Most coals, as they are dug from the ground, have some amount of moisture associated with them. A good portion of this moisture can be removed with gentle heating of the coal at a temperature slightly above the boiling point of water. The moisture content of coals ranges from about 5% to almost 70%. Generally, lignite has the most moisture, while anthracite has the least. Moisture is an undesirable constituent of coals because it reduces the heating value, and its weight adds to the transportation costs of coal.

Ash Content

Ash content and characteristics influence the type of coal that is suitable for a particular boiler

Ash is the non-combustible residue formed from the inorganic or mineral components of the coal. Poorer quality coal burned commercially in the United States produce about 28% ash while the best would be around 10%. The presence of ash residue is an important disadvantage for coal compared with petroleum and natural gas. Burning natural gas leaves no ash and burning even poor grades of heating oil may leave only 0.1% ash. The ash residue of coals follows no regular trend, but appears to depend in part on the local geology of the particular coal seam.

Volatile Matter

When coal that has been dried to remove its moisture, is heated in the absence of air so that it doesn’t burn, the weight of coal is further reduced. This volatile matter ranges from 2% to about 50%. In domestic stoves and furnaces or in small industrial appliances, coals containing large amounts of volatile matter are easy to ignite, but such coals tend to burn quickly and typically with a long, smoky flame. As a rule, coals with higher volatile matter contents have lower heating values.

The American Society for Testing and Materials (ASTM) classifies coals according to their carbon, volatile matter, and energy content

Table 15: Classification of Coals by Rank in the ASTM System

Class	Group	Fixed Carbon Dry %	Fixed Carbon Moist %	Volatile Matter Dry %	Volatile Matter Moist %	Energy Dry BTUs/lb	Energy Moist Mj/kg
Anthracite	Met anthracite	>98	>92	<2	<2	13,500	31.4
	Anthracite	92-98	89-95	2-8	2-8	15,300	35.5
	Semi anthracite	86-92	81-89	8-14	8-15	14,900	34.6
Bituminous	Low-volatile	78-86	73-81	14-22	13-21	15,400	35.8
	Medium-volatile	69-78	65-73	22-31	21-29	14,900	34.6
	High-volatile A	<69	58-65	>31	>30	>14,000	>32.5
	High-volatile B	57	53	57	40	13,000-14,000	30.2-32.5
	High-volatile C	54	45	54	40	10,500-13,000	24.4-30.2
Sub-bituminous	A	55	45	55	38	10,500-11,500	24.4-26.7
	B	56	43	56	35	9,500-10,500	22.1-24.4
	C	53	37	53	36	8,300-9,500	19.3-22.1
Lignite	Lignite A	52	32	35	38	6,300-8,300	14.7-19.3
(brown coal)	Lignite B	52	26	32	50	<6,300	<14.7

Source: American Society for Testing and Materials.

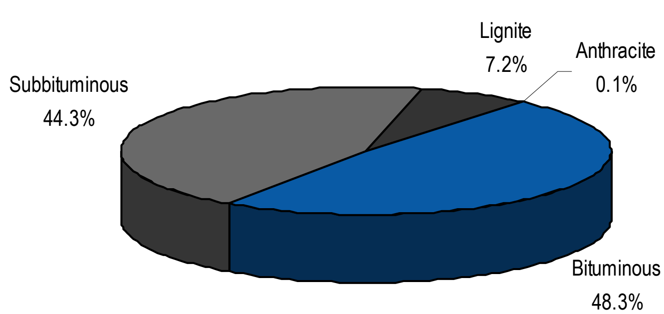
Steam versus Coking

In addition to rank, coal is also categorized into steam coal (also known as thermal coal) and coking coal (also known as metallurgical coal). Rank and the coal's mechanical properties determine whether a coal can be used as a coking coal or whether it is just a better quality steam coal. The other major difference between these two basic coal types is price. Steel makers buy the best quality coal as coking coal and pay a price that is usually about 1.5 to 2.5 times higher than the price for steam coal.

Coking or metallurgical coal has the ability to agglomerate, or fuse together, and form strong porous lumps when heated in a coke oven. Coke is made by heating certain bituminous coals in an oxygen-free *coke oven* in order to remove all the volatile hydrocarbons. Other desirable qualities of coking coal include high energy content and low contaminants. Coke is used as a fuel in steel making and other metal refining processes, where a pure, solid, high-energy content fuel is required.

The vast majority of coal produced in the United States (more than 90% of production) is **steam coal or thermal coal** and it is largely used in power stations. It is pulverized and burnt in steam generating boilers, and the steam is then used for the generation of electricity.

Figure 32: U.S. Coal Production by Coal Rank, 2006



Source: Energy Information Administration

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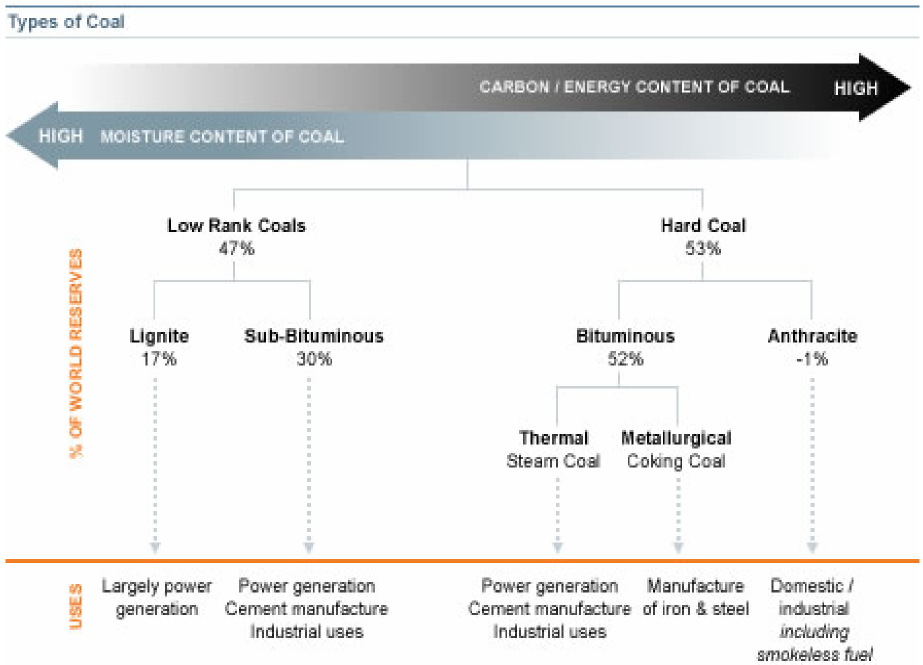
Coking Coal (or Hard-Coking Coal): A category of coal that is used in the steel industry to de-oxidize iron ore in the blast furnace.

Semi-soft Coking Coal: It is a high ash high volatile cocking coal and can be considered as a poorer quality coking coal, that is used to lower coal cost.

Pulverized Coal (PCI): When coal is ground into dust using powdered coal mill, for use in thermal plants, pulverized coal is formed.

Thermal Coal: Coal burned to generate the steam that drives turbines to generate electricity.

Figure 33: Coal types



Source: World Coal Institute

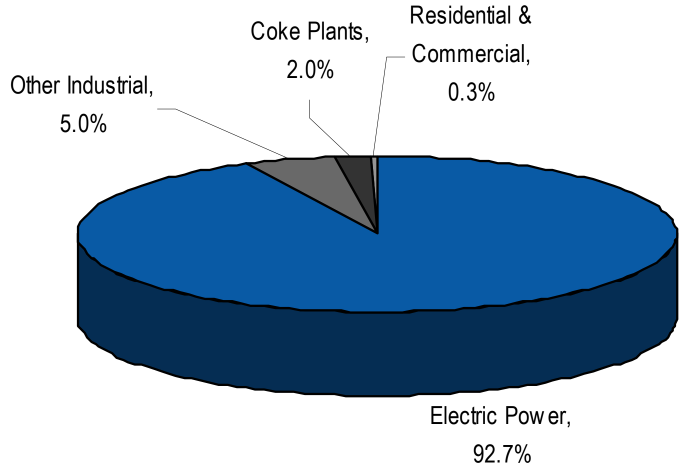
Uses for Coal

Essentially, there are three major ways to utilize coal: combustion, carbonization, and conversion.

Power producers combined consume more than 92% of domestic coal

Combustion involves burning the coal in air to liberate thermal energy (heat). The heat is used as such, for comfort or to carry out industrial processes that require high temperatures. However, the biggest use of this method by far is to generate steam for use in electric power plants. This is demonstrated in Figure 34. In the year 2007, 92.7% of the total coal produced in United States was used Electric Power plants.

Figure 34: U.S. Coal Receipts by End-Use Sector, 2007



Source: Energy Information Administration.

Coking coal – a premium product

Carbonization of coal is used in order to transform coal to coke, a key ingredient in the production of steel. Exposing coal to sufficiently high temperatures in the absence of air produces coke. 1 ton of coke production requires approximately 1.4 ton of coking coal.

What is met coal?

Metallurgical coal is the raw material source of the carbon reductant required for the liberation of iron from ore in a blast furnace environment. Coking coals are classified into three major categories - hard coking coal (HCC), semi-soft coking coal (SSCC) and pulverized injection coal (PCI). Coking coal, in general, refers to HCC and SSCC, while metallurgical coal is term including HCC, SSCC and PCI coals.

Coking coal must have qualities that allow a good strong coke to be made, such as a high swelling index, fluidity and coke strength

Table 16: Types of Coal

Coal Type	Ash % air dried	Volatile Matter % air dried	Crucible Swelling Number	Gieseler Max Fluidity ddpm	Coke Strength after Reaction %	Mean Maximum Reflectance (Ro Max) %
Hard Coking	<10.0	19-35	6-9	200-25,000	>60	1.00-1.60
Semi-hard Coking	8.0-10.5	17-26	4-6	200-5,000	55-62	0.95-1.70
Semi-soft Coking	8.0-11.0	25-41	3-8	100-30,000	45-55	0.70-0.95
Low Volatile PCI	6.0-10.5	10-18	1-2	NA	NA	1.20-3.00
High Volatile PCI	4.0-10.0	26-42	1-5	NA	NA	0.70-0.95

Source: AME Mineral Economics Group

Coking coal must have qualities that allow a good strong coke to be made, such as a high swelling index, fluidity and coke strength. The coal must also have low ash and sulfur content. **Reflectance** measures the degree of metamorphism the coal seam has been subject to and this too is an indicator of a coal's ability to form a strong coke.

Conversion of coal means converting the solid coal to a liquid fuel or a gaseous fuel to provide more leverage. As the new fuel can be used as a substitute for LNG or oil, the leverage provided could be reducing dependence on imported oil and utilizing vast coal. In theory, with carbon capture and storage, CO_2 emissions can be brought down to nearly 80% of the level of emissions caused by conventional oil products.

JPM's economic research team's estimates and those provided by the major oil forecasting agencies; highlight a significant oil supply crunch over coming years. And with growing emphasis on reducing carbon emissions, conversion seems a logical alternative to increasingly scarce and expensive oil.

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Table 17: Planned U. S. Coal & Natural Gas powered Electric Generating Unit Additions

Projects planned for September 2007 to August 2008

Initial Month of Operation	Initial Year of Operation	State	Plant	Company	Net Summer Capacity	Energy Source
9	2007	NM	Afton Generating Station	Public Service Co of NM	94.6	Natural Gas
9	2007	CA	Roseville Energy Park	City of Roseville	42.5	Natural Gas
9	2007	CA	Roseville Energy Park	City of Roseville	85	Natural Gas
9	2007	CA	Grapeland	Southern California Edison Co	40.38	Natural Gas
9	2007	CA	Mira Loma Substation	Southern California Edison Co	40.38	Natural Gas
9	2007	CA	Barre Substation	Southern California Edison Co	40.38	Natural Gas
9	2007	CA	Center Substation	Southern California Edison Co	40.38	Natural Gas
9	2007	WA	Mint Farm Generation LLC	Mint Farm Energy Center LLC	114.38	Natural Gas
9	2007	WA	Mint Farm Generation LLC	Mint Farm Energy Center LLC	159.96	Natural Gas
10	2007	CT	A L Pierce	Connecticut Mun Elec Engy Coop	71.4	Natural Gas
10	2007	MO	MJMEUC Generating Station #1	Missouri Jnt Muni.Pwr Elec. Ut. Comm.	11.31	Natural Gas
11	2007	CA	McGrath Beach	Southern California Edison Co	40.38	Natural Gas
12	2007	FL	Hines Energy Complex	Progress Energy Florida Inc	444.62	Natural Gas
12	2007	NC	Hamlet Generating Facility	North Carolina El Member Corp	61.46	Natural Gas
12	2007	OK	Southwestern	Public Service Co of Oklahoma	84.42	Natural Gas
12	2007	OK	Riverside	Public Service Co of Oklahoma	84.42	Natural Gas
12	2007	FL	Oleander Power Project LP	Southern Power Co	168.98	Natural Gas
12	2007	AR	Harry D Mattison	Southwestern Electric Power Co	73.53	Natural Gas
1	2008	AR	Elkins Generating Center	Arkansas Electric Coop Corp	18.7	Natural Gas
1	2008	WY	Wygen 2	Black Hills Power Inc	83.7	Coal
2	2008	AR	Elkins Generating Center	Arkansas Electric Coop Corp	18.7	Natural Gas
3	2008	AR	Elkins Generating Center	Arkansas Electric Coop Corp	18.7	Natural Gas
3	2008	CO	Lamar Plant	City of Lamar	17.21	Coal
3	2008	NV	Clark	Nevada Power Co	54.66	Natural Gas
4	2008	ID	Evander Andrews Power Complex	Idaho Power Co	146.88	Natural Gas
4	2008	MN	Cannon Falls Energy Center	Invenergy Cannon Falls LLC	169.15	Natural Gas
4	2008	WA	Grays Harbor Energy Facility	Invenergy LLC	150.5	Natural Gas
4	2008	WA	Grays Harbor Energy Facility	Invenergy LLC	258	Natural Gas
4	2008	TX	Victoria	NuCoastal Power Corporation	256.28	Natural Gas
5	2008	FL	Treasure Coast Energy Center	Florida Municipal Power Agency	273.48	Natural Gas
5	2008	CA	Inland Empire Energy Center	Inland Empire Energy Ctr LLC	332.65	Natural Gas
5	2008	NV	Clark	Nevada Power Co	54.66	Natural Gas
5	2008	MN	High Bridge	Northern States Power Co	169.16	Natural Gas
5	2008	MN	High Bridge	Northern States Power Co	215	Natural Gas
5	2008	CO	Plains End II LLC	Plains End Operating Services LLC	5.56	Natural Gas
5	2008	CA	San Francisco Electric Reliability Proj.	San Francisco City & County of	42.93	Natural Gas
5	2008	CA	San Francisco Intl Airport Ct Project	San Francisco City & County of	40.8	Natural Gas
5	2008	AL	H Allen Franklin Combined Cycle	Southern Power Co	174.67	Natural Gas
5	2008	AL	H Allen Franklin Combined Cycle	Southern Power Co	242.43	Natural Gas
5	2008	FL	Arvah B Hopkins	City of Tallahassee	182.75	Natural Gas
5	2008	WI	Port Washington Generating Station	Wisconsin Electric Power Co	143.62	Natural Gas
5	2008	WI	Port Washington Generating Station	Wisconsin Electric Power Co	231.34	Natural Gas
5	2008	TX	Quail Run Energy Center	Navasota Odessa Energy Partners LP	74.39	Natural Gas

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Initial Month of Operation	Initial Year of Operation	State	Plant	Company	Net Summer Capacity	Energy Source
5	2008	AZ	Black Mountain Generating Station	Unisource Energy Development Company	40.8	Natural Gas
6	2008	AZ	Yucca	Arizona Public Service Co	51.43	Natural Gas
6	2008	SD	Groton Generating Station	Basin Electric Power Coop	80.75	Natural Gas
6	2008	CA	Niland Gas Turbines	Imperial Irrigation District	39.95	Natural Gas
6	2008	OR	Klamath	Klamath Generation LLC	145.94	Natural Gas
6	2008	OR	Klamath	Klamath Generation LLC	210.27	Natural Gas
6	2008	KS	Goodman Energy Center	Midwest Energy Inc	8.2	Natural Gas
6	2008	CO	Rawhide	Platte River Power Authority	146.88	Natural Gas
6	2008	NM	Valencia Energy Facility	Public Service Co of NM	135.58	Natural Gas
6	2008	NM	Valencia Energy Facility	Public Service Co of NM	71.57	Natural Gas
6	2008	NM	Valencia Energy Facility	Public Service Co of NM	72.41	Natural Gas
6	2008	NV	Tracy	Sierra Pacific Power Co	157.38	Natural Gas
6	2008	WI	Weston	Wisconsin Public Service Corp	557.52	Coal
6	2008	KS	Emporia Energy Center	Westar Energy Inc	34	Natural Gas
6	2008	KS	Emporia Energy Center	Westar Energy Inc	158.95	Natural Gas
6	2008	NM	Hobbs Generating Station	Colorado Energy Management LLC	159.1	Natural Gas
6	2008	NM	Hobbs Generating Station	Colorado Energy Management LLC	283.8	Natural Gas
6	2008	NV	TS Power Plant	Newmont Nevada Energy Investment, LLC	206.14	Coal
6	2008	TX	Colorado Bend Energy Center	Navasota Wharton Energy Partners LP	74.39	Natural Gas
6	2008	TX	Colorado Bend Energy Center	Navasota Wharton Energy Partners LP	107.5	Natural Gas
7	2008	NV	Clark	Nevada Power Co	54.66	Natural Gas
				Total Coal Capacity Additions	**864.57**	
				Total Natural Gas Capacity Additions	**7007.05**	

Source: Energy Information Administration, Energy Information Administration-860, "Annual Electric Generator Report."

Note: Net summer Capacity is estimated.

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Coal Producing Regions in the US

Coal is mined in 32 American states, which are further classified into the following four major U.S. coal-producing regions:

Appalachia
Alabama, Eastern Kentucky, Maryland, Ohio, Pennsylvania, Tennessee, Virginia, Northern West Virginia and Southern West Virginia

Illinois Basin
Illinois, Indiana and Western Kentucky

Powder River Basin (PRB)
Wyoming and Montana

Western Bituminous Region
Alaska, Arizona, Colorado, New Mexico, North Dakota, Utah and Washington

Apart from these four major regions, *Lignite coal* is produced primarily in western North Dakota, eastern Montana and Texas.

- **Appalachian** mines produce primarily bituminous coal from both surface and underground mines. Appalachian coal tends to be high in energy content and mixed in sulfur content. Appalachian coal is further classified into **Northern Appalachian (NAPP)** coal, which has higher sulfur and heat content primarily coming from MD, OH, PA, Northern WV and **Central Appalachian (CAPP)** coal that comes from Eastern KY, VA, Southern WV.
- **Illinois Basin** mines also produce primarily bituminous coal but are generally underground operations, yielding coal that is high in both energy and sulfur content.

PRB coal, while typically lower in energy content, is known for its particularly low sulfur content

- **Powder River Basin (PRB)** coal is sub-bituminous and generally mined from the surface. PRB coal, while typically lower in energy content, is known for its particularly low sulfur content.
- **Western Bituminous Region** production includes both sub-bituminous and bituminous coal from both underground and surface mines. Heat content is generally slightly higher than in the PRB but with similar sulfur content.

Coal in the East US generally has higher heat content but higher sulfur content, as well

Table 18: Heat Content by Regional Source

Btus per lb

Region	Low	Medium	High
Northern App, Central App, Canada, Australia	<12,500	12,500 - 13,000	>13,000
Midwestern US (Illinois)	<11,600	11,600 - 12,000	>12,000
Powder River Basin	<8,400	8,400 - 8,800	>8,800
Western Bituminous	<11,000	11,000 - 12,000	>12,000

Source: CONSOL Energy.

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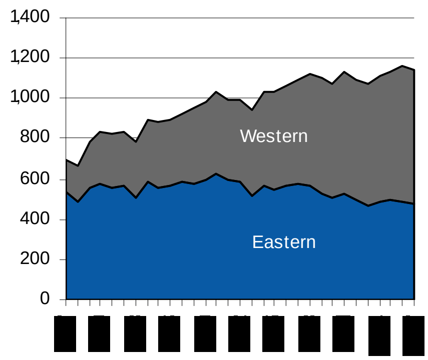
Large, productive mines in the PRB have allowed Western coal to draw nearly even with Eastern coal

Figure 35: Coal Production 1977-2007

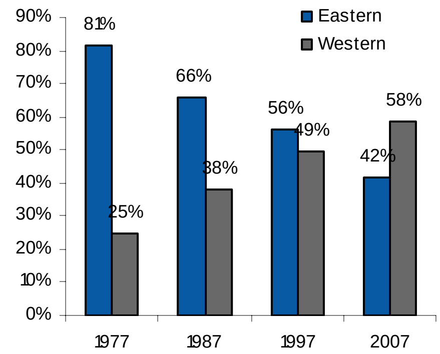
(millions of short tons)



Source: Energy Information Administration.

Figure 36: West vs. East, 1977-2007

(% of total production)



Source: Energy Information Administration.

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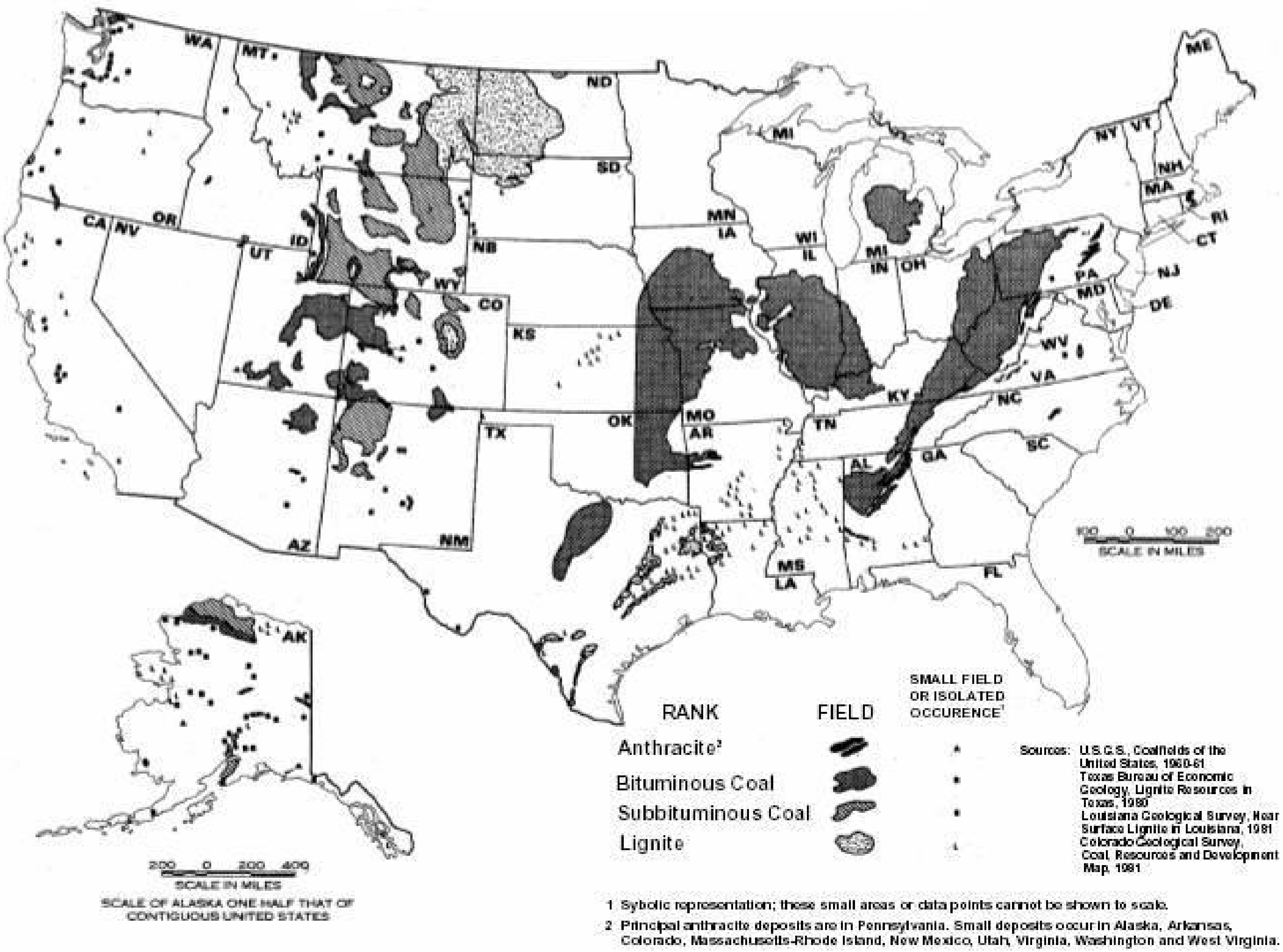
Figure 37: Major Coal Supply Regions in the United States



Source: Energy Information Administration.

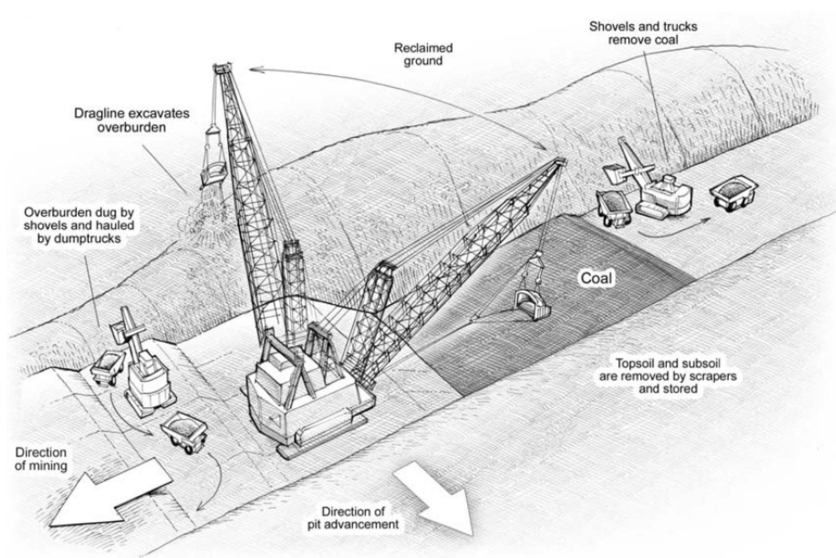
Mining the Coal

Two broad categories of mining techniques are used: surface mining and underground mining.

Surface Mining

In general, surface mining is the cheapest and most productive method of mining coal. These mining techniques can extract a higher percentage of the coal in a particular deposit. Surface mines exist in three general situations:

Figure 38: Surface mining method



Source: Arch Coal

- **Area mines**, where the terrain is flat or gently undulating and the coal seam or seams are at a relatively constant depth.
- **Contour mines**, which most often exist where the terrain is undulating and a number of coal seams exist interspersed with other strata.
- **Mountain removal**, where coal-bearing strata exist near the top of large hills or mountains. In this case, the entire mountain may be excavated to extract the coal.

Open Cut Strip Mining

In the United States, open cut mining accounts for about 69% of production; nearly 100% of the lignite and sub-bituminous coal production is obtained from strip mines. Large open cut strip mines can be a number of kilometers long and up to a kilometer wide. Most open cut mines follow a broadly similar model, although the precise technology applied varies considerably.

The first process is generally referred to as the pre-strip. Bulldozers and scrapers are used to remove the existing vegetation and roughly level the surface. Topsoil is stripped and stockpiled for use in rehabilitation works after mining is completed. Holes may be drilled in the overburden and explosive charges set and fired if the rock cannot be broken with a ripper. This weakens the overburden for easier removal in the next process.

The scale of surface mining equipment is growing – trucks like the one at the right can carry up to 360 tons

Figure 39: Surface Mining Equipment

Source: United Mineworkers of America and Terex Corporation

Sharply higher diesel costs have increased the use of electrically powered draglines

Overburden removal (stripping) is carried out by a number of methods, including dragline, excavator, shovel, or bucket wheel, depending on overburden depth and the precise characteristics of the mine. Sharply higher diesel costs have increased the use of electrically powered draglines. Removing the overburden exposes the coal seam below. When exposed, the coal seam can be mined by wheel loaders and trucks or other combinations of plant. Again, this can involve drilling and blasting to loosen the coal seam for extraction.

Table 19: Methods of Overburden Removal in Surface Mining

Method	Explanation
Dragline	A large excavation machine used in surface mining to remove overburden (layers of rock and soil) covering a coal seam. The dragline casts a very large wire rope-hung bucket at a considerable distance, collects the loose material by pulling the bucket toward itself on the ground with a second wire rope (or chain), elevates the bucket, and dumps the material on a spoil bank, in a hopper, or on a pile. It is one of the largest land-based machines in the world and is one of the lowest cost methods of removing overburden.
Shovel	Whether designed primarily for stripping or loading, the shovel has its greatest application in handling tight or poorly fractured overburden because of its crowding action, which allows a higher breakout force to be applied. Ordinarily, a shovel works from a position directly on top of a coal deposit. Combinations of shovel and truck move the overburden quickly and farther than any stripping capacity dragline. This is a more selective piece of machinery.
Bucket Wheel	The largest, most complicated, and under favorable conditions, the most productive excavating machines used in surface mining. They very effectively remove unconsolidated overburden such as earth glacial till, clay, and soft shale that does not require blasting. The machine can excavate material from a highwall on one side of a mine and deposit as spoil at the rate of 1,500 to 2,000 yd^3/hour up to 426 feet away on the opposite side of the pit. These are used extensively in the German lignite mines.

Source: JPMorgan

In contrast to earlier mistakes, modern strip mining can leave the land more productive than before mining. The topsoil can be replaced, and with drainage, fertilizing, watering, and seeding of new plants, the mined land can be restored to provide an attractive and productive plant community.

Highwall Mining

This technique may be adopted in the late stages of area mines or contour mines. It is used to recover additional resources that cannot be extracted economically by further surface mining. A remote-controlled auger or continuous miner is bored into the exposed coal seam in the highwall of an open cut and extracts coal on to a conveyor system.

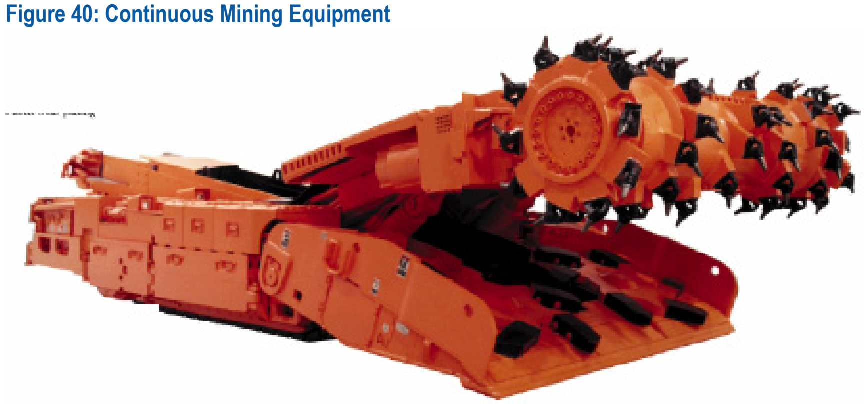
Underground Mining

Continuous mining

Although mines can exclusively use the continuous mining method, continuous mining is generally one element of many in the total underground mining approach. Typically, continuous mining machines are used in development work on roads and ventilation tunnels, prior to the use of a different technique for extracting the coal.

Continuous mining equipment such as this can be used exclusively in a given mine but is more typically used in conjunction with other mining equipment and methods such as longwall mining

Figure 40: Continuous Mining Equipment



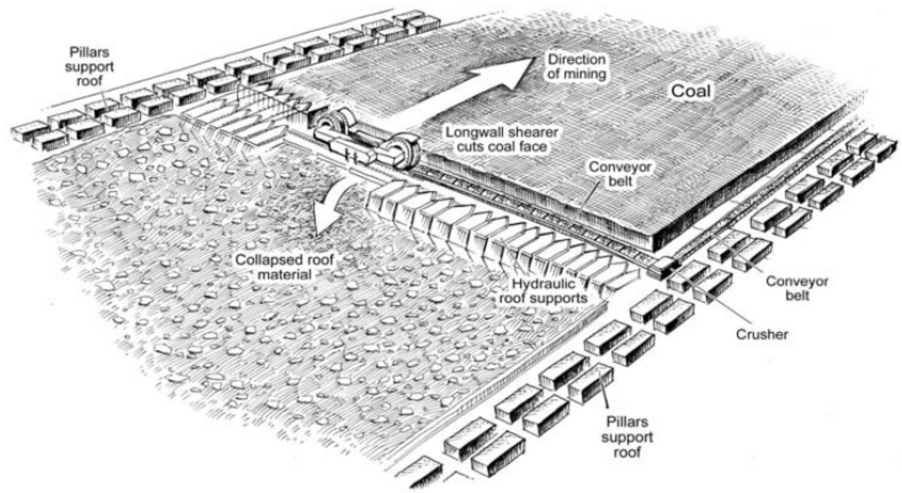
Source: Joy Mining Machinery.

Continuous mining machines cut two parallel entries into the coal seam and then join the two with a crosscut; longwall machinery is then used to mine the coal along the crosscut as it advances further into the coal seam, and the roof area is allowed to collapse as the machinery advances

Longwall Mining

In the longwall method, mechanized mining equipment is used to tear the coal away from the seam face. Where the coal seam is geologically uncomplicated, this is normally the lowest cost underground mining method and can compete with higher strip ratio open cut mines. Continuous mining machines are often used in development work on roadways and ventilation tunnels. Two parallel access roads are developed directly into the coal seam from a central access system, typically using a continuous miner. The two entries, which can be up to 200 meters apart, are then joined by a crosscut tunnel at their far ends. The face that is formed by this crosscut is the longwall. A longwall mining machine is installed in the crosscut. Typically, this machine has a rotating shearer laced with picks, which moves laterally and vertically, shearing the coal from the face. The coal falls off the face on to a conveyor belt, is extracted continuously from the face, and transported to the surface by conveyor.

Figure 41: Diagram of Longwall Mining Operation



Source: Arch Coal.

Longwall systems are safer than many other mining methods since they generally have their own self-advancing hydraulic roof supports. This means that the face workers are always protected by steel roof supports. As the machine advances and mining proceeds, the roof is allowed to fall behind the advancing machine. This fallen roof material is referred to as gob and may contain both coal and other material in varying amounts.

Longwall mining is more efficient than room-and-pillar mining as it allows the recovery of almost all the coal, but its use is restricted to mining situations that can physically accommodate the large machinery used. Underground mining is less productive than strip mining. However, if the coal is deep and of good quality, underground mining may be cost-effective.

Longwall mining equipment like the one shown here is generally the most efficient for underground mining; however, the mine must be able to accommodate the large equipment

Figure 42: Longwall Mining Equipment

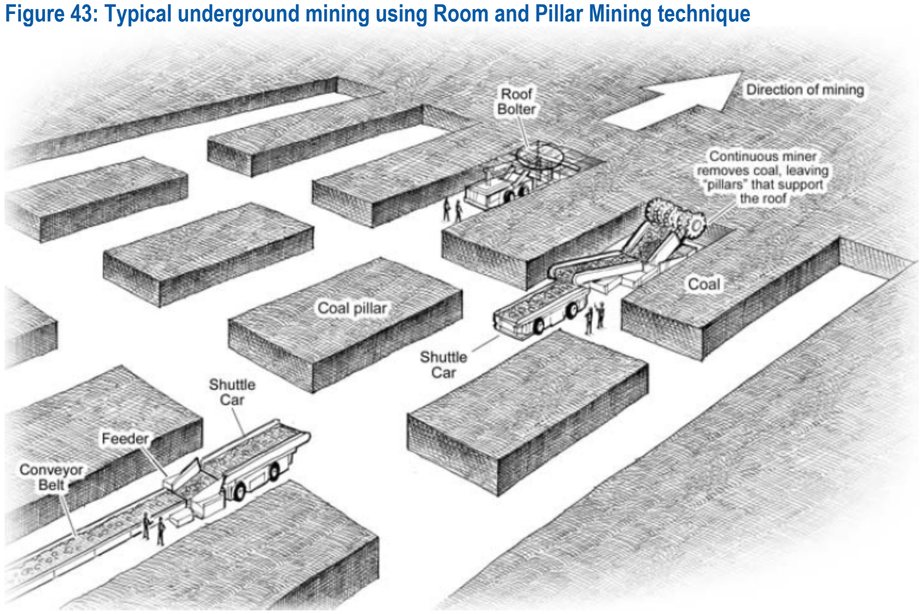
Source: Coal Leader

Room and Pillar

Underground mining is generally performed by one of two methods. The room and pillar method is the traditional method and cuts “rooms” into the coal seam and leaves large pillars of un-mined coal standing to help support the roof. Leaving these pillars of coal means that only about 60% of the coal in a seam is actually extracted. As a result, the exclusive use of this method is viewed as not competitive and is growing less common. However, it is still used where the coal seam is badly faulted and is therefore unsuitable for longwall mining.

The room and pillar method for underground mining leaves large deposits of coal behind and is used where longwall mining is not feasible

Figure 43: Typical underground mining using Room and Pillar Mining technique



Source: Arch Coal

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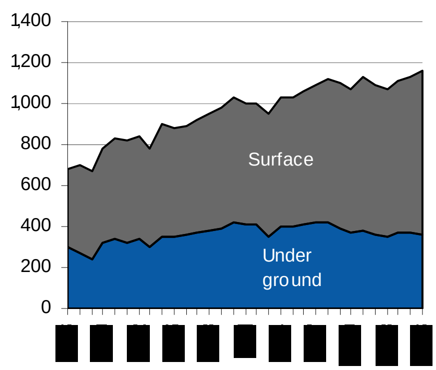
Large surface mines, primarily in the West, have contributed to the growth in production for surface mines compared with underground mines

Figure 44: Coal Production 1976-2006

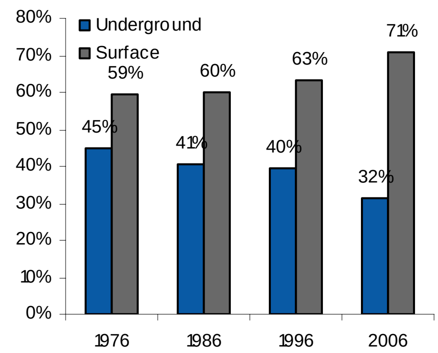
(millions of short tons)



Source: Energy Information Administration.

Figure 45: Underground vs. Surface, 1976-2006

(% of total production)



Source: Energy Information Administration.

Surface mining has benefited from greater technological advances than underground mining in the last 30 years as surface mining machines have become bigger and more productive. Together with the growth in mining of PRB compliance coal, this has led to surface tonnages more than doubling since 1970.

Pricing

Coal typically is sold on contract for terms that range from a single shipment to multi-year agreements for millions of tons, in conjunction with spot purchases to supplement the demand. For this reason, the spot market represents a smaller portion (less than 10%) of the total coal sold in the United States. Contracts that formally identified the mine are becoming more flexible and can allow the coal to be sourced from more than one mine.

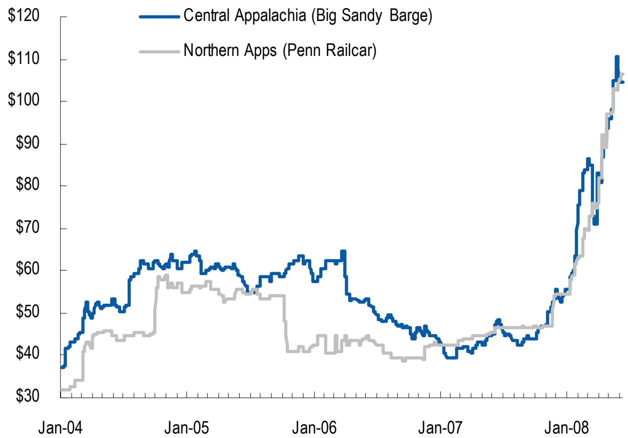
The price of coal is primarily dependent on three factors: heat content, sulfur content, and location. First, coal with higher heat content will have a higher price. In the case of sulfur, given the new restrictions for the release of sulfur dioxide, coal that has lower sulfur content will fetch a higher price than coal with higher sulfur content. Therefore, the lower the sulfur content, the higher the price for the coal.

With increasing use of scrubbers, the utilities are now able to burn high sulfur coal and still meet the restrictions of sulfur emission. Thus, the price differential due to sulfur content will gradually diminish as more capacities get scrubbed.

The third factor to consider when evaluating prices for coal is the source of the coal and where that coal will be used. Coal consumed in the US is usually sold at the mine and transportation costs are borne by the producer. This has to be taken into account because transportation costs are often a major factor in the price paid by the customer for the coal. For example, while the price for coal from the Powder River Basin might be attractive compared with coal in the East, the costs of transportation for a user in the East would make it prohibitive to actually use the PRB coal.

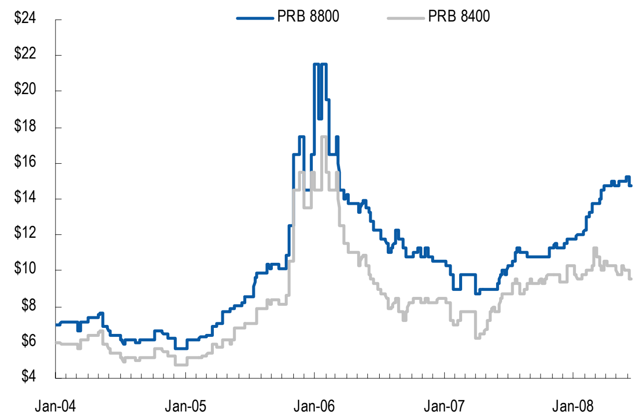
Eastern US coal prices are at their all time highs driven by the tight Asia-Pacific market and PRB and Western Bituminous seem to be catching up.

Figure 46: Eastern US Coal Prices



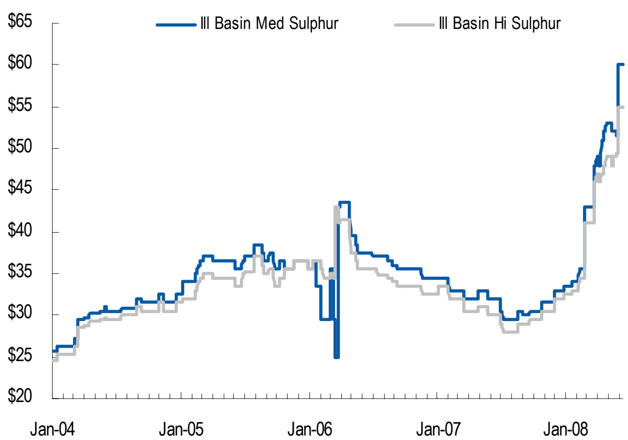
Source: Bloomberg

Figure 47: Powder River Basin Coal Prices



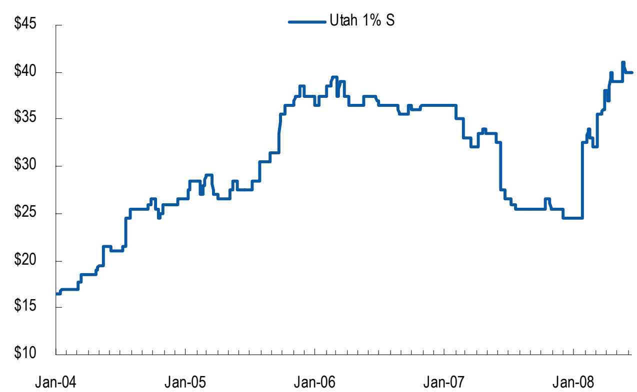
Source: Bloomberg

Figure 48: Illinois Basin Coal Prices



Source: Bloomberg

Figure 49: Western US Coal Prices



Source: Bloomberg

Table 20: Summary of Coal Prices in US

	Current 10-Jun-08	Wk Ago 03-Jun-08	Mth Ago 11-May-08	Year Ago 11-Jun-07	Year End 31-Dec-07	Wk Chg	Mth Chg	YoY Chg	YTD Chg
Big Sandy	$104.50	$104.50	$98.00	$47.50	$55.50	0.0%	6.6%	120.0%	88.3%
Penn Rail	$106.50	$105.50	$97.50	$46.50	$54.50	0.9%	9.2%	129.0%	95.4%
PRB 8800	$14.75	$15.25	$15.00	$9.75	$11.75	(3.3%)	(1.7%)	51.3%	25.5%
PRB 8400	$9.50	$10.00	$9.75	$8.50	$10.25	(5.0%)	(2.6%)	11.8%	(7.3%)
Utah	$40.00	$40.00	$39.00	$27.50	$24.50	0.0%	2.6%	45.5%	63.3%
Ill Medium	$60.00	$60.00	$52.00	$32.00	$33.50	0.0%	15.4%	87.5%	79.1%
Ill High	$55.00	$55.00	$48.00	$30.00	$32.50	0.0%	14.6%	83.3%	69.2%

Source: Bloomberg

Coal Industry Environmental Legislation

The coal mining industry is subject to regulation by federal, state, and local authorities on matters such as:

- employee health and safety
- permitting and licensing requirements
- air quality standards
- water pollution
- plant and wildlife protection
- reclamation and restoration of properties after mining operations are completed
- discharge of materials into the environment
- surface subsidence from underground mining
- effects of mining operations on groundwater quality and availability

In addition, the utility industry is subject to extensive regulation regarding the environmental impact of its power generation activities.

The Clean Air Act Amendments of 1990
Sulfur Dioxide Emissions
Title IV of the Clean Air Act Amendments of 1990 indirectly affects coal mining operations by extensively regulating the air emissions of coal-fueled electric power generating plants. The Clean Air Act requires reduction of sulfur dioxide emissions from electric power generation plants in two phases.

Phase I, which began on January 1, 1995, applies to the 110 utility plants that emit the most sulfur dioxide. These plants emit more than 2.5 pounds of sulfur dioxide per million BTU and are larger than 100 megawatts. Title IV set forth the individual emissions caps for these plants in order to achieve a 3.5 million ton reduction in sulfur dioxide emissions.

Phase II, which began on January 1, 2000, mandated an additional annual emissions reduction of approximately five million tons. Phase II applies to all Phase I plants and every other utility plant that emits more than 1.2 pounds of sulfur dioxide per million BTU and is larger than 75 megawatts.

The affected utilities will be able to meet these requirements by switching to lower sulfur fuels, by installing pollution-control devices such as scrubbers, by reducing electricity generating levels, or by purchasing or trading so-called pollution “credits.” Specific emissions sources receive these “credits,” which utilities and industrial concerns can trade or sell to allow other units to emit higher levels of sulfur dioxide.

Title IV requires the EPA to allocate allowances annually to existing facilities in an amount equal to their annual tonnage emissions caps. For example, an existing plant with an annual emissions cap of 10,000 tons will receive 10,000 allowances each year. New facilities, on the other hand, do not receive yearly allowances from the EPA and must obtain the necessary allowances from other sources. Beginning in 2000, the EPA may not allocate annual allowances that would result in an excess of

8.9 million tons of sulfur dioxide emissions. The actual number of allowances in existence at any one time may be greater than 8.9 million tons, however, because the annual allotment will not include any outstanding allowances that were carried forward from previous years and held for future use.

The sulfur dioxide emissions reduction requirements were projected to increase the demand for low-sulfur coal and potentially decrease demand for high-sulfur coal, however use of scrubbers has prevented prices of high-sulfur coal from diminishing and sulfur dioxide emission from increasing.

Nitrogen Oxide Emissions
Emission of nitrogen oxides are precursors of ozone. The Environmental Protection Agency required 22 eastern states to make substantial reductions in these emissions by 2003 by requiring power plants to install "reasonably available control technology" and additional control measures.

Clean Air Interest Rule and Clean Air Mercury Rule
Clean Air Interest Rule requires further reduction of sulfur dioxide and nitrogen oxide emissions from electricity generating plants in 28 states and the District of Columbia over two rounds in 2009-10 and 2015. It is projected to reduce sulfur dioxide from power plants by approximately 73% and nitrogen oxide emissions by approximately 61% from 2003 levels.

Clean Air Mercury Rule aims to permanently cap and reduce nationwide mercury emissions from coal fired plants by 2018, thereby reducing mercury emissions nearly by 70%. The act contained standards of performance limiting mercury emissions using a cap-and-trade program.

New Source Review
New source review (NSR) is intended to ensure that progress towards emissions control is not degraded by new plants, and defined by the EPA below.

"First, it ensures that air quality is not significantly degraded from the addition of new and modified factories, industrial boilers and power plants. In areas with unhealthy air, NSR assures that new emissions do not slow progress toward cleaner air. In areas with clean air, especially pristine areas like national parks, NSR assures that new emissions do not significantly worsen air quality."

However, uncertainty on the NSR rules has led to litigation between utilities and the EPA and does seem to have slowed the natural de-bottlenecking of existing power generating capacity helped by technology advancements.

Black Lung
As part of the Mine Health and Safety Act of 1969 and the Mine Safety and Health Act of 1977, the Black Lung Benefits Acts require payments of benefits by all businesses conducting current mining operations to coal miners with black lung and to certain survivors of a miner who dies from black lung. In order to compensate 1) miners who are totally disabled owing to black lung and 2) certain survivors of miners who died from the disease and who were last employed as miners prior to 1970, or where no responsible coal mine operator has been identified for claims where the miner's last coal employment was after December 31, 1969, the Black Lung Benefits Acts levy a tax on production of $1.10 per ton for deep-mined coal

and $0.55 per ton for surface-mined coal, but the tax is not to exceed 4.4% of the sales price. In addition, the Black Lung Benefits Acts provide that certain claims for which coal operators had previously been responsible will be obligations of the government trust funded by the tax.

The Revenue Act of 1987 extended the termination date of the tax from January 1, 1996 to January 1, 2014, or the date on which the government trust becomes solvent, whichever is earlier.

Kyoto Protocol

The United States and more than 160 other nations are signatories to the 1992 Framework Convention on Global Climate Change, which is intended to limit or capture emissions of greenhouse gases, such as carbon dioxide. The Kyoto Protocol, drafted in December 1997 under the auspices of the United Nations Framework Convention on Climate Change, raised the public profile of climate change issues in the United States in general and of emissions estimates in particular.

Although the U.S. Senate has not yet ratified the Kyoto Protocol and no comprehensive regulations controlling greenhouse gas emissions have been enacted, efforts to control greenhouse gas emissions could affect the use of coal if electric power generators switch to lower carbon sources of fuel.

If US were to ratify Kyoto protocol, it would be required to reduce greenhouse gas emission to 93% of 1990 levels from 2008 to 2012.

Surface Mining Restrictions

Surface Mining Control and Reclamation Act

The Surface Mining Control and Reclamation Act establishes operational, reclamation, and closure standards for all aspects of surface mining as well as most aspects of deep mining. The Act requires that comprehensive environmental protection and reclamation standards be met during the course of and upon completion of mining activities. Permits for all mining operations must be obtained from the Federal Office of Surface Mining Reclamation and Enforcement or, where state regulatory agencies have adopted federally approved state programs under the act, the appropriate state regulatory authority.

The Act and similar state statutes, among other things, require that mined property be restored in accordance with specified standards and approved reclamation plans. The act requires companies to restore the surface to approximate the original contours as soon as practicable upon completion of mining operations. The mine operator must submit a bond or otherwise secure the performance of these reclamation obligations. The earliest a reclamation bond can be released is five years after reclamation has been achieved. All states impose on mine operators the responsibility for repairing or compensating for damage occurring on the surface as a result of mine subsidence or as a consequence of longwall mining.

In addition, the Abandoned Mine Lands Act, which is part of the Surface Mining Control and Reclamation Act, imposes a tax on all current mining operations, the proceeds of which are used to restore mines closed before 1977. The maximum tax is $0.35 per ton on surface-mined coal and $0.15 per ton on underground-mined coal through September 30, 2007. Pursuant to the Tax Relief and Health Care Act of

2006, from October 1, 2007 through September 30, 2012, the fee will be $0.315 per ton on surface-mined coal and $0.135 per ton on underground-mined coal.

Under the Surface Mining Control and Reclamation Act, responsibility for unabated violations, unpaid civil penalties, and unpaid reclamation fees of independent contract mine operators can be imputed to other companies that are deemed, according to the regulations, to have “owned” or “controlled” the contract mine operator. Sanctions against the “owner” or “controller” are quite severe and can include being blocked from receiving new permits and revocation of any permits that have been issued since the time of the violations or, in the case of civil penalties and reclamation fees, since the time such amounts became due.

West Virginia Mountaintop Mining

State interpretations of Federal regulations in the late 1990s allowed increases in the numbers and sizes of steep slope surface mining operations, including extensive mountain-top removal (MTR) complexes, primarily in West Virginia. Where feasible, steep slope mines and MTR complexes are more efficient than their more moderately scaled competitors because they tend to achieve higher recovery rates from greater numbers of multiple coalbeds than conventional contour mines. However, they produce large amounts of disturbed rock. In recent years, mine operators have been allowed to dispose of these in “valley fills” where, with certain subsurface drainage preparations; they fill in proximate natural stream valleys and create relatively level reclaimed land.

On October 20, 1999, the United States District Court for the Southern District of West Virginia issued an injunction that prohibits the construction of valley fills over both intermittent and perennial stream segments as part of mining operations. Numerous mining operations utilize valley fills to dispose of excess materials mined during coal production. This decision is now under appeal to the Fourth Circuit Court of Appeals, and the District Court has issued a stay of its decision pending the outcome of the appeal.

The Energy Policy Act of 2005

This act contains tax incentives and directed spending to an estimated $14.1 billion to stimulate supply side energy growth and efficiency. The EPACT programs and incentives include funding to demonstrate technologies like coal gasification and IGCC. The act authorizes the Department of Defense to meet its fuel requirements through muti-year contracts.

Glossary of Terms

Acid deposition or acid rain – Refers loosely to a mixture of wet and dry "deposition" (deposited material) from the atmosphere containing higher than normal amount of nitric and sulfuric acids. The precursors or chemical forerunners of acid rain formation result from both natural sources, such as volcanoes and decaying vegetation, and man-made sources, primarily emissions of sulfur and nitrogen oxides resulting from fossil fuel combustion.

Acid mine water – Mine water that contains free sulfuric acid, mainly owing to the weathering of iron pyrites.

ARA – Antwerp/Rotterdam/Amsterdam the main coal import hub for Europe.

Auger – A rotary drill that uses a screw device to penetrate, break, and then transport the drilled material (coal).

Belt conveyor – A looped belt on which coal or other materials can be carried and which is generally constructed of flame-resistant material or of reinforced rubber or rubber-like substance.

Bench – One of to or more divisions of a coal seam separated by slate or formed by the process of cutting the coal.

Bituminous coal – A middle rank coal (between sub-bituminous and anthracite) formed by additional pressure and heat on lignite, and this generally improves its BTU value.

Brattice or brattice cloth – Fire-resistant fabric or plastic partition used in a mine passage to confine the air and force it into the working place. Also termed "line brattice," "line canvas," or "line curtain."

Calorific value – The heating value or calorific value of a substance, usually a fuel or food, is the amount of heat released during the combustion of a specified amount of it. The calorific value is a characteristic for each substance. It is measured in units of energy per unit of the substance, usually mass, such as: kcal/kg, kJ/kg, J/mol, Btu/m^3.

Cape size – A ship of about 80,000t DWT that is too big to pass the Panama canal, and must pass round the Cape of Good Hope.

Car – A railway wagon, especially any of the wagons adapted to carrying coal, ore, and waste underground.

Carbon Sequestration -The uptake and storage of atmospheric carbon in, for example, soil and vegetation.

Cast – A directed explosive blast, in strip-mining, the overburden is cast from the coal to the previously mined area by using special detonation patterns or extra explosives..

Chain conveyor – A conveyor on which the material is moved along solid pans (troughs) by the action of scraper crossbars attached to powered chains.

CIF – Cost, Insurance Freight a payment method for bulk cargos such as coal where the seller pays for the transport of the product to the buyer.

Clean Air Act Amendments of 1990 – A comprehensive set of amendments to the federal law governing the nation's air quality. The Clean Air Act was originally passed in 1970 to address significant air pollution problems in our cities. The 1990 amendments broadened and strengthened the original law to address specific problems such as acid deposition, urban smog, hazardous air pollutants, and stratospheric ozone depletion.

Clean Coal Technologies – A number of innovative, new technologies designed to use coal in a more efficient and cost-effective manner while enhancing environmental protection. Several promising technologies include fluidized-bed combustion, integrated gasification combined cycle, limestone injection multi-stage burner, enhanced flue gas desulfurization (or "scrubbing"), coal liquefaction, and coal gasification.

Coal – A solid, brittle, more or less distinctly stratified combustible carbonaceous rock, formed by partial to complete decomposition of vegetation; varies in color from dark brown to black; not fusible without decomposition and very insoluble.

Coal Gasification – The conversion of coal into a gaseous fuel which is predominantly Carbon Monoxide and hydrogen with some synthetic methane.

Coal-to-liquids (CTL) – The process of converting coal to petroleum-like hydrocarbon liquids which can be substituted for the standard liquid or solid fuels.

Coal washing – The process of separating undesirable materials from coal based on differences in densities. Pyritic sulfur, or sulfur combined with iron, is heavier and sinks in heavy media (magnetite) while coal is lighter and floats.

Coke – A hard, dry carbon substance produced by heating coal to a very high temperature in the absence of air in a coke oven.

Continuous miner – A machine that constantly extracts coal while it loads it. This is to be distinguished from a conventional, or cyclic, unit, which must stop the extraction process in order for loading to commence.

Contour mining– In this method coal is extracted where it outcrops on the side of an hill in a small open pit that will often appear to follow the contour around the hill. It's a little like taking the cream filling from the edge of a dome topped cake.

Conveyor – An apparatus for moving material from one point to another in a continuous fashion. This is accomplished with an endless (that is, looped) procession of hooks, buckets, wide rubber belt, etc.

Crop coal – Coal at the outcrop of the seam. It is usually considered of inferior quality due to partial oxidation, although this is not always the case.

Crusher – A machine for crushing rock or other materials. Among the various types of crushers are the ball mill, gyratory crusher, Handsel mill, hammer mill, jaw crusher, rod mill, rolls, stamp mill, and tube mill.

Demurrage – Compensation paid by the charterer to the vessel's owner unusual delays awaiting the cargo.

Dragline – A large excavation machine used in surface mining to remove overburden (layers of rock and soil) covering a coal seam. The dragline casts a wire rope-hung bucket a considerable distance, collects the dug material by pulling the bucket toward itself on the ground with a second wire rope (or chain), elevates the bucket, and dumps the material on a spoil bank, in a hopper, or on a pile on land where the coal has been extracted.

Fire damp – The combustible gas, methane, CH4. Also, the explosive methane-air mixtures with 5-15% methane. A combustible gas formed in mines by decomposition of coal or other carbonaceous matter, and that consists chiefly of methane.

Flue Gas Desulfurization – Any of several forms of chemical/physical processes that remove sulfur compounds formed during coal combustion. The devices, commonly called "scrubbers," combine the sulfur in gaseous emissions with another chemical medium to form inert "sludge," which must then be removed for disposal.

Fluidized Bed Combustion – A process with a high degree of ability to remove sulfur from coal during combustion. Crushed coal and limestone are suspended in the bottom of a boiler by an upward stream of hot air. The coal is burned in this bubbling, liquid-like (or "fluidized") mixture. Rather than released as emissions, sulfur from combustion gases combines with the limestone to form a solid compound recovered with the ash.

Fly ash – The finely divided particles of ash suspended in gases resulting from the combustion of fuel. Electrostatic precipitators are used to remove fly ash from the gases prior to the release from a power plant's smokestack.

FOB – Free on Board, a sales method where the seller of a bulk cargo is responsible to deliver the product on to the boat chartered by the buyer and the buyer pays the freight to its facility.

Force Majeure – A circumstance beyond reasonable control of the seller. Normally once Force Majeure is declared the seller is protected from penalties associated with its contractual commitments.

Gasification – Any of various processes by which coal is turned into low, medium, or high BTU gases. This product can then be used to produce power directly, or it can be converted into liquid fuels or other higher value chemical products. see also coal gasification.

Highwall – The unexcavated face of exposed overburden and coal in a surface mine or in a face or bank on the uphill side of a contour mine excavation. This mining method is typically low cost.

Highwall miner – A highwall mining system consists of a remotely controlled continuous miner which extracts coal and conveys it via augers, belt or chain conveyors to the outside. The cut is typically a rectangular, horizontal cut from a highwall bench, reaching depths of several hundred feet or deeper.

Integrated Gasification Combined Cycle (IGCC) – IGCC is an innovative electric power generation concept that combines modern coal gasification technology with both gas turbine and steam turbine power generation.

Liquefaction – The process of converting coal into a synthetic fuel, similar in nature to crude oil and/or refined products, such as gasoline.

Longwall Mining – One of three major underground coal mining methods currently in use. Employs a steal plow, or rotating toothed drum, which is pulled mechanically back and forth across a face of coal that is usually several hundred feet long. The loosened coal falls onto a conveyor for removal from the mine.

Methane – A flammable gas formed naturally from the decay of vegetative matter, similar to that which formed coal. Methane, which is the principal component of natural gas, is frequently encountered in underground coal mining operations and is normally kept within safe limits through the use of extensive mine ventilation systems.

Mine mouth electric plant – A coal burning electric-generating plant built near a coal mine to minimize transport cost.

MSHA – Mine Safety and Health Administration; the federal agency which regulates coal mine health and safety.

Outcrop – Coal that appears at or near the surface.

Overburden – Layers of soil and rock covering a coal seam. Overburden is removed prior to surface mining and replaced after the coal is taken from the seam.

Panel – A coal mining block that generally comprises one operating unit.

Panamax – A vessel between 60,000DWT and 80,000DWT which is capable of transiting the Panama canal

Peat – The partially decayed plant matter found in swamps and bogs, one of the earliest stages of coal formation.

Permit – As it pertains to mining, a document issued by a regulatory agency that gives approval for mining operations to take place.

Pillar – An area of coal left to support the overlying strata in a mine; sometimes left permanently to support surface structures.

Portal – The structure surrounding the immediate entrance to a mine; the mouth of an adit or tunnel.

Preparation plant – A place where coal is cleaned, sized, and prepared for market.

Ramp – A secondary or tertiary inclined opening, driven to connect levels, usually driven in a downward direction, and used for haulage.

Reclamation – The restoration of land and environmental values to a surface mine site after the coal is extracted. Reclamation operations are usually underway as soon as the coal has been removed from a mine site. The process includes restoring the land to its approximate original appearance by restoring topsoil and planting native grasses and groundcovers.

Recovery – The proportion or percentage of coal or ore mined from the original seam or deposit.

Reserve – That portion of the identified coal resource that can be economically mined at the time of determination. The reserve is derived by applying a recovery factor to that component of the identified coal resource designated as the reserve base.

Resin bolting – A method of permanent roof support in which steel rods are grouted with resin.

Resources – Concentrations of coal in such forms that economic extraction is currently or may become feasible. Coal resources broken down by identified and undiscovered resources. Identified coal resources are classified as demonstrated and inferred. Demonstrated resources are further broken down as measured and indicated. Undiscovered resources are broken down as hypothetical and speculative.

Respirable dust – Dust particles five microns or less in size.

Retreat mining – A system of robbing pillars in which the robbing line, or line through the faces of the pillars being extracted, retreats from the boundary toward the shaft or mine mouth.

Return – The air or ventilation that has passed through all the working faces of a split.

Rib – The side of a pillar or the wall of an entry. The solid coal on the side of any underground passage. Same as rib pillar.

Roof bolt – A long steel bolt driven into the roof of underground excavations to support the roof, preventing and limiting the extent of roof falls. The unit consists of the bolt (up to 4 feet long), steel plate, expansion shell, and pal nut. The use of roof bolts eliminates the need for timbering by fastening together, or “laminating,” several weaker layers of roof strata to build a “beam.”

Roof fall – A coal mine cave-in especially in permanent areas such as entries.

Roof support – Posts, jacks, roof bolts and beams used to support the rock overlying a coal seam in an underground mine. A good roof support plan is part of mine safety and coal extraction.

Room and pillar mining – A method of underground mining in which approximately half of the coal is left in place to support the roof of the active mining area. Large "pillars" are left while "rooms" of coal are extracted..

Royalty – The payment of a certain stipulated sum on the mineral produced.

Run-of-mine – Raw material as it exists in the mine; average grade or quality.

Scrubber – Any of several forms of chemical/physical devices that remove sulfur compounds formed during coal combustion. These devices, technically know as flue gas de-sulfurization systems, combine the sulfur in gaseous emissions with another chemical medium to form inert "sludge," which must then be removed for disposal.

Seam – A stratum or bed of coal.

Self-rescuer – A small filtering device carried by a coal miner underground, either on his belt or in his pocket, to provide him with immediate protection against carbon monoxide and smoke in case of a mine fire or explosion. It is a small canister with a mouthpiece directly attached to it. The wearer breathes through the mouth, the nose being closed by a clip. The canister contains a layer of fused calcium chloride that absorbs water vapor from the mine air. The device is used for escape purposes only because it does not sustain life in atmospheres containing deficient oxygen. The length of time a self-rescuer can be used is governed mainly by the humidity in the mine air, usually between 30 minutes and one hour.

Shaft – A primary vertical or non-vertical opening through mine strata used for ventilation or drainage and/or for hoisting of personnel or materials; connects the surface with underground workings.

Shaft mine – An underground mine in which the main entry or access is by means of a vertical shaft.

Shearer – A mining machine for long-wall faces that uses a rotating action to "shear" the material from the face as it progresses along the face.

Shuttle car – A self-discharging truck, generally with rubber tires or caterpillar-type treads, used for receiving coal from the loading or mining machine and transferring it to an underground loading point, mine railway or belt conveyor system.

Skip – A car being hoisted from a slope or shaft.

Slope mine – An underground mine with an opening that slopes upward or downward to the coal seam.

Specific gravity – The weight of a substance compared with the weight of an equal volume of pure water at four degrees Celsius.

Stripping ratio – The unit amount of overburden that must be removed to gain access to a similar unit amount of coal or mineral material.

Sub-bituminous, (Western coal) – Coal of a rank intermediate between lignite and bituminous.

Surface mine – A mine in which the coal lies near the surface and can be extracted by removing the covering layers of rock and soil.

Ton – A short or net ton is equal to 2,000 pounds; a long or British ton is 2,240 pounds; a metric ton (tonne) is approximately 2,205 pounds.

Undercut – To cut below or undermine the coal face by chipping away the coal by pick or mining machine. In some localities the terms “undermine” or “underhole” are used.

Unit train – A long train of 60-150 or more hopper cars, carrying only coal between a single mine and destination.

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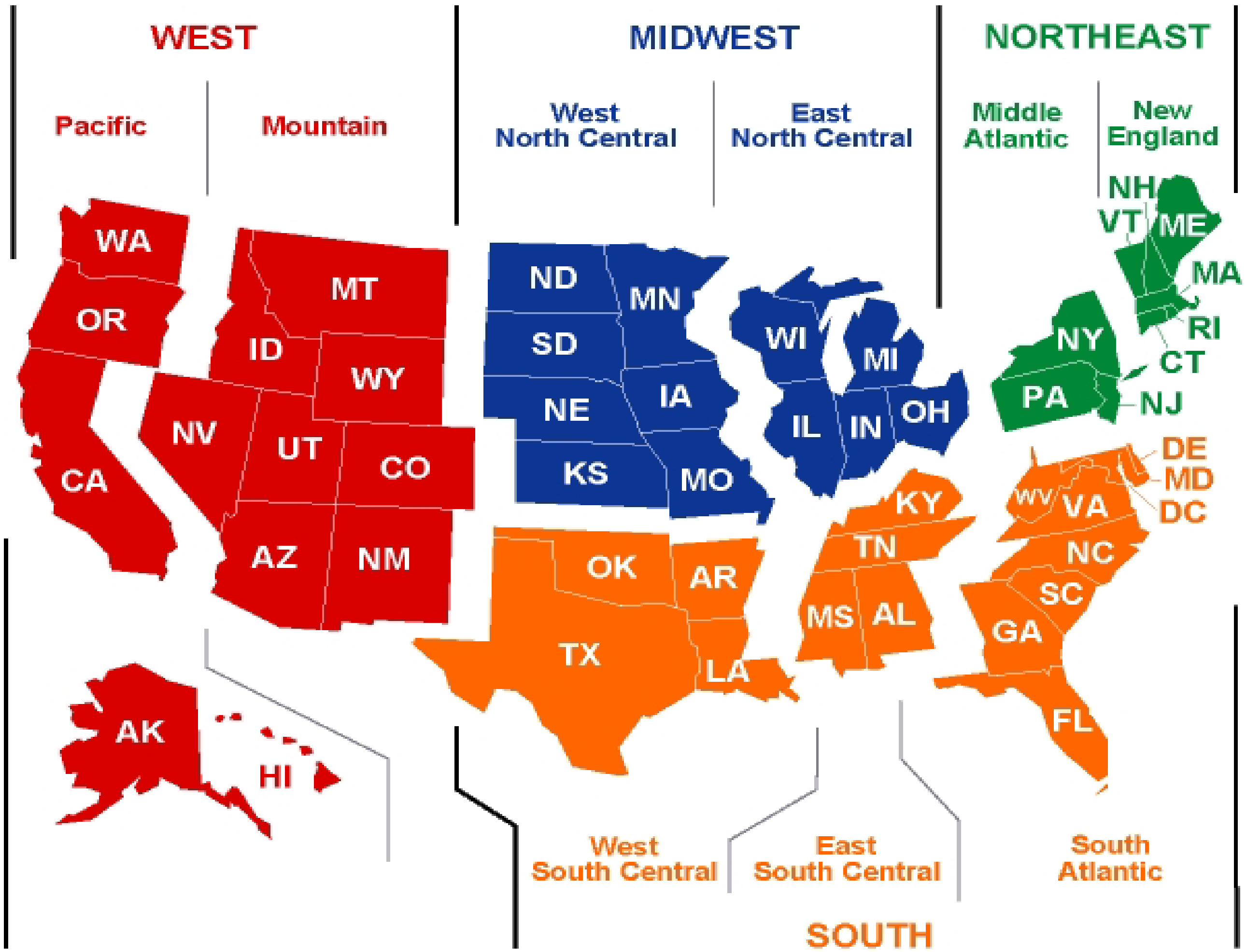
Appendix I: Regions as defined by U.S. Census



Source: Energy Information Administration (as of June 14, 2000).

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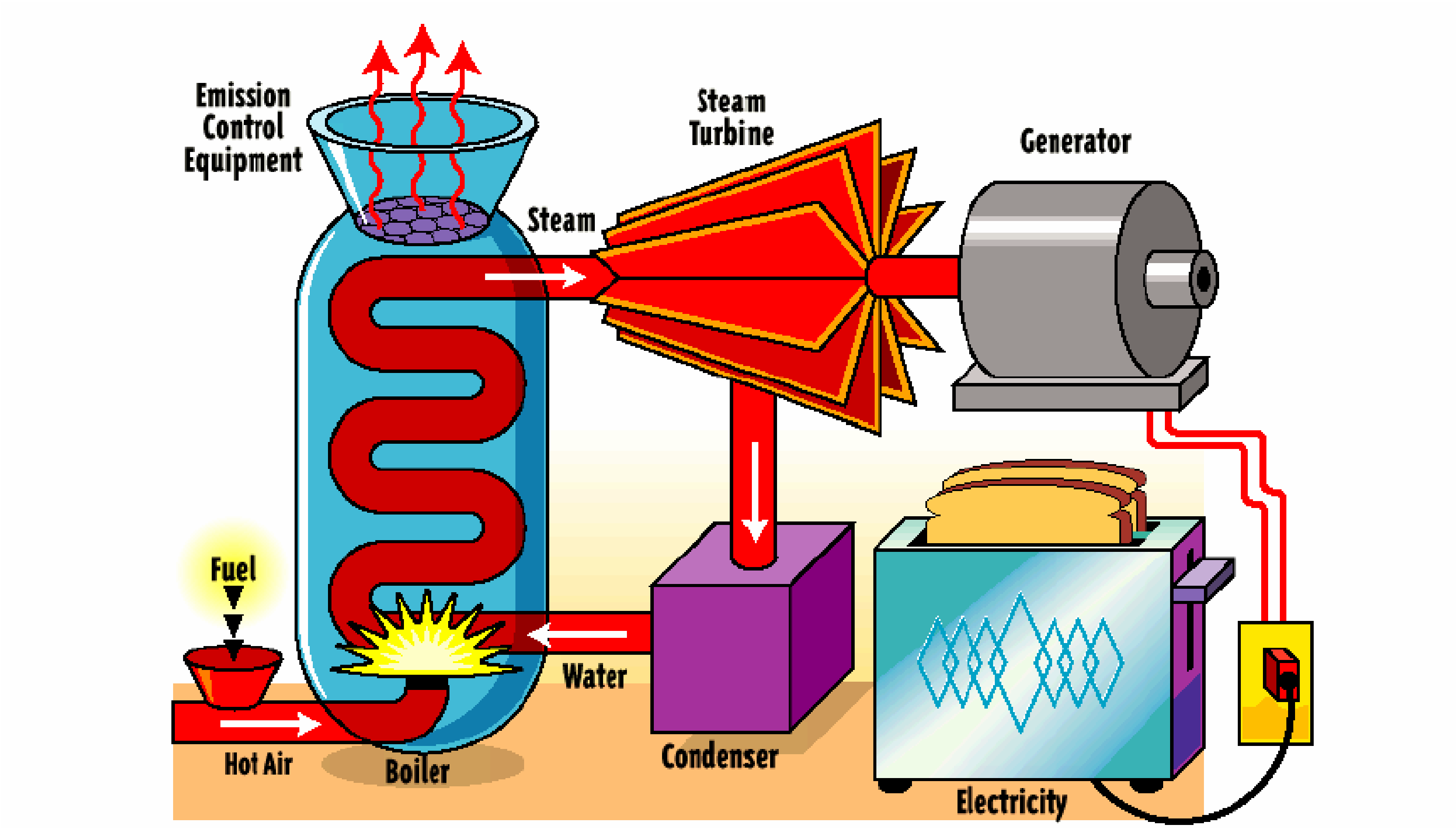
Appendix II: Power Generation Diagram



Source: Energy Information Administration.

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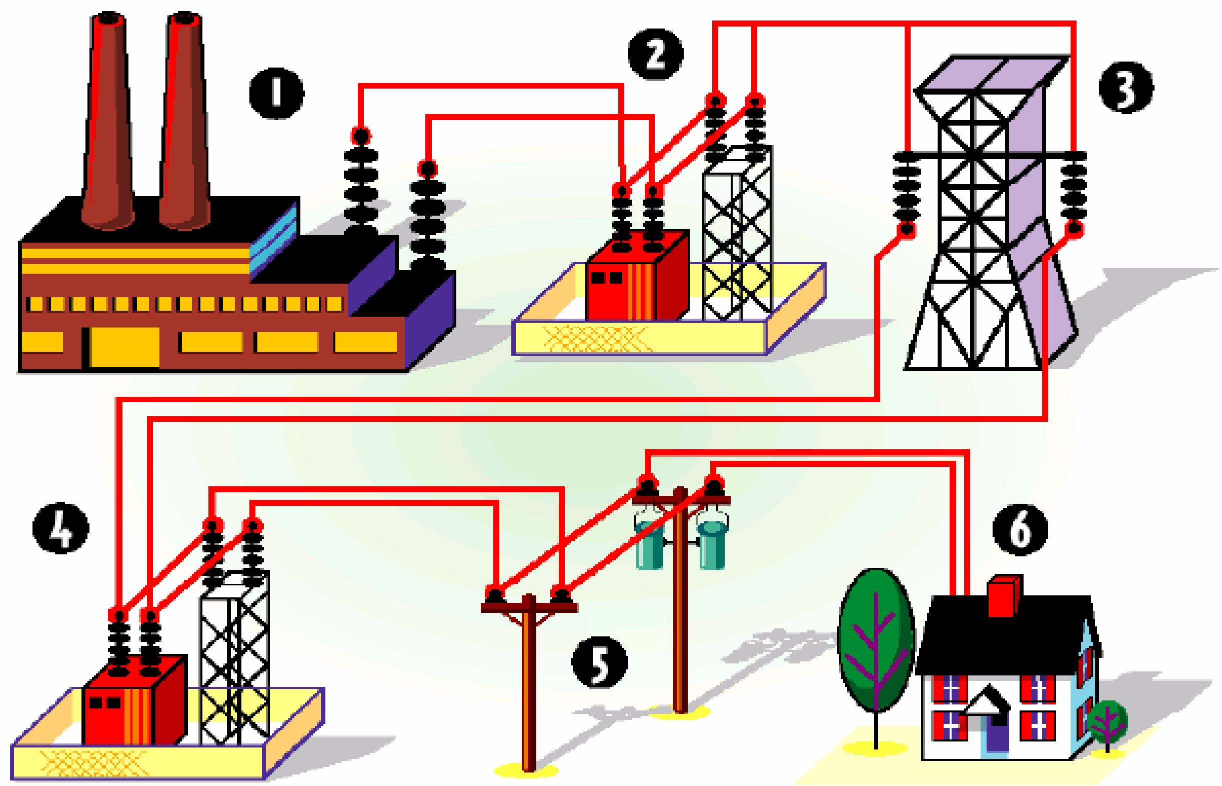
Appendix III: Power Transmission Diagram



When electricity leaves a power plant (1), its voltage is increased at a "step-up" substation (2). Next, the energy travels along a transmission line to the area where the power is needed (3). Once there, the voltage is decreased or "stepped-down," at another substation (4), and a distribution power line (5) carries the electricity until it reaches a home or business (6).

Source: Energy Information Administration.

Appendix IV: Useful Weblinks for Coal

- The Energy Information Administration – www.eia.doe.gov
- The International Energy Association – www.iea.org
- The American Coal Foundation – http://www.acf-coal.org/
- The Department of Energy – http://www.energy.gov/index.html
- The Pennsylvania Bureau of Deep Mine Safety - http://www.dep.state.pa.us/
- The World Coal Institute – http://www.wci-coal.com/
- The American Association of Railroads – http://www.aar.org/
- Earth Science Australia – http://earthsci.org/
- Clean coal technology (BBC – UK) – http://news.bbc.co.uk/1/hi/4468076.stm?ls
- Kentucky Coal Education – http://www.coaleducation.org/
- The Future of Coal – http://web.mit.edu/coal/

Appendix V: Useful conversion factors

Table 21: Conversion factors

From	Conversion Factor	To
Long ton	x 1.016	Metric ton
Short ton	x 0.9072	Metric ton
kcal/kg	x 0.004187	MJ/kg
kcal/kg	x 1.800	Btu/lb
MJ/kg	x 238.8	kcal/kg
MJ/kg	x 429.9	Btu/lb
Btu/lb	x 0.5556	kcal/kg
Btu/lb	x 0.002326	MJ/kg
1 MWh	equals	3600 MJ
1 MW	equals	1 MJ/s
1 MW (thermal power)	equals	1000 kg steam/hour
1 MW (electrical power)	equals	MWth / 3

Source: GWC Coal Handbook & IEA Clean Coal Centre

- A 600 MWe coal-fired power station operating at 38% efficiency and 75% overall availability will consume approximately:
  - Bituminous coal (CV 6000 kcal/kg Net as Received): 1.5 Mt/annum
  - Brown coal (CV 2250 kcal/kg Net as Received)): 4.0 Mt/annum

Rules of thumb

- A 600mw coal fired plant at 38% efficiency and 75% availability consumes;
  - 1.5mt pa of bituminous coal
  - 4.0mt pa of Brown coal
  - Coking coal per ton of steel

Analyst Certification:
The research analyst(s) denoted by an "AC" on the cover of this report certifies (or, where multiple research analysts are primarily responsible for this report, the research analyst denoted by an "AC" on the cover or within the document individually certifies, with respect to each security or issuer that the research analyst covers in this research) that: (1) all of the views expressed in this report accurately reflect his or her personal views about any and all of the subject securities or issuers; and (2) no part of any of the research analyst's compensation was, is, or will be directly or indirectly related to the specific recommendations or views expressed by the research analyst(s) in this report.

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- **Investment Banking (next 3 months):** JPMSI or its affiliates expect to receive, or intend to seek, compensation for investment banking services in the next three months from Arch Coal, CONSOL Energy.
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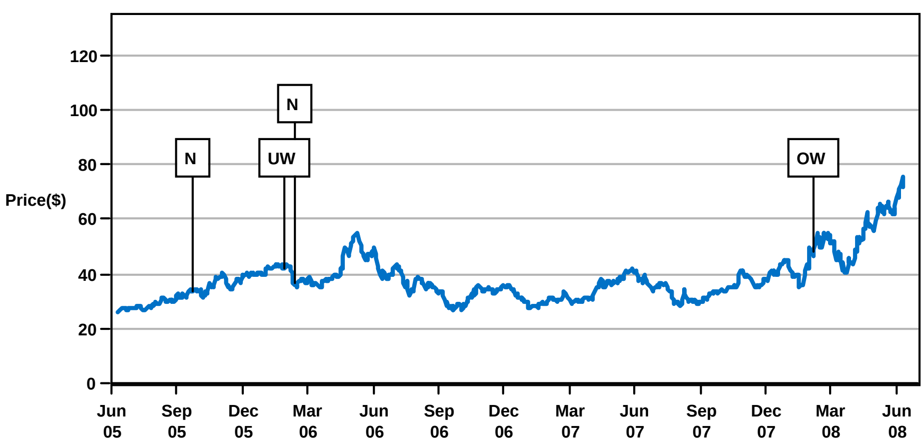
Arch Coal (ACI) Price Chart



Date	Rating	Share Price ($)	Price Target ($)
23-Sep-05	N	33.46	--
27-Jan-06	UW	42.00	--
13-Feb-06	N	36.92	--
05-Feb-08	OW	48.31	--

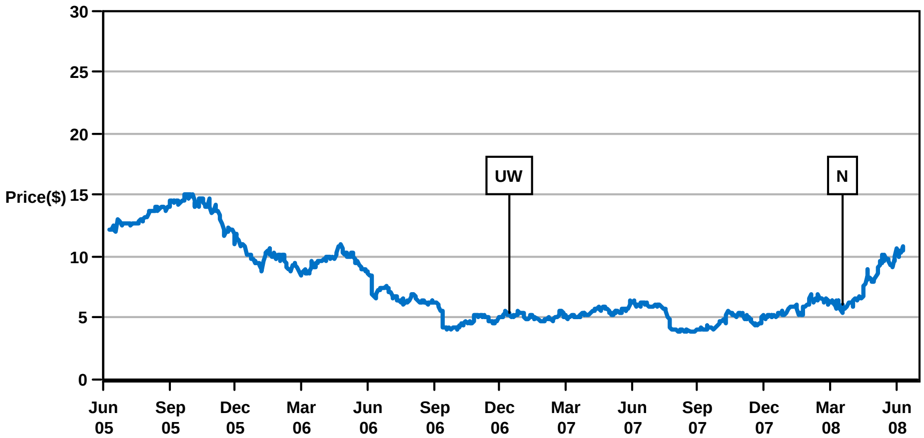
Source: Reuters and JPMorgan; price data adjusted for stock splits and dividends.
This chart shows JPMorgan's continuing coverage of this stock; the current analyst may or may not have covered it over the entire period.
JPMorgan ratings: OW = Overweight, N = Neutral, UW = Underweight.

CONSOL Energy (CNX) Price Chart

Date	Rating	Share Price ($)	Price Target ($)
23-Sep-05	N	36.35	--

Source: Reuters and JPMorgan; price data adjusted for stock splits and dividends.
This chart shows JPMorgan's continuing coverage of this stock; the current analyst may or may not have covered it over the entire period.
JPMorgan ratings: OW = Overweight, N = Neutral, UW = Underweight.

International Coal Group (ICO) Price Chart



Date	Rating	Share Price ($)	Price Target ($)
14-Dec-06	UW	5.40	-
19-Mar-08	N	6.03	-

Source: Reuters and JPMorgan; price data adjusted for stock splits and dividends.
Initiated coverage Dec 14, 2006. This chart shows JPMorgan's continuing coverage of this stock; the current analyst may or may not have covered it over the entire period.
JPMorgan ratings: OW = Overweight, N = Neutral, UW = Underweight.

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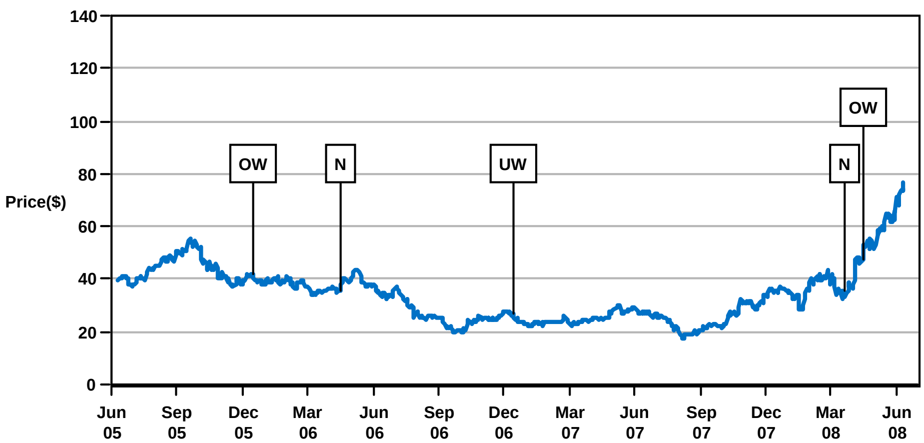
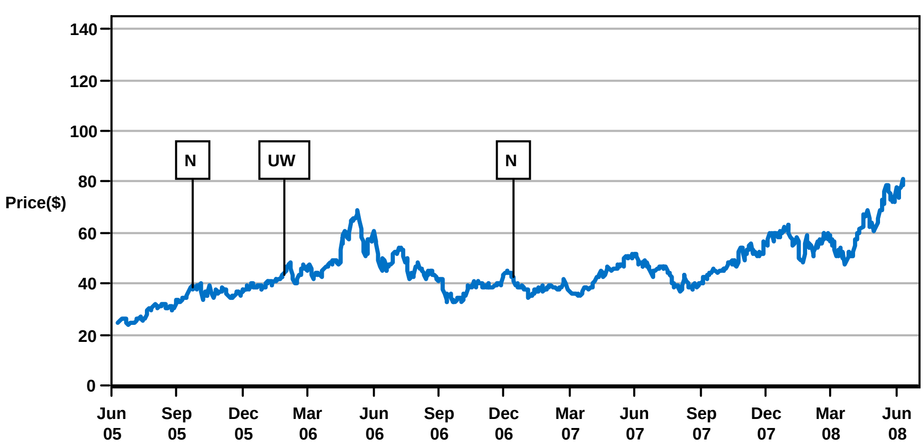
Massey Energy (MEE) Price Chart



Date	Rating	Share Price ($)	Price Target ($)
16-Dec-05	OW	41.54	-
17-Apr-06	N	35.81	-
14-Dec-06	UW	26.51	-
19-Mar-08	N	35.21	-
15-Apr-08	OW	47.19	-

Source: Reuters and JPMorgan; price data adjusted for stock splits and dividends.
Initiated coverage Dec 16, 2005. This chart shows JPMorgan's continuing coverage of this stock; the current analyst may or may not have covered it over the entire period.
JPMorgan ratings: OW = Overweight, N = Neutral, UW = Underweight.

Peabody Energy (BTU) Price Chart



Date	Rating	Share Price ($)	Price Target ($)
23-Sep-05	N	38.46	--
27-Jan-06	UW	43.24	--
14-Dec-06	N	42.90	--

Source: Reuters and JPMorgan; price data adjusted for stock splits and dividends.
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JPMorgan Equity Research Ratings Distribution, as of March 31, 2008

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IB clients*	50%	51%	39%
JPMSI Equity Research Coverage	41%	47%	11%
IB clients*	70%	66%	54%

*Percentage of investment banking clients in each rating category.
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"Other Disclosures" last revised February 6, 2008.

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