POWDER RIVER BASIN COAL RESOURCE AND COST STUDY

Campbell, Converse and Sheridan Counties, Wyoming
Big Horn, Powder River, Rosebud and Treasure Counties, Montana

Prepared For

XCEL ENERGY

By

John T. Boyd Company

Mining and Geological Consultants

Denver, Colorado

Report No. 3155.001

SEPTEMBER 2011

John T. Boyd Company
Mining and Geological Consultants

Denver
Dominion Plaza, Suite 710S
600 17th Street
Denver, CO 80202-5404
(303) 293-8988
(303) 293-2232 Fax
jtboydd@jtboyd com

Pittsburgh
(724) 873-4400
jtboydp@jtboyd com

Brisbane
61 7 3232-5000
jtboydau@jtboyd com

Beijing
86 10 6500-5854
jtboydcn@jtboyd com

London
44 208 748-5344 Tel/Fax

www.jtboyd.com

October 6, 2011
File: 3155.001

Mr. Mark W. Roberts
Manager, Fuel Supply Operations
Xcel Energy
1800 Larimer St., Suite 1000
Denver, CO 80202

Subject: Powder River Basin Coal Resource and Cost Study

Dear Mr. Roberts:

Presented herewith is John T. Boyd Company's (BOYD) draft report on the coal resources mining in the Powder River Basin of Wyoming and Montana. The report addresses the availability of resources, the cost of recovery of those resources and forecast FOB mine prices for the coal over the 30 year period from 2011 through 2040. The study is based on information available in the public domain, and on BOYD's extensive familiarity and experience with Powder River Basin operations.

Respectfully submitted,

JOHN T. BOYD COMPANY
By:

John T. Boyd II
President and CEO

EXECUTIVE SUMMARY

The Powder River Basin (PRB) of Wyoming and Montana is the largest coal producing region in the world, supplying over 40% of the coal consumed for power generation in the United States. Xcel Energy, which purchases substantial volumes of coal from the region retained John T. Boyd Company (BOYD), a worldwide mining and geological consultancy with extensive experience in the PRB, to develop an analysis of coal resource availability, future cost trends and prices. This summary presents the key findings of that analysis.

Coal Resources

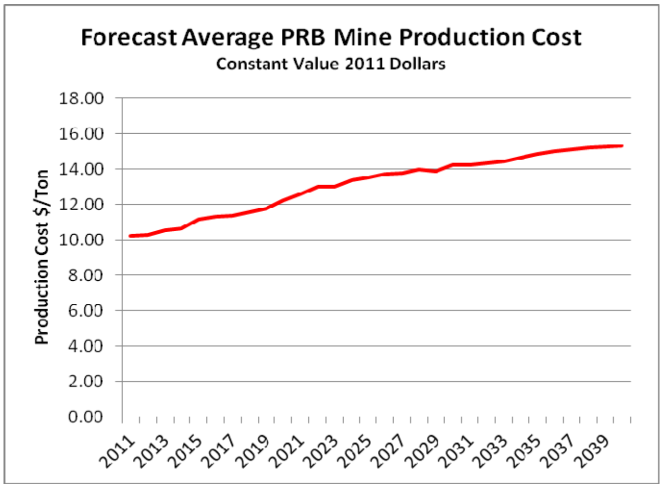
BOYD's forecast of PRB demand indicates approximately 17 billion tons of recoverable coal resources will be required over the 30 year timeframe of this study. While no comprehensive basin-wide resource assessment is available, the U.S. Geological Survey (USGS) has completed studies focusing on certain portions of the basin. These studies indicate a coal resource of over 140 billion tons in the areas that are of most interest for mining. In the Gillette Coalfield, which is the primary PRB production area, authoritative estimates by the USGS indicate approximately 77 billion tons of coal are potentially recoverable, with about 10 billion tons considered "reserves" (i.e., economically recoverable at the time of estimation). Based on information in the USGS study, BOYD estimates an additional 24 billion tons for a total of 34 billion would reasonably be expected to be economically viable over the study period. Thus, in the Gillette field alone, sufficient resources are available to satisfy nearly double the expected demand.

To further assess resource availability, BOYD reviewed the coal accessible to the operating mines and selected development projects in the PRB as of year-end 2010. Each mine or project was evaluated independently, with production requirements estimated, and available coal resources assessed in specific tracts logically mineable by the operation. The results of this mine-by-mine evaluation indicated that 20.5 billion tons of the 34 billion tons of economically viable resources are mineable from existing or planned operations, as summarized:

	Tons (Millions)
Resources Within Mine Permit Areas	5,773
Resources Recently Leased or Identified for Leasing	4,680
Resources Logically Mineable Within a Mine's Area of Interest	10,113
Total	20,566

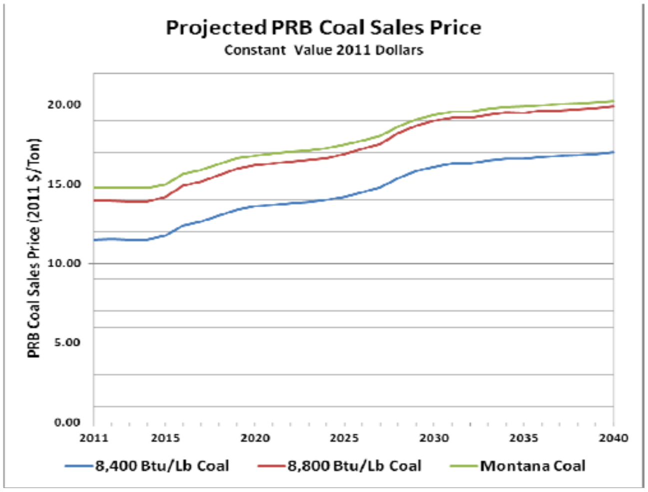
This site specific analysis further demonstrates that sufficient resources are available to support planned mining over the 30 year period. Moreover, as indicated by the USGS study, extensive additional resources are available beyond the areas identified.

Cost Trends



Typically as a coal basin matures, mining proceeds from the most favorable to less favorable resources, a trend which puts upward pressure on costs. Generally speaking, this is the case in the PRB, particularly in the Gillette area where the mines are progressing from shallower, less expensive resources on the eastern edge of the basin to more deeply buried and thus more costly resources to the west. In addition, physical factors such as road relocations and coal haul distances will tend to increase costs. This increase will however, occur very slowly due to the nature of the deposit and scale of operations. BOYD's forecasts of average mining costs, shown on the nearby graph indicate a modest increase of ±1% per year in real terms from about $10/ ton (constant 2011 dollars) to about $15/ton in 2040.

Price Forecasts



Over the long term, prices in the PRB are primarily driven by costs – prices will experience upward pressure as production costs at marginal, higher cost mines increase. BOYD's forecast of prices for the three common "benchmark" grades of PRB coal are illustrated on the nearby graph.

As shown, we expect prices to increase modestly, averaging 1% to 2% per year. We would also note that the forecast is inherently conservative (high) insofar as it does not incorporate the impacts of potential technological or operational improvements. Generally we would expect such improvements to be modest.

TABLE OF CONTENTS

TABLE OF CONTENTS – Continued

K:\Projects\3155 001 Xcel Energy - PRB Resource & Cost Study\GBG\Final Report\Contents.doc

1.0 GENERAL STATEMENT

Xcel Energy operates several electrical generating facilities that are fueled by coal produced in the Powder River Basin (PRB) of Wyoming and Montana (see Figure 1.1, Regional Location Map, following this chapter). The PRB is a major source of coal for utilities in the United States and the large surface mines in the PRB currently produce around 470 million tons per year, making the PRB the largest coal producing region in the world.

Recently, questions have been raised about the PRB's viability as a long term fuel source for electrical power generation. To provide an independent assessment of this issue, Xcel Energy retained the services of John T. Boyd Company (BOYD) to provide expert opinions as to:

- The quantity and economic viability of the coal resources remaining in the PRB.
- Probable trends in mining costs in the PRB.
- Forecast prices for PRB coal.

By assignment this study addresses a 30 year timeframe (through 2040), and we have also provided comments regarding industry trends during and beyond the 30 year period which could affect the PRB. This study is completed on a desktop basis based on publically available information and our extensive knowledge of the PRB mines and markets. Our review of the literature regarding the PRB also identified two key concepts which are important to understanding the long term future of the PRB:

- **Reserves and Resources**. The terms "reserves" and "resources" are often used interchangeably. However, in the industry, and more importantly for financial reporting purposes, the terms are not synonymous and are understood to reflect differing levels of assurance and economic viability. Under currently accepted definitions "resources" generally include all of the coal in a specific deposit which, in consideration of technical and legal constraints can reasonably be considered recoverable. "Reserves" are the portion of those resources that have been adequately explored and that can be mined and marketed economically at the time the estimate is made. Any "reserve" estimate is not a static value, rather it is essentially a "snapshot" subject to change over time. For purposes of this report, we have used the broader term "resources" to characterize the recoverable coal available in the PRB recognizing that the term "reserves" is not appropriate when assessing a 30 year timeframe.
- **Long Term Mining and Cost Trends**. When possible, mining companies generally produce the most economical coal first, deferring the more expensive resources for

the future. Thus, as a coal basin matures, and the more expensive resources are mined, overall costs increase. This is the case in the PRB, particularly in the Gillette area. In that coalfield the coal seams dip gradually to the west, thus increasing the depth at which the seams are buried. The mines, which were developed initially along the eastern edge of the coalfield, therefore experience increasing overburden depths as they progress to the west. Overburden removal is the major driver of costs, thus the increase in overburden depth puts upward pressure on costs throughout the basin.

Certain environmental interests have opposed coal development in the PRB, both politically and legally. While BOYD's view is that this opposition can generally be accommodated, that cannot be assured. This study is based on the assumption that the various laws and regulations governing coal leasing, mine permitting, health, safety and transportation, and the enforcement of those laws and regulations will effectively continue as they are today. Major changes in the legal/regulatory framework could affect our conclusions.

Primary sources of public information utilized in this study include the following:

- Mining Permit Applications (from the Office of Surface Mining).
- United States Geological Survey (USGS) publications.
- Bureau of Land Management maps and data.
- Mine Safety and Health Administration (MSHA) data.
- Annual Reports and 10-K filings for producers and consumers of PRB coal.
- Coal Industry Periodicals including Argus Coal Daily, Argus Coal Weekly, Platts Coal Trader, Platts Coal Outlook, Platts Coal Trader International, International Longwall News, Coal Age, Coal Transporter, etc.
- Environmental Impact Statements associated with various proposed activities in the PRB region.

We have relied upon the information from these public sources as being accurate within the reasonable limits of the data available and depth of study. Our analysis is performed on a mine by mine basis and accumulated to define basin-wide trends. While site-specific mining conditions and/or operating practices may result in variations between a specific mine's actual performance versus the estimates shown herein, our methodology and assumptions provide a reasonable basis for estimates and forecasts for the PRB industry as a whole. Price forecasts address the three major product types of PRB coal, those being Wyoming 8,800 Btu/Lb, Wyoming 8,400 Btu/Lb, and Montana 8,600 Btu/Lb (Absaloka) coal. All price and cost forecasts are expressed in constant value 2011 dollars.

This report is prepared for the use of Xcel Energy to enhance the understanding of PRB coal resources, production costs and price trends. The findings and conclusions presented herein represent the independent professional opinions of BOYD based on our review of the available data. Although we believe the findings and conclusions are reasonable and consistent with accepted standards for such studies, we do not warrant this report in any manner, express or implied.

Following this page is Figure 1.1, Regional Location Map, Powder River Basin, Southeastern Montana & Northeastern Wyoming.

Respectfully submitted,

JOHN T. BOYD COMPANY
By:

Lee A. Miller
Senior Mining Engineer

Richard L. Bate
Vice President

K:\Projects\3155.001 Xcel Energy - PRB Resource & Cost Study\GBG\Final Report\Chapters\Chapter 1 - General Statement doc

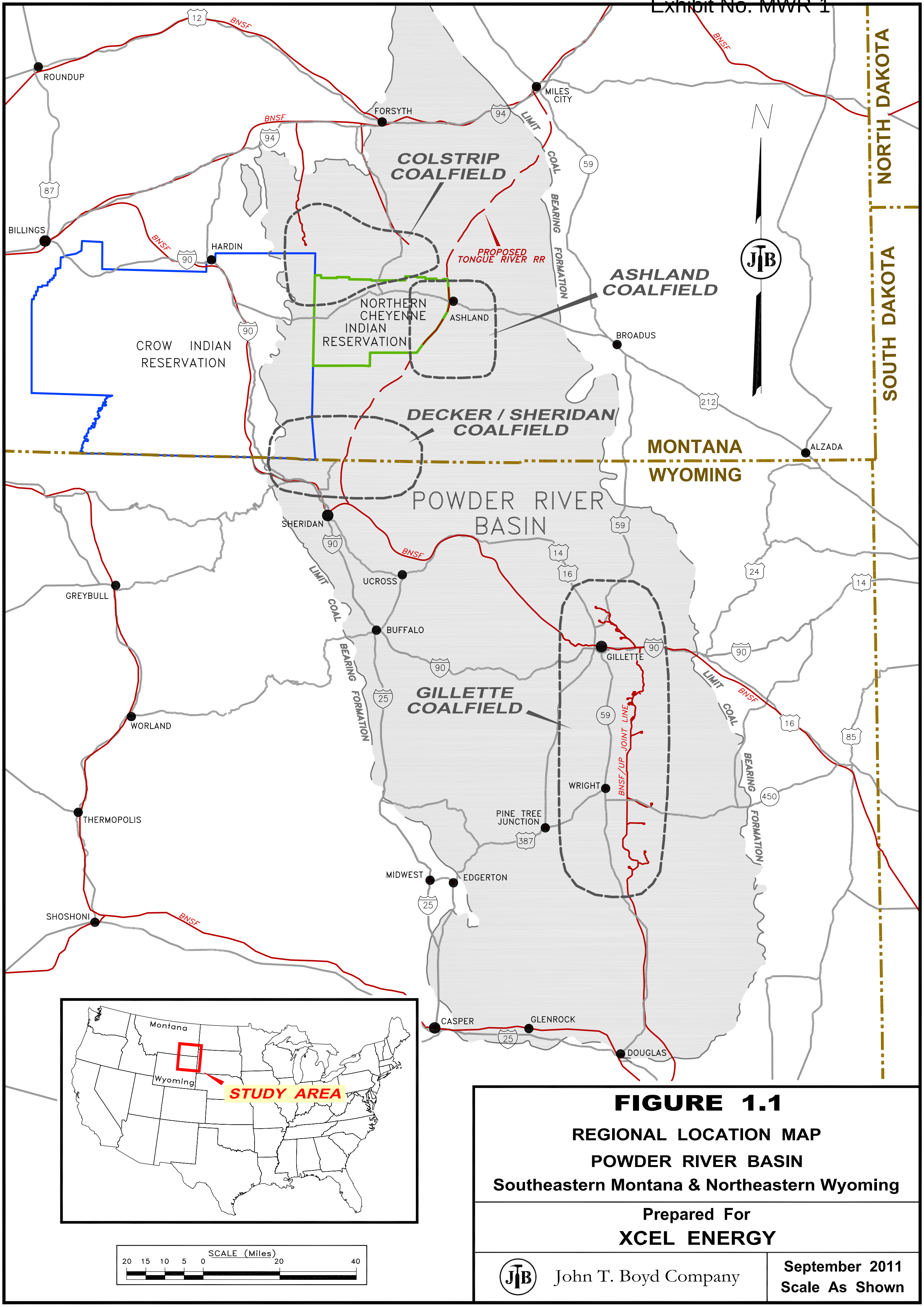


FIGURE 1.1

REGIONAL LOCATION MAP

POWDER RIVER BASIN

Southeastern Montana & Northeastern Wyoming

Prepared For

XCEL ENERGY

John T. Boyd Company

September 2011
Scale As Shown

K:\Projects\3155.001 Xcel Energy...\PLD\Figure 1.1.dwg

2.0 SUMMARIZED FINDINGS

The major findings and conclusions of BOYD's study are summarized in this chapter. These summary points are supported by and expanded upon in the text, tables and figures in the subsequent chapters of this report.

2.1 PRB Coal Resources

The Powder River Basin (PRB) is located in northeastern Wyoming and southeastern Montana, extending roughly 300 miles north-south by 100 miles east-west. The geology of the PRB is relatively simple with generally flat-lying, thick coal seams situated close to the surface so as to make production economically viable by high production surface mining methods. The coals are subbituminous in rank with low ash, low sulfur and thermal content in the range of 8,200 to 9,400 Btu/Lb.

2.1.1 Land Tenure

The United States is the dominant owner of coal rights in the PRB, and coal rights leased from the federal government are the core reserve holding of most mines. The Bureau of Land Management (BLM) leases the coal competitively, primarily using a Lease by Application (LBA) process. BLM has historically leased coal at approximately the rate it is mined. This allows the operating mines to control resources to support between 10 and 20 years of operation, a sufficient amount to justify necessary investment and planning. Overall, the most important issue relative to obtaining the right to mine future resources is the availability of federal coal for leasing. Our review indicates that, for the 30 year study period of this report (and well beyond), and so long as the current BLM policy remains in-place, availability of federal coal leases in the PRB should be adequate to meet projected demand.

2.1.2 PRB Coal Resource Estimates

Numerous assessments have been conducted over the years to quantify the "Reserves" or "Resources" available in the PRB. In this study we have addressed PRB coal resources from the standpoint of the available supply of coal for use as fuel for electrical generation – coal which would be considered a "Resource", but not necessarily a "Reserve". For purposes of this report "viable resources" are defined as the recoverable coal tonnage that is or could reasonably be expected to become technically and legally mineable, and which is economic today or could reasonably be expected to become economic within the 30 year timeframe of this study.

Our review indicates that most PRB production within the timeframe of this study will come from existing mines, with a relatively small amount coming from new mine development. The existing mines will progress into new mining areas, and will experience gradually less favorable conditions and modestly increasing costs. Our assessment of the viable resources available to these mines focuses on three categories:

- Permitted Resources. Includes resources that are permitted and/or reported in financial filings. These resources are typically well explored, permitted for mining, and committed to a specific mine plan.
- LBA Resources. Includes resources that are controlled but are not permitted or reported in financial filings, and resources on identified tracts that have been applied for via the LBA process and are considered likely to be leased.
- Future Resources. Includes resources on lands that are within a particular mine's area of interest, are accessible from the existing operation, and which could logically be incorporated into future plans for the mine.

Our estimate of viable coal resources available for the PRB mines is summarized:

	Coal Resources (Millions of Tons)			
Mine	Permitted	LBAs	Future	Total
Antelope	252.0	406.6	479.0	1,137.6
North Antelope/Rochelle	723.0	1,179.0	1,535.0	3,437.0
School Creek	762.0	0.0	279.0	1,041.0
Black Thunder	1,256.4	1,988.4	1,944.6	5,189.4
Coal Creek	198.0	56.0	224.0	478.0
Cordero Rojo	190.1	776.7	701.5	1,668.3
Belle Ayr	155.0	0.0	745.0	900.0
Caballo	235.2	221.7	598.0	1,054.9
Wyodak	261.9	0.0	0.0	261.9
Dry Fork	110.9	0.0	0.0	110.9
Eagle Butte	425.0	0.0	398.0	823.0
Rawhide	329.7	0.0	1,448.0	1,777.7
Buckskin	280.7	52.0	1,202.0	1,534.7
Decker	12.0	0.0	0.0	12.0
Spring Creek	329.0	0.0	271.0	600.0
Absaloka	49.8	0.0	130.2	180.0
Rosebud	202.0	0.0	158.0	360.0
Totals	5,772.7	4,680.4	10,113.3	20,566.4

Coal Resource estimates are as of December 31, 2010.

As shown, the available viable resources total about 20.6 billion tons, an amount that is more than adequate to meet the anticipated coal demand over the 30 year period of this study. Extensive additional resources exist to support both new mine development and for mine life extension beyond the study period.

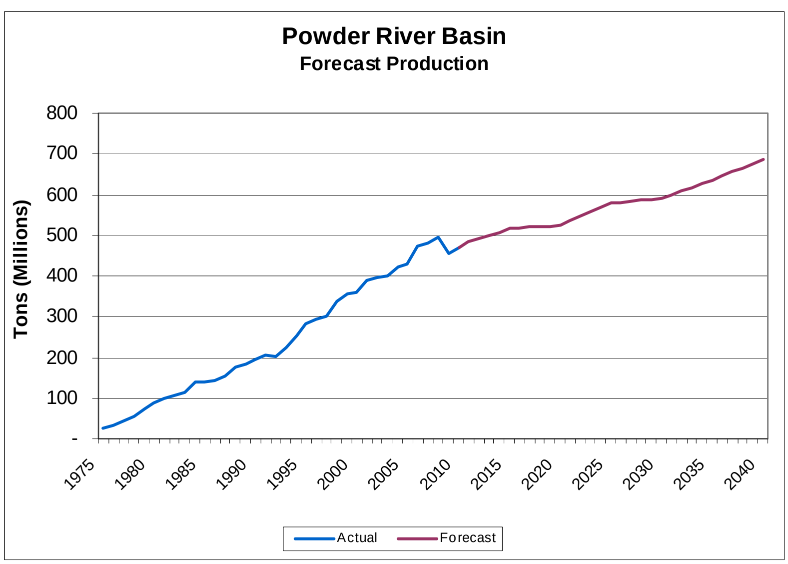
Throughout the history of the PRB, mine expansion and new mine development have been driven by market demand and accessibility to rail transportation. Availability of resources for mining has rarely, if ever, been a significant impediment. In BOYD's opinion, this will continue to be the case. The PRB has sufficient recoverable coal resources to meet even the most aggressive demand levels for the foreseeable future.

2.2 PRB Mines – Production and Costs

There are sixteen existing mines in the PRB – twelve in Wyoming and four in Montana. The majority of the large PRB coal mines, accounting for over 90% of production, are located in the Gillette Coalfield portion of the PRB. The Gillette-area producers are commonly divided into two groups based on coal quality; those in the southern portion of the coalfield producing an 8,800-Btu/Lb coal and the northern mines producing an 8,400-Btu/Lb coal.

2.2.1 Projected PRB Production

Production in the PRB is driven primarily by market demand, and to the extent the producers in the basin have not met that demand, it has been by a small margin and temporary. Past production and BOYD's projections of demand, and therefore production, in the PRB are illustrated below:



As shown, we expect that over the long term demand will continue to increase, but at a slower pace than has been the case historically. Our forecast has demand reaching approximately 685 million tons per year by 2040, with capacity in the range of 700 million tons.

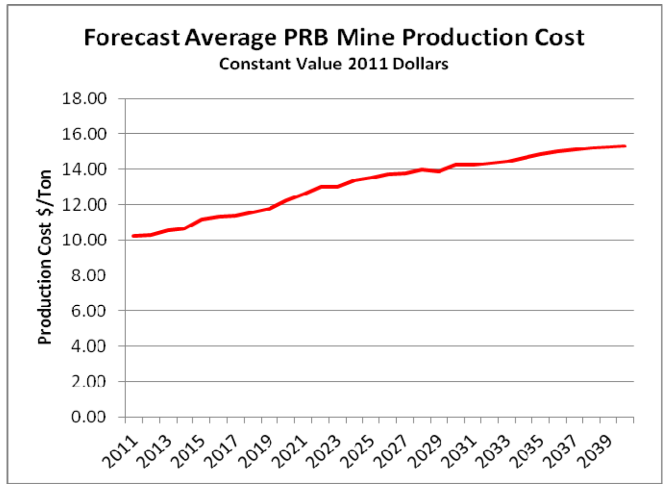
The future production will come primarily from the existing mines with a relatively small component from new mines in the future years. Current and projected coal production from the existing and potential new mines is summarized below.

	Annual Coal Production (million tons)			
	2011	2020	2030	2040
Montana Mines:				
Rosebud	12.0	12.0	12.0	12.0
Absaloka	6.0	6.0	6.0	6.0
Spring Creek	20.0	20.0	20.0	20.0
Decker	3.0	-	-	-
Subtotal	41.0	38.0	38.0	38.0
Existing Wyoming “8,400 Btu/Lb” Mines:				
Buckskin	25.0	25.0	30.0	45.0
Rawhide	14.5	25.0	30.0	45.0
Eagle Butte	25.0	25.0	25.0	-
Dry Fork	5.5	5.5	5.5	-
Wyodak	6.0	6.0	6.0	6.0
Caballo	25.0	25.0	34.0	40.0
Belle Ayr	25.0	20.0	20.0	20.0
Cordero Rojo	40.0	40.0	40.0	50.0
Coal Creek	15.0	15.0	15.0	15.0
Subtotal	181.0	186.5	205.5	221.0
Existing Wyoming “8,800 Btu/Lb” Mines:				
Black Thunder	122.0	125.0	135.0	165.0
North Antelope Rochelle	105.0	100.0	100.0	100.0
Antelope	36.0	28.0	28.0	24.0
Subtotal	263.0	253.0	263.0	289.0
Undeveloped Properties:				
School Creek	-	30.0	30.0	35.0
Otter Creek	-	18.0	34.9	34.9
Youngs Creek	-	2.0	15.0	15.0
Others	-	-	4.3	52.6
Subtotal	-	50.0	84.2	137.5
Total PRB Production	485.0	524.4	590.7	685.5

2.2.2 Production Costs

Projected production costs for each existing and potential new mine were estimated considering the individual mine’s production levels, geologic conditions, mining methods, labor force productivities, coal haul distances, and coal ownership (federal, state, private). The total estimated production cost includes all mining costs, overheads, royalties, production taxes, property taxes and insurance, to arrive at a total cost loaded into the railcar.

Typically as a coal basin matures, mining proceeds from the most favorable to less favorable resources, a trend which puts upward pressure on costs. Generally speaking, this is the case in the PRB, particularly in the Gillette area where the mines are progressing from shallower, less expensive resources on the eastern edge of the basin to more deeply buried and thus more costly resources to the west. In addition, civil features (roads, railroads, etc.) and increasing coal haul distances will tend to increase costs. This increase will occur very slowly due to the nature of the deposit and scale of operations. BOYD's forecasts of average mining costs, shown on the nearby graph indicate a modest increase of ± 1% per year in real terms from about $10/ton (constant 2011 dollars) to about $15/ton in 2040.



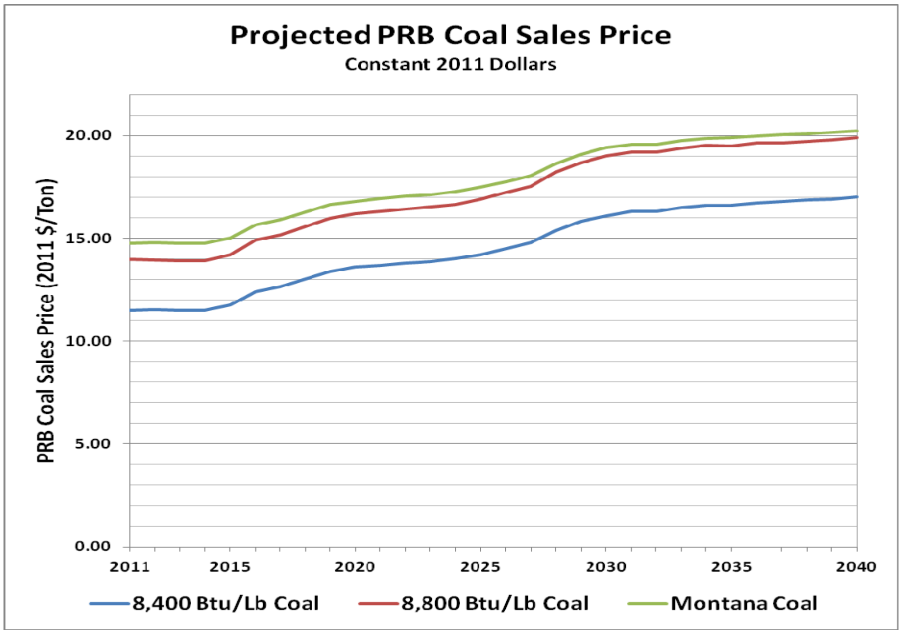
2.3 PRB Markets and Prices

PRB coal is marketed across the United States due to its favorable quality characteristics – notably low sulfur – and relatively low price. PRB coal is the most widely consumed coal in the U.S., supplying approximately 43% of total U.S. production on a tonnage basis. Significant production began in the late 1970s, and since that time the PRB has become a large, reliable, competitive and relatively stable fuel supply source for electrical generation, and is the dominant player in coal markets across most of the United States. BOYD projects PRB coal demand to continue to increase over the timeframe of this study albeit at a slower rate than experienced historically, to around 685 million tons per year in 2040.

PRB coal prices are fundamentally driven by coal production cost. Market imbalances which might potentially lead to higher prices – such as a sharp increase in demand or a production shortfall – have occurred, but not frequently. There are occasions when PRB coal prices have "spiked" for a short period of time; usually due to a brief disruption in coal supply – e.g., railroad problems, pit flooding, or extreme weather events (snow).

Oftentimes these events are so short lived that there is little or no impact on coal prices, largely because a large portion of the coal is sold under multi-year contracts at set prices[1].

This study develops long term price forecasts for three different types of PRB coal – Gillette 8,400 and 8,800 Btu/Lb products, and a typical Montana product. The projected prices (FOB Mine in constant value 2011 dollars) for these coal types over the 30 year study period are:



The projected coal sales prices for the three coal products are summarized at five-year intervals in the table below.

Year	Projected Coal Sales Price ($/Ton) 8,400 Btu/Lb	8,800 Btu/Lb	Montana
2011	11.50	14.00	14.75
2015	11.75	14.20	15.00
2020	13.60	16.20	16.80
2025	14.20	16.90	17.50
2030	15.80	17.80	18.80
2035	16.60	19.00	19.40
2040	17.50	19.50	19.90

Projected coal sales prices are stated in constant value 2011 dollars.

[1] For purposes of this report "market prices" are defined as the price that would be negotiated, at the relevant time, between a knowledgeable buyer and reliable seller for substantial quantities of coal to be delivered over a multi-year future period. As used herein "price" is not necessarily the same as a spot price, a forward market price, or prices that would reflect a distressed situation on the part of either buyer or seller.

As shown, we project a relatively steady increase in prices throughout the forecast period albeit at a rate that is below historic norms. Note that our forecast is intended as a long term projection – there will almost certainly be variations from the forecast due to shorter term factors that could significantly impact prices.

Overall, our evaluation of future mine costs and projection of long term price trends indicates that while prices for PRB coal will increase in real terms, that increase will not be at the pace of the past decade, and buyers will not experience large price increases due to resource shortages within the timeframe of this study.

K:\Projects\3155.001 Xcel Energy - PRB Resource & Cost Study\GBG\Final Report\Chapters\Chapter 2 - Summarized Findings.doc

3.0 POWDER RIVER BASIN COAL RESOURCES

3.1 Introduction

The Powder River Basin (PRB) of Wyoming and Montana is, in terms of production, the largest coal mining region in the world, and is widely viewed as holding sufficient resources to support production for the foreseeable future. Many estimates of PRB coal resources have been made since the first geological studies in the early 1900s. These estimates were developed for various purposes, often incorporated differing estimating parameters, and may or may not have been based on adequate geological data. As such, the resulting estimates of available coal resources varied considerably from study to study.

This chapter describes the geological setting of the PRB, provides background on land ownership issues, summarizes various studies of the quality and quantity of PRB resources, and provides estimates of identified resources within the logical mining advance areas of the existing and planned mines.

3.2 PRB Geology

The PRB extends roughly 300 miles north-south by 100 miles east-west, spanning large portions of northeastern Wyoming and southeastern Montana. The coal bearing rocks in the basin occur in the Cretaceous age Ft Union Formation which is over 2,000 ft thick, and contains aggregate coal thicknesses of nearly 400 ft in up to 12 seams.

The Wyoming portion of the basin is part of a broad asymmetrical syncline with relatively shallow dips along the eastern boundary, and steeply inclined strata adjacent to the Bighorn Mountains on the West. The coal seam of primary interest is the Wyodak-Anderson (or Roland) which is relatively thick (60 ft to 120 ft) and amenable to surface mining over large areas. The major mines are found in the Gillette Coalfield and account for over 90% of PRB production. In the Gillette area, mining began along the outcrop of the Wyodak-Anderson on the east, and has gradually progressed into deeper cover to the west.

The Gillette-area producers are loosely divided into “Southern” mines and “Northern” mines. This division is based on coal quality with the “Southern” mines nominally producing 8,800-Btu/Lb coal and the “Northern” mines producing 8,400-Btu/Lb coal. The “Southern” mines include the three southernmost operations in the PRB (Black Thunder, North Antelope/Rochelle, and Antelope). These mines alone currently produce around 60% of total PRB output, and are major players in PRB coal markets. It should also be noted that the actual quality at any one mine will likely vary from the 8,800-Btu/Lb and 8,400-Btu/Lb values, and other factors such as sulfur content are important from a market perspective.

In the Montana portion of the basin, the Fort Union Formation strata dip very gradually to the southeast, but are essentially flat lying over large areas. Some faulting is present although it tends to be fairly widely spaced and is not a major impediment to mining. The coal seams of interest mainly occur in the Tongue River Member, and while some are correlative with the Wyodak-Anderson Zone, the strata often split, resulting in multiple seams which, while still relatively thick, are not in the 100 ft range found near Gillette.

There are two primary producing areas in the Montana portion of the PRB, the Sheridan (or Decker) Coalfield and the Colstrip Field. Two mines are operating in the Sheridan Coalfield producing a higher heat value coal (± 9,300-Btu/Lb), while two other mines operate in the Colstrip Field producing an approximate 8,600-Btu/Lb product. A third area in Montana, the Ashland Field is in the early stages of development. Coal resources extend well beyond these areas, but have not been the focus of exploration or development efforts.

All coal currently produced in the PRB is classified as subbituminous. The most important quality parameters relate to thermal content (measured as Btu/Lb) and sulfur, with sodium as a concern in certain areas. Typically the thermal content is in the range of 8,200 to 9,400 Btu/Lb although some mines produce a lower or higher Btu product. PRB coals tend to be low in sulfur, typically in the 0.5% range and some of the coal produced from the area south of Gillette or available in the Ashland area is a very low sulfur product in the range of 0.3% sulfur. Sodium in ash (which can be problematic in utility boilers) is typically in the 1% – 2% range, but can exceed 5% in some of the Montana regions.

3.3 Land and Mineral Ownership

Mineral rights (including coal) ownership in much of the Powder River region is, as elsewhere in the western U.S., often severed from the surface ownership. The United States is the dominant mineral owner in the PRB, and those mineral rights can only be leased, not purchased. The Bureau of Land Management (BLM) controls federal leasing activities and most of the resource availability in the PRB is dictated by BLM land management policy.

Federally owned coal rights in the PRB are leased competitively, primarily using a Lease by Application (LBA) process. With an LBA, a proponent (usually a coal producer) nominates a particular tract for leasing. The BLM evaluates the tract, perhaps modifying its boundaries, and determines whether it is suitable for leasing. Generally, some level of environmental assessment (EA or Environmental Impact Statement) with attendant public comment opportunities is required. If the tract is found suitable for leasing, BLM holds a sealed bid auction-type sale, allowing the original proponent, and any other interested, qualified party, to bid on the coal rights within that tract. Once the bids are received, BLM analyzes the high bid to assure that it meets “Fair Market Value”, and if so, the coal on that tract will be leased to the winning bidder. This process from nomination to leasing, can take five years (or more) to complete.

As a practical matter, most companies will attempt to define LBA tracts that, because of location or geometry, are of interest only to the nominating company. This minimizes competitive bidding on the tract, and may result in a lower cost lease. Where competition has existed for coal leases (mostly in the southern Gillette area but recently in the central portion of the coalfield) relatively high bonus bids in the range of \$0.90 – \$1.10/ton have resulted. BLM has, even in non-competitive cases, required “Fair Market Value” bids in this range, particularly in the Southern PRB. This is illustrated in the following summary of recently awarded coal leases:

Lease	Date	Tons (Millions)	Bonus Bid ($/Ton)
Wyoming			
NARO South	June 2004	297	0.92
NARO North	July 2004	325	0.92
Little Thunder	Sept. 2004	719	0.85
Hay Creek	Nov. 2004	143	0.30
West Antelope	Dec. 2004	195	0.75
West Roundup	Feb. 2005	327	0.97
Eagle Butte West	Feb. 2008	255	0.71
South Maysdorf	Apr. 2008	288	0.87
North Maysdorf	Jan. 2009	55	0.88
West Antelope II (N)	May 2011	350	0.85
West Antelope II (S)	June 2011	56	0.88
Belle Ayr North	July 2011	222	0.95
West Caballo	Aug. 2011	130	1.10
Montana			
Spring Creek Ext.	Apr. 2007	109	0.18

Portions of the Montana PRB coal deposits are located within the Crow and Northern Cheyenne Indian Reservations. These lands are also administered by the federal government (acting as trustee for the tribes), working in conjunction with Tribal authorities. The Absaloka Mine in Montana operates on Crow Tribal lands.

State owned land (mostly state school sections) and limited private lands are also interspersed among the federal ownership. Coal rights on these lands are leased, or purchased, separately, and lease terms may differ from the federal standard. While the federal government is the dominant owner of the coal rights, it is difficult but not impossible to assemble a logical mining unit without incorporating some federal or Indian lands. The proposed Youngs Creek Mine in the Sheridan Field is an example of a logical mining unit does not include federal coal rights.

Various environmental interests have recently threatened or filed lawsuits to force greater consideration of global climate issues and similar concerns in leasing decisions. While this has the potential to limit the resources available for leasing, there is strong bipartisan opposition, and it is considered more likely than not that leasing will continue more or less as at present into the foreseeable future.

Ownership of the surface rights in the PRB is primarily in private hands, although some state, federal or Indian surface occurs. Although the surface estate is usually severed from the minerals, the surface owner has, as a result of various laws and regulations governing coal mining, considerable influence over the mineral owner. For federal coal leasing purposes "surface owner consent" is required before the lease can be issued. Surface owners may also influence mine development activities via the permitting process. Often, but not always, operators have found it more effective to purchase the surface rights prior to undertaking leasing activities.

The BLM has historically pursued a practice of leasing coal at a rate approximately equal to the rate at which it is mined. Currently the BLM is considering leasing on at least nine tracts with an estimated four billion tons of coal resources:

LBA Property	Adjacent Mine	Application Date	Tons (Millions)
North Hilight Field	Black Thunder	Oct. 2005	325
South Hilight Field	Black Thunder	Oct. 2005	266
West Hilight Field	Black Thunder	Jan. 2006	440
West Coal Creek	Coal Creek	Feb. 2006	57
West Jacobs Ranch	Black Thunder	Mar. 2006	957
Hay Creek II	Buckskin	Mar 2006	52
Maysdorf II	Cordero Rojo	Aug. 2006	434
North & South Porcupine	North Antelope Rochelle	Sep. 2006	1,179
Belle Ayr West	Belle Ayr	Aug 2011	253
Total			3,963

It is likely that additional tracts are being evaluated by the various operating companies, but have not been nominated for leasing as yet. The leasing of the nine LBA properties identified above would allow the operating mines to control sufficient resources to support between 10 and 20 years of production, which is thought to be sufficient to justify necessary investment and planning. It is also important to consider that the PRB mining companies have limited incentive to control more than the 10 to 20 years of coal resources, for two primary reasons:

- Federal leases carry diligent development requirements such that if the lease is not combined into a “Logical Mining Unit” (LMU) or put into production within 10 years, the lease will be forfeited.
- The bonus bid is paid by the company “up-front” (actually over a 5 year period following lease issuance). The most recent bonus bids have now exceeded $1.00/ton, or in the most recent auction, over $140 million. It is financially challenging for even the largest mining companies to make such large up-front payments if the coal will not be mined for many years. Consequently, the companies must balance the need to control sufficient resources with the economic penalty of making the large up-front payment.

Overall, the most important issue relative to obtaining the right to mine future resources is the availability of federal coal leases. Our review indicates that, for reasonable planning horizons, and so long as the current BLM policy remains in-place, availability of federal leases in the PRB should be adequate for projected demand.

3.4 PRB Coal Resource Estimates

Estimates of resources in the PRB vary widely, and can be both conflicting and confusing. Two specific areas which are critical are technical/legal recoverability, and economic viability.

Several of the more broadly based estimates of coal resources are expressed as “in-place” tons without regard to technical or legal recoverability. In such cases the portion of the resource that is actually recoverable will be less, and sometimes only a small fraction of the in-place resource. Statements of in-place resources should be viewed as being indicative of the maximum potential tonnage that might be recoverable eventually, but not representative of the resources that could be recovered under current conditions using existing technologies.

As discussed previously, the terms “reserves” and “resources” are understood in the industry to reflect economic viability, although in many cases past studies used those terms more or less interchangeably. Over the last decade the difference between “reserves” and “resources” has become increasingly important, primarily due to financial reporting regulations. Under currently accepted definitions “resources” generally include all of the coal in a specific deposit which, in consideration of technical and legal constraints can reasonably be considered recoverable. “Reserves” are the portion of those resources that have been explored to the point that the estimated tonnages are “demonstrated” and that can be mined and marketed economically at the time the estimate is made, essentially resulting in a “snapshot” at that time. Because exploration is going on constantly, and market factors (primarily prices) change over time “reserve” tonnages may also change – coal that might not be considered “reserves” this year may qualify as “reserves” next year.

This study addresses the PRB resources from the standpoint of the available supply of coal for use as fuel for electrical generation. Because fuel planning is necessarily a long term issue, and most coal is purchased under term contracts at set prices, our focus is on the coal that is in known deposits, is legally and technically available, or likely to become available for mining, within reasonable limits of economic viability – i.e., “resources”. Some or all of those resources may or may not qualify as “reserves” at the present time. For that reason this report addresses “viable resources” defined as the recoverable (as opposed to in-place) coal tonnage that is, or could reasonably be expected to become technically and legally mineable, and which is economic today or could reasonably be expected to become economic within the 30 year timeframe of this study.

As discussed in Section 3.5, BOYD bases the assessment of available resources on site specific mine level analyses. However, it is helpful to view those estimates in the larger context of the total PRB resource. Basin-wide geological studies of the PRB have varied widely in estimates of coal resources, with some approaching 2 trillion tons and others arriving at substantially lower totals. Several recently published studies have provided important insights into these PRB coal resource estimates. The first of these, prepared in 1999 by the United States Geological Survey (USGS) as part of its National Coal Resource Assessment (NCRA) effort, addressed coal resources within three specific planning areas which include the majority of coal lands in the PRB. Resources were defined as coal in seams greater than 2.5 ft in thickness, and less than 2,000 ft in depth. These estimated resources total over 500 billion in-place tons as summarized:

State/County	Resources (Tons-Millions)
Wyoming	
Campbell	280,000
Converse	15,000
Johnson	160,000
Sheridan	52,000
Subtotal	507,000
Montana	
Powder River	22,200
Rosebud	4,700
Big Horn	4,200
Treasure	1,300
Subtotal	32,400
Total Resources	539,400

The estimates above do not include coal occurring on non-federal acreage, or on Indian lands in Montana. Those additional resources are very loosely estimated to be in the range of 80 billion tons. Thus, one might impute an order of magnitude estimate of ± 620 billion in-place resource tons in the PRB.

A second study was published in late 2007 by the U.S. Departments of Energy, Agriculture and Interior. This study addressed the federally owned coal in the PRB, and attempted to determine the portion that would be available for leasing for coal development. This study found that only about 5% of the federally owned coal land was actually available for leasing. However, the bulk of the rest of the coal resources were considered unavailable because land use planning had not been completed (70%), or because surface owner consent had not been obtained (14%). Only about 10% was unleaseable due to environmental or legal restrictions. Extrapolating this to the 620 billion ton estimate, something on the order of 560 billion tons of resources could be legally available for mining pending land use evaluations and obtaining requisite surface and mineral rights.

An important implication of this study is that the vast majority of coal resource areas in the PRB have never been explored or evaluated for development (and thus had not been the subject of land use planning efforts), but are available for possible future mining.

Several more detailed studies have recently become available from the USGS that are focused on specific coal producing areas. These include:

- USGS Open-File Report 2008-1202 – *"Assessment of Coal Geology, Resources, and Reserves in the Gillette Coalfield, Powder River Basin, Wyoming"*
- USGS Professional Paper 1625-A – *"Ashland Coalfield: Powder River Basin, Montana: Geology, Coal Quality and Coal Resources"*
- USGS Professional Paper 1625-A – *"Colstrip Coalfield: Powder River Basin, Montana: Geology, Coal Quality and Coal Resources"*
- USGS Professional Paper 1625-A – *"Decker Coalfield: Powder River Basin, Montana: Geology, Coal Quality and Coal Resources"*

These reports have estimated a combined 141 billion tons of coal resources within the Gillette, Ashland, Colstrip and Decker coalfields. Although the PRB resources are much more extensive than just these four coalfields they are generally considered the most favorable mining regions in the PRB.

The entire 141 billion tons of coal resources would not be economically viable at today's prices for coal, but much of the total could reasonably be expected to become economically viable over the 30-year timeframe of this study.

To provide an indication of the magnitude of the viable resource that is available to supply utility coal markets we have estimated a subset of the 141 billion tons based on economic and recoverability criteria as follows:

PRB Region	Coal Resources (Million tons)	Viable Resources (Million tons)
Gillette Coalfield	77,000	33,878
Ashland Coalfield	6,000	1,921
Colstrip Coalfield	13,000	427
Decker Coalfield	45,000	6,937
Total	141,000	43,163

Gillette Coalfield coal resources were estimated by the USGS in 2008.

Ashland, Colstrip & Decker Coalfield coal resources were estimated by the USGS in 1999.

Viable Resources are defined as follows:

Gillette Coalfield - Produced at less than $20/ton.
Ashland and Decker Coalfields - measured and indicated resources, < 200 ft OB, >40 ft Coal
Colstrip Coalfield – measured and indicated resources, < 150 ft OB, >20 ft Coal, excludes coal within the mine areas.

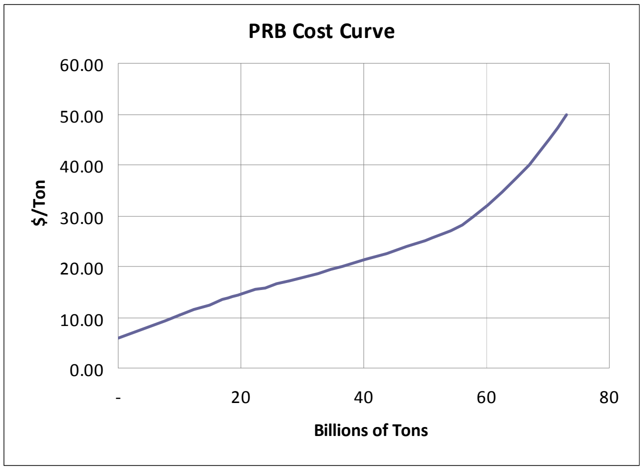
The viable resources of 43.2 billion tons would be sufficient to supply the PRB coal market for 91 years at the current production rate of 470 million tons per year. At higher production rates (which are expected), the viable resources would be depleted sooner. However, even if the production rate increased well beyond any current forecast, these resources are still sufficient to provide fuel for the life of existing power plants and beyond.

The study addressing the Gillette Coalfield (USGS Open-File Report 2008-1202) is important not only because the Gillette Coalfield is the largest production source in the PRB, but because the study imposes specific operational and economic constraints on the resources to arrive at an estimate of the then (2007) economically recoverable reserves in the coalfield. The study estimated the original in-place coal resource in just the Gillette Field at over 200 billion tons, with the technically and legally recoverable portion of that in-place figure, as shown above totaling about 77 billion tons (maximum stripping ratio [2] of 10 BCY/ton and deducting mining and processing losses). Economic analyses, based on a coal price of $10.47/ton and an 8% after-tax return on investment, concluded that approximately 10 billion tons or about 6% of the original in-place

[2] Stripping Ratio is defined as the amount of overburden which must be removed, measured in bank cubic yards (BCY), to expose a ton of recoverable coal. Because overburden removal is the largest cost factor in surface mining, the ratio of overburden to coal is a key economic indicator.

resource would be economically recoverable as of 2007. BOYD, as noted above, estimates an additional 24 billion tons, for a total of 34 billion tons would reasonably be expected to be economically viable over the timeframe of this study.

While this USGS analysis, and the conclusion that only 6% of the original in-place resource is economically recoverable, has been widely quoted, it may wrongly give the impression that coal resources in the Gillette Field are more limited than is truly the case. Even by this relatively conservative analysis, the available economically recoverable reserve is still quite large, exceeding 20 years production at current rates. Furthermore, the USGS study recognizes that the reserve estimate is based on a single point in time and provides a "cost curve" to allow assessment of the economically recoverable reserve at various pricing levels. That curve is reproduced below:



As shown, as the price increases, the "reserve" total increases significantly. At $14/ton, approximately 18.5 billion tons are estimated to be economically viable, and at $20/ton approximately 38 billion tons would be viable. This compares to the 34 billion tons at $20/ton estimated by BOYD (above) as viable resources in the Gillette Field.

The important point of the USGS study and other evaluations is that in an overall context, the cost curve for the PRB is relatively "flat", meaning that small changes in price (or costs) can have major impacts on the magnitude of the economically recoverable resource.

3.5 Coal Resources at Existing Mines

Reliable evaluation of available resources in the PRB requires analyzing each operating or potential mine individually to assess the resources that could logically be recovered by that mine. Over the 30 year timeframe of this study, most production will come from the existing PRB mines which can be expected to expand production capacity as demand for PRB coal increases. Thus risks associated with new mine development are minimal in the context of the overall supply. New supply sources will be developed, but only when they can compete economically with the existing mines, and when transportation infrastructure is extended into more remote parts of the PRB.

Several sources of information were used to evaluate the coal resources at the existing PRB mines, including:

- Mining Permit Application data
- Bureau of Land Management (BLM) information regarding federal coal leases and Lease By Application (LBA) tracts
- Annual Reports and 10-K Reports from the various mining companies
- Environmental Impact Statements
- USGS coal resource studies
- Montana Bureau of Mines and Geology studies

The resource estimates derived from these and other sources generally fall into three categories:

- <u>Permitted Resources</u>. Includes resources that are permitted and/or reported in financial filings. These resources are typically well explored, permitted for mining, and committed to a specific mine plan. Permitted resources must be controlled, typically via a federal lease, and the mining company must have the legal right to mine those tonnages. Resource tonnage estimates as reflected in permit documents and financial filings are considered very reliable.
- <u>LBA Resources</u>. Includes resources in two categories reflecting coal rights control:
    - o Resources that are controlled (i.e., leased) by the operating company, but are not permitted or reported in financial filings and;
    - o Resources in federally owned tracts that have been applied for via the LBA process and are considered likely to be leased.

  Estimates of resources in this category are relatively reliable because the LBA process requires adequate exploration and evaluation of the tract. However, resources in this category may not be controlled, and would typically not be permitted.

- Future Resources. Includes resources on lands that are generally within a particular mine's area of interest, and which could logically be incorporated into future plans for the mine. These resources are not controlled by the mining company, and estimates of resource quantities are typically less reliable than for permitted or LBA resources. However, the estimates are computed based on data from the USGS Open-File Report 2008-1202 which is comprehensive and considered adequately reliable. Future resources are evaluated in this study only to the extent necessary to sustain the mines through the 30 year study period – extensive additional "future resources" exist.

The estimated coal resources for the existing PRB mines based on the information discussed above are discussed in detail for each mine in Chapter 4 of this report. The estimates are summarized by category in the table below. The locations of these mines are shown on Exhibit 1, following this report.

	Coal Resources (Millions of Tons)			
Mine	Permitted	LBAs	Future	Total
Antelope	252.0	406.6	479.0	1,137.6
North Antelope/Rochelle	723.0	1,179.0	1,535.0	3,437.0
School Creek	762.0	0.0	279.0	1,041.0
Black Thunder	1,256.4	1,988.4	1,944.6	5,189.4
Coal Creek	198.0	56.0	224.0	478.0
Cordero Rojo	190.1	776.7	701.5	1,668.3
Belle Ayr	155.0	0.0	745.0	900.0
Caballo	235.2	221.7	598.0	1,054.9
Wyodak	261.9	0.0	0.0	261.9
Dry Fork	110.9	0.0	0.0	110.9
Eagle Butte	425.0	0.0	398.0	823.0
Rawhide	329.7	0.0	1,448.0	1,777.7
Buckskin	280.7	52.0	1,202.0	1,534.7
Decker	12.0	0.0	0.0	12.0
Spring Creek	329.0	0.0	271.0	600.0
Absaloka	49.8	0.0	130.2	180.0
Rosebud	202.0	0.0	158.0	360.0
Totals	5,772.7	4,680.4	10,113.3	20,566.4

Coal Resource estimates are as of December 31, 2010.

As shown, the existing mines effectively control about 10.5 billion tons of coal resources. The identified Future Resources total about 10.1 billion tons, bringing the total to about 20.6 billion tons. Of this, some 1.2 billion tons are in the Montana portion of the basin, with the balance – 19.4 billion tons being in the Gillette Coalfield. That resource is sufficient to allow the mines to meet projected demand over the 30 year study period addressed in this report. Note also that the 19.4 billion tons available in the Gillette Field approximates the resources shown on the USGS cost curve at approximately a $14/ton price – a level comparable with current prices.

It should be emphasized that throughout the PRB the available resources are much more extensive than is required to meet demand over the 30 year period of this study. As discussed above, the viable resources in the PRB could readily double the amount shown at reasonably foreseeable prices and without major additions to transportation infrastructure.

3.6 New Mine Development

Most of the PRB coal produced over the next 30 years will come from existing mines. New mines will be developed but only when they can compete economically with the existing mines and when transportation infrastructure is extended into more remote parts of the PRB. New mines that have good development potential include:

- Otter Creek. The Otter Creek property is located in the Ashland Field with coal occurring primarily in the Knobloch Seam. The coal is typical of PRB in terms of quality but is high in sodium. The property is controlled by Arch Coal Inc. via leases with the State of Montana and Great Northern Properties. Resources are reported to total 1.3 billion tons at stripping ratios in the range of 3 BCY/ton. Coal quality is in the range of 8,600 Btu/lb and 0.3% sulfur. Arch has announced its plans to develop the Otter Creek tracts to serve export markets.

  Development in the Otter Creek area will require construction of the Tongue River Railroad, which is permitted but not yet built. This railroad would likely provide access to additional resources in the same coal formations that exist south along the Tongue River as well as north and west onto the Northern Cheyenne Indian Reservation.

- Decker, Montana region. The existing Decker Mine is approaching depletion. As that mine tapers off, a new mine may be developed to fill that production void. Some of the more prominent new mine projects are the CX Ranch Mine which was delineated and designed more than 20 years ago, and the Youngs Creek Mine. The Youngs Creek Mine, a joint venture of Consol Energy and Chevron Mining is planned for production of up to 15 million tons per year, with quality in the range of 9,350 Btu/Lb and 0.5% sulfur. Early stage efforts to secure permits for the project have been underway for some time. There are also extensive coal resources on the Crow Indian Reservation in the Decker area that could be developed in one or more new mines.

- North of Gillette, Wyoming. The Burlington Northern Santa Fe (BNSF) Railway presently extends north of Gillette as far as the Buckskin Mine. The outcrop of the Wyodak-Anderson Seam; however, extends north and west of the Buckskin Mine for some distance. Potential coal leases have been identified in this area in the past, including the Calf Creek, Rock Pile and Wild Cat tracts. An incremental extension of the railroad extension would open these mines for development.

- Buffalo, Wyoming region. Very large, low cost coal resources exist in the vicinity of Lake DeSmet in Johnson County, Wyoming. These resources were delineated by Texaco in the early 1970s. The coal is poorer quality than elsewhere in the PRB

(±6,200 Btu/Lb, 23% ash and 0.55% sulfur) but would be ideal for a large coal-to-liquid (gasoline or diesel) facility. It is currently being studied for that application.

In the more distant future – beyond 2040 – other properties and areas of the PRB may be developed. Those areas may include the following:

- Between the Wyodak and Caballo mines. In this area the coal seams tend to split into multiple seams and the coal quality is poorer (lower Btu/Lb, higher ash and higher sulfur).
- Between the Black Thunder and Coal Creek mines. In the past, the Kintz Creek and Keeline federal coal properties were delineated but either were never leased (Kintz Creek) or the lease was relinquished (Keeline). The coal seams tend to split in this area resulting in somewhat higher mining costs.
- Western Flank of the PRB. The Glenrock Mine was located on the western flank of the PRB and had been the fuel source for the Dave Johnson power plant for many years. As the mine advanced into higher strip ratio areas, it became less economic and coal was purchased from mines in the Gillette area. Transportation infrastructure would have to be developed along the western flank of the basin to provide access to coal markets.
- Underground Coal Production. The USGS Study of the Gillette Coalfield estimated 77 billion tons of coal resources. The production costs corresponding to those resources ranged between $6/ton and $60/ton assuming the coal is produced by surface mining methods. It is common for surface mines to transition to underground mining methods when surface mining becomes more costly than underground mining the same deposit. At production costs around $30/ton, it would likely become more economic to produce coal by underground methods than surface methods. As a consequence, PRB production costs could effectively be capped around $30/ton regardless of increasing strip ratio. This production cost cap would exist not only in the Gillette Coalfield but throughout the PRB, and thus allow production from the many billions of tons of deeper coal resources throughout the PRB.

Throughout the history of the PRB new mine development has been driven by market demand and accessibility to rail transportation. Availability of resources for mining has rarely, if ever, been more than a temporary impediment. In BOYD's opinion this continues to be the case. The PRB has sufficient recoverable coal resources to meet even the most aggressive demand levels for the foreseeable future.

4.0 POWDER RIVER BASIN OPERATIONS AND COSTS

4.1 Introduction

There are 16 existing PRB mines which currently produce around 470 million tons per year. This chapter provides a description of each existing mine and potential new mines that may come on line over the next 30 years. The assessment of each mine describes the resources available to that mine, and develops estimates of future operating costs, emphasizing the key cost drivers that are specific to that mine.

Xcel also requested BOYD provide comments regarding future trends (beyond 2040) in the PRB. That assessment of long term future trends is provided in Section 4.6 of this chapter.

4.2 PRB Mine Cost Model

Production costs for existing and new PRB mines were estimated using BOYD’s proprietary PRB surface mine cost model. The cost model provides estimates of the coal production costs through to loading coal in the railcar or in the case of Wyodak and Rosebud for delivery to nearby generating stations. The production costs estimated include all direct operating costs, royalties, taxes, overhead and non-cash costs such as depreciation, depletion and amortization.

The primary cost drivers in the model include the following:

- Annual coal production (tons per year)
- Strip ratio (Prime Bank Cubic Yards of waste per ton of coal produced)
- Average coal seam thickness (feet)
- Annual disturbance area (acres)
- Average topsoil depth (feet)
- Percent of overburden removed with draglines
- Estimated dragline rehandle (% of dragline overburden excluding cast blast benefit)
- Percent of overburden removed with trucks and shovels
- Percent of overburden cast blasted
- Cast blast powder factor (Lbs of explosives per BCY of overburden)
- Cast blast benefit (% to final placement)

- Percent of overburden fragmented with conventional blasting
- Conventional blasting powder factor (Lbs of explosives per BCY of overburden)
- Percent of overburden not blasted
- Coal blasting powder factor (Lbs of explosive per ton of coal)
- Coal truck haul distance (one-way distance in miles)
- Coal conveying distance (miles)
- Labor force productivity (measured in “equivalent mining units” – EMUs which are defined as BCY of overburden plus tons of coal per employee-hour)
- Federal coal production (% of total coal production)
- State coal production (% of total coal production)
- Private land (Fee coal) coal production (% of total production)

The major cost drivers focus on the key mining functions or processes within a surface mine which include the following:

- Topsoil salvage and replacement
- Overburden drilling and blasting
- Overburden removal (by dragline, truck/shovel)
- Coal drilling and blasting
- Coal loading and hauling
- Mine support operations
- Coal processing (crushing, handling, storage and loadout)
- Land reclamation

The key mining function or process costs are estimated by multiplying the various annual production quantities by their associated unit costs ($/BCY, $/ton, $/acre). General maintenance costs and General and Administrative costs are added to the functional costs. The cost model also includes a Mine Closing Accrual which amounts to a $/ton cost that is accrued over the life of the mine to cover the costs of reclaiming the final pit and removing the mine facilities and infrastructure.

Royalties, production taxes, and estimated property taxes and insurance are added to the mining cost as summarized below.

- Federal royalty – 12.5% of realization
- Montana state royalty – 12.5% of realization

- Wyoming state royalty – 8.0% of realization
- Private land royalties – 8.0% of realization
- Coal workers Pneumoconiosis (Black Lung) excise tax – 4.4% of realization up to maximum $0.55/ton
- Abandoned Mine Lands (AML) reclamation fee – $0.315/ton (2011 and 2012), $0.28/ton (2013 – 2021) and $0.35/ton (2022 and thereafter)
- Wyoming severance and gross proceeds taxes – 13.0% of realization (less royalties and processing costs)
- Montana gross proceeds tax – 5.0% of realization
- Montana severance taxes – 15.0% of realization (less Black lung tax less AML fee less royalties less gross proceeds tax plus $0.15/ton)
- Montana resource indemnity trust tax (RITT) – 0.4% of realization
- Property taxes – estimated at 1.0% of asset value per year
- Insurance – estimated at 0.5% of asset value per year

Initial, replacement and sustaining capital investment in the mines is recognized through addition of a $/ton depreciation cost. Federal bonus bid expenditures have been included as a $/ton depletion cost rather than as lump sum payments in the five years following award of the federal lease.

The individual costs described above are summed to a total mine production cost.

4.3 Mining Obstacles or Limitations

There are some obstacles to the normal progression of mining that are not directly calculated within the cost model. We have adjusted individual mine costs to account for the additional expenses related to mining around these obstacles. The obstacles and limitations and expenses involved are described below.

The Burlington Northern Santa Fe (BNSF) and the Union Pacific (UP) railroads serve the mines in the PRB. The mines located south of the town of Gillette are served by both railroads via the Joint Line. All the mines located north of Gillette and into Montana are served only by the BNSF Railway. When the mines south of Gillette were initially developed, most of the mines were west of the Joint Line. A few of the mines including North Antelope/Rochelle, North Rochelle, Black Thunder, Jacobs Ranch and Coal Creek were developed east of the Joint Line. As these mines advance west from shallow to deeper resource areas, they will eventually encounter the Joint Line right-of-way. There are several options for addressing this situation with two that appear most viable. One is to relocate the Joint Line to the west and when mining progresses to that point, and once mining is complete relocate the line it back on to mined out ground. A second and more conservative solution is to develop new pits on the west side of the Joint Line without relocating the railroad.

For purposes of this study, we have made the conservative assumption and assumed the mines would develop new pits on the west side of the Joint Line. This cost is addressed by increasing the amount of overburden that must be moved in five years preceding the transition to the new pits, thus accounting for the development of the new box pits. The increase in overburden removal requirements results in increased production costs in those years.

Another obstacle as mines advance to the west is Highway 59 which is the main highway from Gillette to the south. Some of the mines are already within about one mile of Highway 59. We have addressed this obstacle by including costs to relocate Highway 59 to the west. This relocation would be similar to the relocation of Highway 14-16 that runs north out of Gillette. It has recently been relocated to the east of the Eagle Butte Mine to allow unhindered advance of the mine to the west.

While the towns of Gillette and Wright, Wyoming could be obstacles to mining, the existing operations will not mine near these towns over the 30-year timeframe of this study.

The haulage capacity of the BNSF and UP railroads may be viewed as a limitation on the production output of the PRB. However, the railroads will not be likely to have a long term limiting impact on PRB coal production. In the past the railroads have responded to increases in demonstrated demand for PRB coal by adding new capacity to their systems. This is apparent from the double, triple and quadruple trackage along certain sections of the railroads. It is reasonable to expect that the railroad companies will respond to increasing demand by adding new capacity as it is required.

4.4 Existing PRB Mines

The existing PRB mines are typically categorized by state (Montana or Wyoming) and the thermal content of the coal. There are 16 existing mines which currently produce around 470 million tons per year. The existing mines include the following operations:

Montana PRB mines:

- Rosebud
- Absaloka

- Spring Creek
- Decker

Wyoming PRB – 8,400 Btu/Lb Coal Mines:

- Buckskin
- Rawhide
- Eagle Butte
- Dry Fork
- Wyodak
- Caballo
- Belle Ayr
- Cordero Rojo
- Coal Creek

Wyoming PRB – 8,800 Btu/Lb Coal Mines:

- Black Thunder
- North Antelope/Rochelle (NARO)
- Antelope

Each of these mines is described in the following sections. Table 4.1, following this chapter, provides a summary of key data for each mine. Table 4.2, summarizes the projected annual production and production cost for all of the mines over the 2011 – 2040 timeframe. The locations of these mines are shown on Exhibit 1, at the end of this report.

4.4.1 Rosebud Mine

The Rosebud Mine is owned and operated by Western Energy Company (a subsidiary of Westmoreland Coal Company). The mine has been in operation since 1968, and primarily provides the fuel supply to the nearby Colstrip power plant. As coal resources near the plant are depleted, more distant resources have been leased or purchased. Over the last 10 years mine production has ranged between 10.0 and 13.4 Million tons per year (Mtpy) with the mine producing 12.2 million tons of coal of coal in 2010. We have assumed the mine will continue to operate over the 30-year study horizon and supply a steady 12.0 Mtpy to the Colstrip plant. At that projected production level, currently controlled coal resources of 202 Million tons (Mt) will be depleted in 2027. We have assumed additional more-distant coal resources, which are known to exist, will be acquired for the 2028 through 2040 period.

Four draglines – 3 Marion 8050 models and 1 Marion 8200 – and truck/shovel fleets are the primary mining equipment. Key cost drivers for the Rosebud Mine include:

- Total coal thickness averages 30 feet in two seams (22-foot Rosebud Seam and 8-foot McKay Seam)
- 75% of overburden removed by a cast blast and dragline system
- 25% of overburden removed by truck/shovel fleets
- Labor force productivity in 2010 was approximately 97 EMUs/employee-hour

The projected strip ratio trend, annual coal production and production costs through 2040 are summarized below:

Year	Strip Ratio (BCY/Ton)	Projected Coal Production (Million Tons)	Estimated Production Cost ($/Ton)
2011	5.4	12.0	16.10
2015	5.6	12.0	16.47
2020	3.9	12.0	13.77
2025	7.0	12.0	20.36
2030	5.9	12.0	18.63
2035	6.2	12.0	19.27
2040	6.5	12.0	20.17

The Rosebud Mine currently has higher strip ratio than other mines in the PRB and associated higher production cost. The mine is adjacent to the power plant therefore the delivered cost of coal is generally less than if coal was purchased and delivered by railroad from other PRB mines. Although the mine has sold coal on the open market previously, it is not likely to be a significant influence on markets and prices since nearly all of the coal goes to the Colstrip power plant.

4.4.2 Absaloka Mine

The Absaloka Mine is owned and operated by Westmoreland Resources, Inc. (a subsidiary of Westmoreland Coal Company). The coal resources are leased from the Crow Indian Tribe. Over the last ten years, mine production has been in the 5.0 to 7.0 Mtpy. In 2010, the Absaloka Mine produced 5.5 million tons of coal.

A single dragline, BE-2570 (100 cy), and multiple truck/loader fleets are the primary mining equipment. The mine opened in 1974 and shallow coal resource areas were targeted that could be stripped almost entirely by dragline. Most of the shallow coal resources have been mined and future mining areas will require increasing amounts of pre-strip ahead of the dragline. The remaining coal resources within the Absaloka Mine plan (49.2 Mt) are sufficient to sustain the operation at 6.0 Mtpy production level through 2018. Considerable resources occur nearby on the Crow Reservation, and in currently leased areas north of the Reservation. We have assumed additional higher strip ratio resources will be obtained to support the operation through 2040.

Key cost drivers for the Absaloka Mine include the following:

- Total coal thickness averages 29 ft in two seams (12-ft Rosebud and 17-ft McKay seam)
- 80% of overburden removed by a cast blast and dragline system
- 20% of overburden removed by truck/loader fleets
- Labor force productivity in 2010 was approximately 71 EMUs/employee-hour

The projected strip ratio trend, annual coal production and production costs through 2040 are summarized below.

Year	Strip Ratio (BCY/Ton)	Projected Coal Production (Million Tons)	Estimated Production Cost ($/Ton)
2011	3.7	6.0	13.13
2015	3.7	6.0	13.10
2020	3.7	6.0	13.25
2025	3.9	6.0	13.83
2030	4.1	6.0	14.83
2035	4.3	6.0	15.56
2040	4.5	6.0	15.99

The Absaloka Mine produces an 8,600 Btu/Lb coal product. While this coal is not appreciably better than coal from the Gillette-area mines, Absaloka has a transportation advantage into power plants in the upper mid-west. We project the mine will continue to produce at current levels over the 30-year study horizon.

4.4.3 Spring Creek Mine

The Spring Creek Mine is owned by Cloud Peak Energy Resources LLC. Mine production has increased in recent years as production has declined at the nearby Decker Mine. In 2010, the Spring Creek Mine produced 19.3 million tons of coal which is its highest annual production since the mine opened in 1982. In addition to serving traditional US utility markets, Spring Creek coal has been exported through Canadian ports to Asian markets in limited but increasing quantities since 2008. This appears to be a growing trend and we project exports will increase as new port capacity is installed along the west coast. The current permitted capacity is 24 million tons per year.

Cloud Peak's 2010 10K report states total proven and probable reserves are 329.0 Mt. This is sufficient coal to sustain production through 2026 at a 20.0 Mtpy rate. There are extensive coal resources to the south and east of the operation though at increasing strip ratio. We have assumed these additional resources will be acquired to support mine operation through 2040.

Two draglines, BE-1570 (78 cy) and Page 757 (52 cy), and multiple truck/shovel fleets are the primary mining equipment. Key cost drivers for the Spring Creek Mine include:

- Total coal thickness averages 80 ft (the Anderson and Dietz seams merge into one seam at Spring Creek)
- 63% of overburden removed by a cast blast and dragline system
- 37% of overburden removed by truck/shovel fleets
- Labor force productivity in 2010 was approximately 121 EMUs/employee-hour

The projected strip ratio trend, annual coal production and production costs through 2040 are summarized below:

Year	Strip Ratio (BCY/Ton)	Projected Coal Production (Million Tons)	Estimated Production Cost ($/Ton)
2011	2.5	20.0	10.15
2015	2.9	20.0	10.80
2020	3.3	20.0	11.51
2025	3.7	20.0	12.62
2030	4.0	20.0	13.56
2035	4.2	20.0	14.32
2040	4.5	20.0	14.99

The Spring Creek Mine produces a 9,350 Btu/Lb coal product which is favorable from a transportation perspective (cheaper to transport a higher Btu/Lb product on a $/mmBtu basis). High sodium content in the ash causes problems in some boilers. The coal is also considered desirable in the Asian markets as it can be blended with other lower sodium coals to achieve acceptable boiler performance.

4.4.4 Decker Mine

The Decker Mine is jointly-owned by Level 3 Communications and Cloud Peak Energy Resources LLC, and operated by Kiewit Mining Group Inc. Mine production has declined in recent years as long-term sales contracts have expired and economically viable coal resources have depleted. In 2010 the Decker Mine produced 3.0 million tons of coal, down from the high of 13.0 million tons per year in the late 1970s.

The Decker Mine contains extensive coal resources at higher strip ratios – around 5.0 to 6.0+ BCY/ton. Other mines in the PRB generally will not reach that strip ratio range for approximately 25 to 30 years, thus, we expect Decker will close in the near future, and not reopen within the time horizon of this study.

Two draglines and multiple truck/shovel fleets are the primary mining equipment. Key cost drivers for the Decker Mine are:

- Total coal thickness averages 67 ft (in multiple seams)
- 50% of overburden removed by a cast blast and dragline system
- 50% of overburden removed by truck/shovel fleets
- Labor force productivity in 2010 was approximately 47 EMUs/employee-hour (this may reflect a high level of reclamation activities)

The projected strip ratio trend, annual coal production and estimated production costs are summarized below.

Year	Strip Ratio (BCY/Ton)	Projected Coal Production (Million Tons)	Estimated Production Cost ($/Ton)
2011	4.5	3.0	15.39
2015	-	-	-
2020	-	-	-
2025	-	-	-
2030	-	-	-
2035	-	-	-
2040	-	-	-

The Decker Mine produces a 9,500 Btu/Lb coal product which is favorable from a transportation perspective. There may be a few niche markets for this coal in the near term, but over the longer term we believe the Decker Mine will not be economically viable. We have projected the mine will be idled or closed around 2014.

4.4.5 Buckskin Mine

The Buckskin Mine is owned and operated by Kiewit Mining Properties, Inc. In 2010 the Buckskin Mine produced 25.5 million tons of coal. The current permitted capacity is 27 Mtpy.

The Buckskin Mine permit includes 280.7 Mt of controlled coal resources. Kiewit has submitted an application to lease the Haystack II property which contains 52 million tons of coal, sufficient to extend the mining operation through about 2023. We have identified an additional 1.2 billion tons of future coal resources north and west of the current operations within the mine's area of influence [3]. The strip ratios associated with these coal resources gradually increase from around 3.0 to 5.0 BCY/ton. The combined coal resources within permitted areas, LBA and future mine areas total 1.53 billion tons.

The primary mining equipment at Buckskin is multiple large truck/shovel fleets. Key cost drivers at the Buckskin Mine are:

- Total coal thickness averages 104 ft
- 100% of overburden removed by truck/shovel fleets
- Labor force productivity in 2010 was approximately 97 EMUs/employee-hour

The projected strip ratio trend, annual coal production and estimated production costs through 2040 are:

Year	Strip Ratio (BCY/Ton)	Projected Coal Production (Million Tons)	Estimated Production Cost ($/Ton)
2011	2.4	25.0	9.55
2015	2.4	25.0	9.59
2020	1.7	25.0	8.37
2025	3.6	30.0	13.41
2030	3.7	30.0	14.30
2035	4.0	38.5	15.00
2040	4.0	45.0	14.65

The Buckskin Mine appears to be in a favorable strip ratio position for several years to come, and consequently the mine can support increased annual coal production as demand dictates. While the Buckskin Mine is located among the group of mines producing 8,400 Btu/Lb coal, there have been occasions when Buckskin coal had lower thermal content (i.e., <8,400 Btu/Lb). In such instances there are typically price adjustments which result in an overall lower coal sales price.

4.4.6 Rawhide Mine

The Rawhide Mine is owned and operated by Caballo Coal Company, a subsidiary of Peabody Energy Corp. In 2010 the Rawhide Mine produced 11.2 million tons of coal. The current permitted capacity is 24 Mtpy.

---

[3] The term "area of influence" as used in this study refers to the geographic area which is adjacent to and could be logically developed as an extension of the current operation. Future resources referred to herein generally occur within the mine's area of influence.

The Rawhide Mine has generally been operated to supplement production from Peabody's North Antelope/Rochelle and Caballo mines. Since the mine was opened in 1977, production has ranged widely between zero (the mine was idled in 2000 and 2001) and 18.4 Mtpy.

The Rawhide Mine permit area incorporates 329.7 million tons of coal resources, sufficient to sustain mine operation through 2024 at 24.0 Mtpy. No LBA tracts are being pursued at this time. An additional 1.14 billion tons of future coal resources lie west of the current mining operation within the mines area of influence. The strip ratio for these additional coal resources gradually increases from around 2.9 to 5.3 BCY/ton. The total combined coal resources within the Rawhide mine plan and area of interest are 1.47 billion tons.

The primary mining equipment at Rawhide is multiple large truck/shovel fleets. Key mining factors and cost drivers include:

- Total coal thickness averages 116 feet
- 100% of overburden removed by truck/shovel fleets
- Labor force productivity in 2010 was approximately 74 EMUs/employee-hour

The projected strip ratio trend, annual coal production and production costs through 2040 are summarized below.

Year	Strip Ratio (BCY/Ton)	Projected Coal Production (Million Tons)	Estimated Production Cost ($/Ton)
2011	1.6	14.5	8.44
2015	1.6	23.4	7.86
2020	1.9	25.0	8.44
2025	2.4	30.0	10.06
2030	2.6	30.0	11.49
2035	4.2	35.0	14.75
2040	4.2	45.0	15.47

The Rawhide Mine will enjoy a relatively low strip ratio for several years to come, and we have therefore projected its annual production to rise to meet anticipated demand. As with Buckskin, the Rawhide Mine is grouped with mines producing 8,400 Btu/Lb coal, although the coal does not always meet this specification. In such instances there are typically price adjustments which result in an overall lower coal sales price.

4.4.7 Eagle Butte Mine

The Eagle Butte Mine is owned and operated by Alpha Coal West, Inc., a subsidiary of Alpha Natural Resources. In 2010 the Eagle Butte Mine produced 23.2 million tons of coal. The current permitted capacity is 35 Mtpy.

In May 2008 the previous owner of the Eagle Butte Mine successfully leased the Eagle Butte West LBA containing 255 Mt of coal. The bonus bid for property was $180.5 million, equivalent to $0.71/ton. The average strip ratio for the property is reported to be 2.9 BCY/ton. Alpha Coal West has since incorporated the Eagle Butte West LBA tract within their mine plan and permits. Highway 14-16 which runs north out of Gillette divided the Eagle Butte Mine from the Eagle Butte West LBA. The highway has already been rerouted to the east of the Eagle Butte Mine to allow an uninterrupted transition into the Eagle Butte West property.

The Eagle Butte Mine permit allows production of 425 million tons through 2027 (at a 25.0 Mtpy rate). The Eagle Butte West LBA has been incorporated into the mine plan and permits. Beyond 2027, additional coal resources will need to be acquired. We have identified 398.0 million tons of future coal resources situated west of the mine permit area. The strip ratios for these future resources range from 4.6 to 6.8 BCY/ton. The future expansion potential of the Eagle Butte Mine appears limited due to the rising topography (buttes and bluffs) approximately one to two miles west of the current mining area and the associated higher production costs. Excluding this area, the total coal resources within the mine permit and future area of interest are 823.0 million tons.

Multiple large truck/shovel fleets are the primary mining equipment at Eagle Butte. Key cost drivers for the operation include the following:

- Total coal thickness averages 123 ft
- 100% of overburden removed by truck/shovel fleets
- Labor force productivity in 2010 was approximately 123 EMUs/employee-hour

The projected strip ratio trend, annual coal production and estimated production costs through 2038 are summarized below.

Year	Strip Ratio (BCY/Ton)	Projected Coal Production (Million Tons)	Estimated Production Cost ($/Ton)
2011	2.6	25.0	9.83
2015	3.1	25.0	10.86
2020	3.3	25.0	11.72
2025	2.7	25.0	10.60
2030	4.9	25.0	16.32
2035	5.0	25.0	16.63
2040	-	-	-

The Eagle Butte Mine has a very favorable coal resource position with relatively low strip ratios in their current mining areas and the Eagle Butte West LBA. Beyond these areas the strip ratios increase rapidly. The mine is located near the Gillette airport and we have project mining around the airport (instead of relocating the airport). The topography west of the mine includes several buttes. Mining in those areas causes the strip ratio to increase into the 6.0+ BCY/ton range. Consequently, we would anticipate the mine will be idled or closed late in the study period.

4.4.8 Dry Fork Mine

The Dry Fork Mine is owned and operated by Western Fuels Association Inc. The coal is primarily sold to various electric Co-ops that rely upon Western Fuels for fuel supply services. In 2010 Dry Fork produced 5.4 million tons of coal. The current permitted capacity is 15 Mtpa.

The Dry Fork Mine has a large coal resource base but has minimal opportunity to add resources to that base in the future. The mine is bordered by the Eagle Butte Mine to the west, Wyodak Mine and City of Gillette to the south, and the coal subcrop to the north and east. Total coal resources within the mine permit area are 110.9 million tons.

The primary mining equipment at Dry Fork are multiple truck/shovel/loader fleets. Key cost drivers for the Dry Fork Mine include:

- Total coal thickness averages 87 feet
- 100% of overburden removed by truck/shovel/loader fleets
- Labor force productivity in 2010 was approximately 82 EMUs/employee-hour

The projected strip ratio trend, annual coal production and production costs through 2030 are summarized below:

Year	Strip Ratio (BCY/Ton)	Projected Coal Production (Million Tons)	Estimated Production Cost ($/Ton)
2011	1.22	5.5	7.32
2015	1.15	5.5	7.27
2020	1.76	5.5	8.92
2025	2.70	5.5	11.55
2030	1.50	5.5	8.85
2035	-	-	-
2040	-	-	-

We have projected the Dry Fork Mine will continue to supply fuel to the various member Co-ops. Dry Fork will also be the fuel source for the newly commissioned Dry Fork power plant located adjacent to the mine. As currently projected, the mine will deplete the available resources in the 2030 time frame.

4.4.9 Wyodak Mine

The Wyodak Mine is predominantly a captive mine to the Wyodak and Wygen Power Plants located immediately east of Gillette, Wyoming. Relatively minor amounts of coal are sold on the open market to other utilities. The mine is operated by Wyodak Resources a subsidiary of Black Hills Power and Light. In 2010, Wyodak produced 5.9 million tons of coal. The current permitted capacity is 12 Mtpy. The Wyodak Mine controls over 40 years of coal resources (261.9 million tons), so there are no current efforts to acquire additional coal properties.

The primary mining equipment at Wyodak includes trucks/shovels to remove the overburden and an in-pit crushing and conveying system and large front end loaders to mine and transport the coal. Key cost drivers for the Wyodak Mine include the following:

- Total coal thickness averages 90 feet
- 100% of overburden removed by truck/shovel fleets
- Labor force productivity in 2010 was approximately 85 EMUs/employee-hour

The projected strip ratio trend, annual coal production and production costs through 2040 are summarized below.

Year	Strip Ratio (BCY/Ton)	Projected Coal Production (Million Tons)	Estimated Production Cost ($/Ton)
2011	2.5	6.0	9.95
2015	2.5	6.0	10.17
2020	2.5	6.0	10.64
2025	2.5	6.0	10.97
2030	2.5	6.0	11.12
2035	3.0	6.0	12.39
2040	3.0	6.0	12.39

The Wyodak Mine will continue to be the primary fuel supply for the Wyodak power plant. We do not anticipate any appreciable increase in production from Wyodak, and we do not anticipate the Wyodak coal being sold on the open market in significant volumes.

4.4.10 Caballo Mine

The Caballo Mine is owned and operated by Caballo Coal Company, a subsidiary of Peabody Energy Corp. In 2010 the Caballo Mine produced 23.5 million tons of coal. The current permitted capacity is 50 Mtpy.

In July 2004 a previous owner of the Belle Ayr Mine (immediately south of Caballo) applied for the Belle Ayr North LBA. This coal property was intended as a future mining area for Belle Ayr when current coal resources deplete around 2019. A lease sale was held in July 2011, and Peabody Energy Company outbid Alpha Coal West (Belle Ayr's owner) with a bonus bid of $210 million for 221.7 million tons of coal ($0.95/ton).

In a subsequent lease sale in August 2011, Alpha Coal West outbid Peabody for the West Caballo LBA which lies in advance of the Caballo Mine. The winning bonus bid established a new high of $1.10/ton based on a bid of $143.4 million for 130.2 M tons (at 4.2 BCY/ton strip ratio).

These lease sales appear to leave Alpha Coal West in a difficult position in that the West Caballo LBA tract does not appear to be adjacent to the Belle Ayr Mine, and consequently the Belle Ayr pit cannot advance onto the West Caballo property. The West Caballo tract does not appear to be essential to the Caballo Mine operation as other coal properties are available. The natural solution would appear to be trading LBA properties, however, it is not assured that will happen.

The Caballo mining sequence emphasizes advancing to the west although there are extensive unmined coal properties on the eastern side of the Caballo Mine. These eastern areas had been included and scheduled in earlier mining permits, but are currently excluded. While the Caballo mining permit does not explain this change of course, it may be due to coal quality or other geologic issues.

The Caballo Mine permit includes 235.2 million tons of controlled coal resources. The Belle Ayr North LBA, with 221.7 million tons would bring the controlled total to 456.9 Mt. Future coal resources estimated at 598.0 million tons are situated immediately west of the Caballo Mine and could extend the mine life beyond 2040. The strip ratios of these future resources steadily trend from 3.5 to 5.4 BCY/ton.

The primary mining equipment at Caballo are multiple large truck/shovel fleets. Key geologic factors and cost drivers for the Caballo Mine are:

- Total coal thickness averages 75 feet
- 100% of overburden removed by truck/shovel fleets
- Labor force productivity in 2010 was approximately 132 EMUs/employee-hour

The projected strip ratio trend, annual coal production and estimated production costs through 2040 are summarized below.

Year	Strip Ratio (BCY/Ton)	Projected Coal Production (Million Tons)	Estimated Production Cost ($/Ton)
2011	3.7	25.0	11.56
2015	3.7	25.0	11.60
2020	3.9	25.0	12.90
2025	4.2	30.0	13.54
2030	4.2	34.0	14.10
2035	4.5	35.0	14.79
2040	5.0	40.0	15.82

The Caballo Mine appears to be in a generally favorable strip ratio position for most of the study period. Thus, the mine is relatively well positioned to meet future demand growth. We have therefore projected annual coal production rates to rise from 25.0 Mtpy to 40.0 Mtpy.

4.4.11 Belle Ayr Mine

The Belle Ayr Mine is owned and operated by Alpha Coal West, Inc., a subsidiary of Alpha Natural Resources. In 2010 Belle Ayr produced 25.8 million tons of coal. The current permitted capacity is 45 Mtpa.

The Belle Ayr Mine permit provides for production of 155.0 million tons of controlled coal resources which should be sufficient to support the operation through 2016 at 25.0 Mtpy production rate. Alpha Coal West recently leased the Caballo West LBA which contains 130.2 million tons. This LBA is not adjacent to the Belle Ayr Mine permit area and thus does not allow a logical mining transition into the LBA. The cost to develop a new pit and the limited tonnage within the LBA are factors that will likely mean Alpha will not develop this LBA. We consequently have not included this tonnage in our forecast. Future coal resources will likely be acquired west of the present mine permit area. We have identified 745.0 million tons of coal resources with strip ratios gradually increasing from 4.2 to 5.6 BCY/ton. The combined mine permit and future coal resources total 900.0 million tons.

The Belle Ayr Mine appears is in a difficult coal resource position in the near term. If a trade cannot be negotiated with Peabody for the Belle Ayr North LBA, then alternate LBA tracts will have to be leased. The leasing process is currently taking 5 to 7 years. Controlled and permitted coal resources would be near depletion before an alternate LBA could be leased. Delays would then be incurred to obtain mining permits over the new lease area.

The Belle Ayr Mine employs multiple truck/shovel fleets are the primary mining equipment. Key cost drivers for the Belle Ayr Mine include the following:

- Total coal thickness averages 72 feet
- 100% of overburden removed by truck/shovel fleets
- Labor force productivity in 2010 was approximately 166 EMUs/employee-hour

The projected strip ratio trend, annual coal production and production costs through 2040 are summarized below.

Year	Strip Ratio (BCY/Ton)	Projected Coal Production (Million Tons)	Estimated Production Cost ($/Ton)
2011	3.5	25.0	10.69
2015	3.8	25.0	11.21
2020	4.3	20.0	13.60
2025	4.4	20.0	14.15
2030	4.7	20.0	15.05
2035	4.7	20.0	15.51
2040	5.3	20.0	16.32

Due to its limited coal resource position, we do not believe there will be near term production increases at Belle Ayr. When the coal resource situation is ultimately resolved, Belle Ayr will be facing increasing strip ratios and production costs.

4.4.12 Cordero Rojo Mine

The Cordero Rojo Mine is owned and operated by Cordero Mining Company, a subsidiary of Cloud Peak Energy Resources LLC. In 2010 the Cordero Rojo Mine produced 38.5 million tons of coal. The current permitted capacity is 65 Mtpy.

In 2008 and 2009, Cordero Mining Company successfully bid on the North and South Maysdorf LBA tracts. These two tracts contain 342.6 million tons of coal. The bonus bids for two tracts totaled $298.9 million and equivalent to $0.87/ton. The average strip ratio for these tracts is reported to be 3.7 BCY/ton.

The Cordero Rojo Mine permit (August 2007 version) schedules production totaling 190.1 million tons of coal. The North and South Maysdorf LBAs add 346.2 MT, bringing the controlled total to 536.3 million tons, sufficient to extend the mine life into 2024. The mine would subsequently advance onto the Maysdorf II LBA tract which contains 434.0 million tons and an additional future coal resource of 701.5 million tons is located west of the LBA tracts within the mine's area of interest. The additional coal resources have an average strip ratio around 5.5 BCY/ton. The total coal resources within the mine permit area, LBAs and future area of interest are 1.67 billion tons.

Three draglines (2 Marion 8750 and 1 Marion 8200) and multiple truck/shovel fleets are the primary mining equipment at Cordero Rojo. Key cost drivers for the mine include:

- Total coal thickness averages 60 feet

- 64% of overburden removed by a cast blast and dragline system
- 36% of overburden removed by truck/shovel fleets
- Labor force productivity in 2010 was approximately 138 EMUs/employee-hour

The projected strip ratio trend, annual coal production and estimated production costs through 2040 are:

Year	Strip Ratio (BCY/Ton)	Projected Coal Production (Million Tons)	Estimated Production Cost ($/Ton)
2011	3.6	40.0	9.53
2015	3.8	40.0	10.00
2020	3.7	40.0	11.20
2025	4.0	40.0	11.82
2030	4.8	40.0	13.89
2035	5.3	50.0	15.30
2040	5.6	50.0	15.98

The Cordero Rojo Mine is currently equipped so that draglines move the majority of the overburden. As the mine strip ratio and pit depth steadily increase, the more costly truck/shovel fleets will move a large percentage of the overburden (67% in 2040) which will impact the cost structure.

4.4.13 Coal Creek Mine

The Coal Creek Mine is owned and operated by Thunder Basin Coal Company, a subsidiary of Arch Coal Inc. In 2010 Coal Creek produced 11.4 million tons of coal. The current permitted capacity is 50 Mtpy. The Coal Creek Mine has generally been operated to supplement production from the Black Thunder Mine. Since the mine was opened in 1982, production has ranged widely between zero (the mine was idled from 2001 through 2005) and 11.5 Mtpy.

Thunder Basin Coal Company recently bid on the West Coal Creek LBA. That bid was rejected by the BLM due to the absence of Qualified Surface Owner Consent. This decision should not, however have any impact on the ability of the Coal Creek Mine to reach and sustain the projected 15.0 Mtpa production over the study horizon.

The Coal Creek Mine permit provides for production of 198.0 million tons. The West Coal Creek LBA would extend the mine life through 2027 if surface owner consent can be secured. Additional future coal resources of 224.0 million tons are available immediately south and west of the mine permit area to support the mine operation through 2040. The average strip ratio of these future coal resources is around 3.0

BCY/ton. The combined total coal resources including tonnage within the mine permit, LBA and future areas of interest are 478.0 million tons.

The primary mining equipment currently at Coal Creek comprises multiple truck/shovel fleets. Earlier in the mine life, the BE-1300 dragline was assigned to the Coal Creek Mine, but that machine is now in use at Black Thunder. Key cost drivers for the Coal Creek Mine include the following:

- Total coal thickness averages 35 ft (in two seams)
- 100% of overburden removed by truck/shovel fleets
- Labor force productivity in 2010 was approximately 118 EMUs/employee-hour

The projected strip ratio trend, annual coal production and production costs through 2040 are summarized below.

Year	Strip Ratio (BCY/Ton)	Projected Coal Production (Million Tons)	Estimated Production Cost ($/Ton)
2011	2.5	15.0	9.37
2015	2.5	15.0	9.71
2020	2.5	15.0	10.04
2025	3.3	15.0	12.69
2030	3.0	15.0	12.66
2035	3.0	15.0	12.75
2040	3.0	15.0	12.85

Although the Coal Creek Mine does not have a high annual production level, it should remain competitive over the study horizon due to its relatively low strip ratio.

4.4.14 Black Thunder Mine

The Black Thunder Mine is owned and operated by Thunder Basin Coal Company, a subsidiary of Arch Coal Inc. In 2010, Arch purchased the adjacent Jacobs Ranch Mine from Rio Tinto Energy America and incorporated that operation into the Black Thunder Mine. As a consequence, Black Thunder Mine production totaled 116.2 million tons in 2010. The current permitted capacity is 125 Mtpy.

The Black Thunder and Jacobs Ranch Mine permits incorporate lands with 1.256 billion tons of controlled coal resources. This is sufficient tonnage to support the mining operation through 2020.

Thunder Basin Coal Company currently has application submitted for three LBA properties with combined coal tonnage of 1.99 billion tons:

- West Hilight Field LBA – 440 M tons
- Hilight Field (includes a North and South tract) LBA – 591 M tons
- West Jacobs Ranch LBA – 957 M tons

Lease sales for these LBAs may occur as soon as late 2011. These three LBAs would support the mining operation through 2036 at a 120.0 Mtpy production rate. We have identified additional future coal resources of 1.94 billion tons that are situated immediately west and north of the Black Thunder Mine. The strip ratios within these future areas of interest range from 4.5 to 5.5 BCY/ton. The combined total coal resources within the mine permit boundary, LBAs and future area of interest are 5.19 billion tons.

The primary mining equipment at Black Thunder includes six large draglines – 3 BE-2570, 1 BE-1570, 1 BE-1300, 1 Marion 8750 – and multiple truck/shovel fleets. Key cost drivers for the Black Thunder Mine are:

- Total coal thickness averages 70 ft
- 36% of overburden removed by a cast blast and dragline system
- 64% of overburden removed by truck/shovel fleets
- Labor force productivity in 2010 was approximately 161 EMUs/employee-hour

The projected strip ratio trend, annual coal production and estimated production costs through 2040 are summarized below.

Year	Strip Ratio (BCY/Ton)	Projected Coal Production (Million Tons)	Estimated Production Cost ($/Ton)
2011	3.8	122.0	10.66
2015	4.2	130.0	12.11
2020	4.6	125.0	13.11
2025	4.7	131.8	14.32
2030	4.9	135.0	14.26
2035	5.1	150.0	14.81
2040	5.0	165.0	14.81

With the acquisition of Jacobs Ranch the Black Thunder Mine is now the largest coal mine in the United States. Strip ratios increase more slowly – even at higher production rates – than at the competing North Antelope/Rochelle Mine. Consequently we have projected significant production increases at Black Thunder over the next 30 years and stable production at North Antelope/Rochelle.

4.4.15 North Antelope/Rochelle Mine

The North Antelope/Rochelle Mine is owned and operated by Powder River Coal LLC, a subsidiary of Peabody Energy Corp. In 2010 the North Antelope Rochelle Mine produced 105.8 million tons of coal. The current permitted capacity is 110 Mtpy.

The North Antelope Rochelle mine permit incorporates a production schedule for 723.0 million tons of coal resources. This is sufficient tonnage to support the operation into 2017 at 105.0 Mtpy production rate.

Powder River Coal LLC has submitted an application to lease the North and South Porcupine LBA tracts containing 1.18 billion tons of coal. The lease sale is scheduled for the later part of 2011. These LBAs have adequate coal resources to extend the mining operation through 2027.

Future coal resources of 1.53 billion tons are located immediately west of the North Antelope/Rochelle Mine. This tonnage is sufficient to support the mining operation through 2040 at 105.0 Mtpy production rate. The strip ratio of these resources average around 5.6 BCY/ton.

Total coal resources within the mine permit boundary, LBAs and future areas of interest total 3.44 billion tons.

The primary mining equipment at North Antelope/Rochelle includes three large draglines - BE-2570 (100 cy), Marion 8200 (64 cy) and BE-2570 (117 cy) – and multiple truck/shovel fleets. Key cost drivers for the North Antelope/Rochelle Mine include:

- Total coal thickness averages 73 feet
- 27% of overburden removed by a cast blast and dragline system
- 73% of overburden removed by truck/shovel fleets
- Labor force productivity in 2010 was approximately 172 EMUs/employee-hour

The projected strip ratio trend, annual coal production and production costs through 2040 are summarized below.

Year	Strip Ratio (BCY/Ton)	Projected Coal Production (Million Tons)	Estimated Production Cost ($/Ton)
2011	3.0	105.0	9.49
2015	3.4	105.0	11.33
2020	4.5	100.0	14.24
2025	5.4	100.0	16.13
2030	5.5	100.0	16.02
2035	5.5	100.0	16.14
2040	5.8	100.0	16.93

The North Antelope Rochelle Mine had been the largest mine (on an annual production basis) in the United States until Arch Coal combined Black Thunder Mine and Jacobs Ranch Mine into a large mining complex. We have projected North Antelope/Rochelle Mine production to remain stable at 105.0 Mtpy through 2040. If production was increased above this level then the mine would advance more rapidly into areas of higher strip ratio – over 6.0 BCY/ton – with corresponding higher production costs.

4.4.16 Antelope Mine

The Antelope Mine is owned and operated by Antelope Coal Company, a subsidiary of Cloud Peak Energy Resources LLC. In 2010 the Antelope Mine produced 35.9 million tons of coal. The current permitted capacity is 45 Mtpy.

The mining sequence in the Antelope mine permit schedules production through 2017 when permitted coal resource would deplete.

In July 2011 Antelope Coal company successfully bid on the West Antelope II LBA. This LBA includes north and south tracts. The north tract contains an estimated 350 million tons of coal at a strip ratio of 4.6 BCY/ton. The south tract contains 56 million tons at a reported 5.0 BCY/ton strip ratio. These LBAs would support the mining operation through 2028 at a production rate of 36.0 Mtpy.

Additional coal resources would be needed to carry the mining operation through the 2040 term of this study. We have identified future coal resource of 479.0 million tons that are west of the current operations. The strip ratios of these coal resources range from 5.6 to 6.8 BCY/ton.

The total coal resource within the Antelope Mine permit, LBAs and future areas of interest are 1.14 billion tons.

A single dragline and multiple truck/shovel fleets are the primary mining equipment. Key cost drivers for the Antelope Mine include the following:

- Total coal thickness averages 70 ft
- 25% of overburden removed by a cast blast and dragline system
- 75% of overburden removed by truck/shovel fleets
- Labor force productivity in 2010 was approximately 147 EMUs/employee-hour

The projected strip ratio trend, annual coal production and production costs through 2040 are summarized below.

Year	Strip Ratio (BCY/Ton)	Projected Coal Production (Million Tons)	Estimated Production Cost ($/Ton)
2011	2.9	36.0	10.08
2015	3.3	36.0	10.84
2020	4.4	28.0	13.37
2025	4.8	28.0	14.59
2030	5.2	28.0	15.32
2035	5.7	24.0	16.53
2040	6.1	24.0	17.39

Although the Antelope Mine has the desirable 8,800 Btu/Lb coal, the mine will rapidly advance into higher strip ratio areas. As a consequence we have projected declining production in the later years of this forecast.

4.5 Future PRB Mines

Several future PRB mines are in various stages of planning and development. We have identified those projects that appear to be the most likely to move toward development and incorporated production as appropriate from these mines over the 30-year timeframe of this study. We have included three specific properties in our production schedule: Otter Creek in Montana, and School Creek and Youngs Creek in Wyoming. In addition, we would expect two or more other mines to come on line within the study period, however exactly which properties would be developed is unknown. We have therefore incorporated two “generic” mines in the forecast one in Montana (potentially CX Ranch, Tanner Creek/Youngs Creek, Montco, Cook Mountain, Coal Creek and/or

Many Stars), and one in Wyoming (potentially Calf Creek, Rock Pile, Wild Cat, Kintz Creek and/or Keeline).

Each of the identified mines and their primary cost drivers are described in the following sections. Table 4.2, following this chapter, summarizes the projected annual production and production cost for these mines.

4.5.1 Otter Creek Mine

The Otter Creek Mine is located approximately six miles from Ashland, Montana, and consists of private, state and federal coal properties controlled by Arch Coal Company. Projected coal quality is approximately 8,600 Btu/Lb and 0.3% sulfur. The proposed Tongue River Railroad will have to be constructed at least as far as Ashland, Montana for the Otter Creek Mine to be viable.

A key source of information about the Otter Creek Mine is a valuation prepared for the Montana Department of Natural Resources and Conservation in 2009. That valuation includes a conceptual mine plan and cost forecasts.

Key cost drivers for the Otter Creek Mine include the following:

- Total coal thickness averages 57 ft
- 75% of overburden removed by a cast blast and dragline system
- 25% of overburden removed by truck/shovel fleets
- Labor force productivity is assumed to be similar to the Spring Creek Mine at approximately 120 EMUs/employee-hour

The projected strip ratio trend, annual coal production and production costs through 2040 are summarized below.

Year	Strip Ratio (BCY/Ton)	Projected Coal Production (Million Tons)	Estimated Production Cost ($/Ton)
2011	-	-	-
2015	-	-	-
2020	2.3	18.0	8.96
2025	3.3	34.9	10.72
2030	3.5	34.9	11.44
2035	3.7	34.9	12.20
2040	3.8	34.9	12.41

We have scheduled the Otter Creek Mine to come online in 2018.

4.5.2 School Creek Mine

The School Creek Mine is owned by Powder River Coal LLC, a subsidiary of Peabody Energy Corp. The mine is situated between the Arch's Black Thunder Mine and Peabody's North Antelope/Rochelle Mine. Total controlled and permitted coal resources are 762.0 million tons. We have identified an additional 279.0 Mt of future coal resources that may logically be added to the currently controlled resources for a total resource base of 1.04 billion tons. Quality of the School Creek Mine coal is estimated at 8,800 Btu and 0.3% sulfur. The School Creek Mine is fully permitted and can be brought into production in a relatively short timeframe.

The northern part of the School Creek Mine is the idled North Rochelle Mine. The North Rochelle Mine adjoins the Black Thunder Mine and was purchased by Arch from Triton Coal Company in August 2004. Arch intended to expand the North Rochelle coal resource base through addition of the West Roundup LBA property. Peabody competitively bid against Arch in May 2005 for West Roundup and won the lease with a bonus bid of $0.97/ton – the highest bonus bid rate ($/ton) to that time. Arch's future at North Rochelle was effectively cut off as Peabody controlled the coal resources ahead of the mine. Arch and Peabody subsequently negotiated an agreement whereby Arch received the North Rochelle mining equipment and Peabody received the remaining coal resources and mine infrastructure including coal storage barn, rail loadout, and rail spur and loop track. Another key asset with the remaining coal resources was the fully developed pit. Peabody can essentially start the School Creek mining operation from the idled North Rochelle pit.

Key cost drivers for the School Creek Mine include the following:

- Total coal thickness averages 67 ft
- 25% of overburden removed by a cast blast and dragline system
- 75% of overburden removed by truck/shovel fleets
- Labor force productivity is assumed to be similar to the North Antelope Rochelle Mine at approximately 170 EMUs/employee-hour

The projected strip ratio trend, annual coal production and production costs through 2040 are summarized below.

Year	Strip Ratio (BCY/Ton)	Projected Coal Production (Million Tons)	Estimated Production Cost ($/Ton)
2011	-	-	-
2015	4.0	17.9	11.56
2020	3.6	30.0	11.29
2025	3.8	30.0	12.09
2030	4.2	30.0	13.44
2035	4.0	30.0	13.25
2040	5.7	35.0	16.40

We have scheduled the School Creek Mine to come online in 2013.

4.5.3 Youngs Creek Mine

The proposed Youngs Creek Mine is a joint venture (50/50) between Chevron Mining Inc. and CONSOL Energy Inc. The Youngs Creek Mine is located 15 miles north of Sheridan, Wyoming and encompasses approximately 7,700 acres of predominately privately-held coal resources and surface rights. Estimated recoverable coal resources are 325 million tons, with quality of 9,350 Btu/Lb and 0.3% sulfur. Approximately half of the resource has strip ratio under 3.0 BCY/ton.

Draglines and truck/shovel fleets would be the primary mining equipment. Key cost drivers for the Youngs Creek Mine include the following:

- Total coal thickness is estimated to average 60 ft
- 50% of overburden removed by a cast blast and dragline system
- 50% of overburden removed by truck/shovel fleets
- Labor force productivity is assumed to be similar to the Spring Creek Mine at approximately 120 EMUs/employee-hour

The projected strip ratio trend, annual coal production and production costs through 2040 are summarized below.

Year	Strip Ratio (BCY/Ton)	Projected Coal Production (Million Tons)	Estimated Production Cost ($/Ton)
2011	-	-	-
2015	-	-	-
2020	4.0	2.0	14.54
2025	2.8	15.0	10.43
2030	3.0	15.0	11.17
2035	3.4	15.0	12.05
2040	3.8	15.0	12.69

We have scheduled the Youngs Creek Mine to come online in 2020.

4.5.4 Other Mines

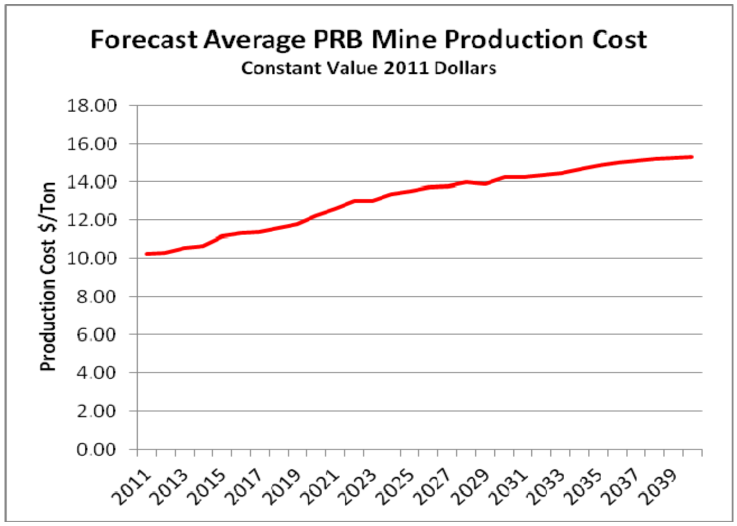
There are several potential mine projects that might come online in the latter years of the study timeframe. In Montana, these include CX Ranch, Tanner Creek/Youngs Creek, Montco, Cook Mountain, Coal Creek and/or Many Stars. In Wyoming, potential mining properties include Calf Creek, Rock Pile, Wild Cat, Kintz Creek and Keeline. Other tracts may be developed between the Wyodak and Caballo mines. All of these tracts have been identified and evaluated to a greater or lesser extent for potential mine development. In each case the available resources are considered sufficient to support mine development if market demand justifies. For purposes of forecasting production and costs, we developed generic mines with characteristics typical of these properties and incorporated those values into the models.

4.6 Overall Mining Cost Trends

Typically as a coal basin matures, mining proceeds from the most favorable to less favorable resources, a trend which puts upward pressure on costs. This is particularly true in the Gillette area where the mines are progressing from shallower, less expensive resources on the eastern edge of the basin to more deeply buried and thus more costly resources to the west. For most of the mines, this advance will also tend to increase coal haul distances putting further upward pressure on costs. Civil features (roads, railroads, buildings, pipelines etc.) will also require additional expenditures in some cases to accommodate.

Historically the trend towards increasing costs in the PRB has largely been offset by improved technology and economies of scale. The next section describes some of the technological trends which could continue to offset increasing costs going forward. For purposes of developing the cost forecasts in this study however, we have assumed that mining technology remains essentially unchanged over the forecast period. While we would expect such improvements to be modest, the forecasts presented herein are still considered conservative (i.e., likely to be high). As shown on Table 4.2, and summarized below, the result is a gradual increase in average mining costs in real terms, over the forecast period.

	Coal Production Cost (2011 $/Ton)			
	2011	2020	2030	2040
Montana Mines:				
Rosebud	16.10	13.77	18.63	20.17
Absaloka	13.13	13.25	14.83	15.99
Spring Creek	10.15	11.51	13.56	14.99
Decker	15.39	-	-	-
Existing Wyoming “8,400 Btu/Lb” Mines:				
Buckskin	9.55	8.37	14.30	14.65
Rawhide	8.44	8.44	11.49	15.47
Eagle Butte	9.83	11.72	16.32	-
Dry Fork	7.32	8.92	8.85	-
Wyodak	9.95	10.64	11.12	12.39
Caballo	11.56	12.90	14.10	15.82
Belle Ayr	10.69	13.60	15.05	16.32
Cordero Rojo	9.53	11.20	13.89	15.98
Coal Creek	9.37	10.04	12.66	12.85
Existing Wyoming “8,800 Btu/Lb” Mines:				
Black Thunder	10.66	13.11	14.26	14.81
North Antelope Rochelle	9.49	14.24	16.02	16.93
Antelope	10.08	13.37	15.32	17.39
Undeveloped Properties:				
School Creek	-	11.29	13.44	16.39
Otter Creek	-	8.96	11.44	12.41
Youngs Creek	-	14.54	11.17	12.69
Unidentified MT	-	-	17.01	14.38
Unidentified WY	-	-	-	13.79



The cost trend is illustrated on the nearby graph. Unlike many coal producing areas, this increase occurs very slowly in the PRB due to the nature of the deposit and scale of operations. BOYD's forecasts of average mining costs indicate a modest increase of ± 1% per year in real terms from about $10/ton (constant 2011 dollars) to about $15/ton in 2040. Note that this represents the average of all mines studied – individual mines may vary significantly both in trend and magnitude of costs.

4.7 Future Trends

The viability of PRB coal as a power plant fuel source over the timeframe of this study and beyond may be influenced in many ways including the following:

- Mining technology trends
- Geologic trends
- Transportation changes
- Energy industry trends
- Political influences

These trends are speculative but reasonably define potential future trends.

4.7.1 Mining Technology Trends

Past technology changes in the PRB have generally centered around introduction of draglines into the PRB mines and up-scaling the size of the mining equipment. While future up-scaling of machine sizes may continue, we think the potential for doubling or tripling machine sizes is minimal. Future size increases will be incremental.

Equipment Automation. Automation of equipment will be a trend in the future. Fully autonomous machines (for example, haul trucks) will offer savings in labor cost as no operator is required, and increased operating time as no operator-related delays (shift changes, shift breaks, lunch breaks, etc.) will be incurred. The automation of trucks is the main focus as the numbers of truck in the mines will increase as strip ratios increase.

Fully autonomous trucks are now in the testing stages in large iron ore mines in Australia. The benefits of this early testing will spread as the technology is proven.

Remote Machine Monitoring. Remote monitoring of machine systems and functions is continuing to evolve to effect improvements in machine availability and productivity. Modern mining machines are being equipped with sensors to monitor nearly all systems and functions of the machines. The collected information is transmitted via wireless signal to the mine office, corporate office, and to maintenance providers. The ability to react to machine needs is enhanced and will result in shorter downtimes and increased operating time. This all combines to decrease mining costs.

Electrical-Powered Equipment. Fuel price increases present a level of vulnerability to the mining operations as much of the haulage and support equipment is diesel driven. The transition to more electrical-driven equipment will work to mitigate some of that fuel price risk. Trolley assist for large haul trucks is being used in certain areas of the world, particularly where trucks must drive up long, steep grades to exit deep pits. This technology will continue to spread especially as the power distribution system that drives the trolley assist operation becomes more flexible and moveable.

Widespread GPS Usage. The use of global positioning system (GPS) equipment is currently being used in some of the PRB mines. That use will spread to all of the mines. GPS equipment is used to both monitor the performance of machines and also load electronically-transmitted mining plans to the mining equipment. This technology is used to achieve precise reclamation grades.

Advanced Mine Planning. Mining industry software and simulation packages will continue to improve. These will be able to interface with surveying hardware and software that can scan the mine surface in a short time so that topographic surfaces can be rapidly updated. A large number of mine plan alternatives will be evaluated in a short time so that the most cost-effective mining alternative can be followed.

Underground Mining Methods. The transition to underground mining methods will occur when it is less expensive than surface mining. Longwall Top Coal Caving methods are currently being used in thick-seam Chinese coal mines to achieve maximum recovery of the coal resource. The introduction of underground mining methods would effectively cap mining costs as underground mining is not influenced by increases in strip ratio.

4.7.2 Geologic Trends

The main geologic trend that will influence production costs is the gradual increase in strip ratio as mines advance down dip. As production costs in the deeper mines increase, new mines will be developed along the edges of the basin where strip ratios and mining costs are lower.

Other geologic trends include the splitting or parting of seams so that multiple coal seams are mined. This generally increases mining costs compared to mining a single, thick seam.

Coal quality generally improves as mines advance away from the subcrop line. There are often areas of higher sulfur and ash and lower Btu/Lb along the subcrop line. As mines advance down dip, there is often a slight increase in thermal content (Btu/Lb). This helps to offset the production cost when measured on a $/mmBtu basis.

4.7.3 Transportation Changes

Railroads will continue to be the primary transporters of PRB coal over the longer term. Capacity will be increased in step with increased PRB coal demand. Other transportation trends include the following:

Tongue River Railroad. The Tongue River Railroad was originally planned as an extension off the BNSF Railway between Miles City, Montana and the Montana-Wyoming border near Sheridan, Wyoming. In June 2011 Forrest Mars, the billionaire former chief executive of Mars Inc, purchased about one-third of the planned railroad that would have passed through his 140 square mile Diamond Cross Ranch near Birney, Montana. The railroad extension will now terminate around Ashland, Montana. This new railroad would provide access to the proposed Otter Creek Mine near Ashland, Montana.

Dakota, Minnesota and Eastern (DM&E) Railroad. The DM&E railroad (a subsidiary of the Canadian Pacific Railroad) has contemplated a build in to the PRB from DM&E lines that currently extend to the western side of South Dakota. The addition of a third railroad (along with the Burlington Northern Santa Fe railroad and Union Pacific railroad) would increase rail competition and result in lower transportation rates. The final Environmental Impact Statement for the build in has been approved and the next major step involves securing financing for the project.

Port Capacity. Increased coal demand within Asian markets has spurred new interest in PRB coal. In the past, a small percentage of overall PRB production has been delivered into Asian markets. This coal was primarily shipped through ports around Vancouver, British Columbia. Earlier this year, Arch Coal announced an agreement to ship PRB coal through Ridley coal terminal located near Prince Rupert, British Columbia. Ambre Energy, an Australian company, has purchased a port facility near Portland, Oregon on the Columbia River. They plan to expand the port to transload coal for sales into Asian markets. Other coal port projects along the west coast are in various stages of development. Even with all these port projects in operation, still only a relatively small percentage of overall PRB production would be exported. The increased demand for PRB coal would generally result in slight upward price pressures.

Power Transmission. The rail component of the delivered cost of PRB coal to various power plants is generally greater than the coal production cost. If rail transportation costs increase, it may become more economic to locate new power plants within or near the PRB and transmit the power over high-voltage transmission lines. This coal-by-wire alternative will become more viable with technological advances in power transmission.

Diesel Fuel Prices. A major component in transportation costs (and mining costs) is the cost of diesel fuel. If diesel prices increases significantly, the market range for PRB coal could be impacted. In such case locally produced coals or lignite may be more cost competitive than PRB coal.

4.7.4 Energy Industry Trends

The various sources of energy (coal, natural gas, uranium, petroleum) will continue to go through market cycles which will lead to emphasizing production of certain fuels over others. Many of the large electric utilities manage these market cycles by diversifying their power generating fleet through a mix of coal-fired, gas-fired, nuclear, and renewable generation.

Oil prices will continue to have an influence on mining costs as well as the cost of diesel fuel and gasoline at the pump. Some of the energy industry trends that may impact PRB viability include the following:

Low Cost Natural Gas. Large quantities of natural gas are being discovered and produced from shale formations across the country. The production of shale gas involves directional drilling (horizontal) and fracturing the formation (fracing) to liberate the gas. The potential impact of fracing on overlying aquifers is gaining attention within the media and may hinder growth of the industry if new regulations are passed. The current increase in gas supply has resulted in lower gas prices. This in turn has led exploration companies to re-direct their efforts more toward oil production which currently has higher profit margins. While natural gas prices are relatively low, it may be more economic for utilities to emphasize gas-fired power generation.

Carbon Capture and Sequestration (CCS) Technology. CCS technology aims to collect the CO2 that would otherwise be emitted into the atmosphere and inject it into permeable geologic formation. The sequestration of CO2 through injection into older oil fields may enhance oil recovery from the fields and also partially or totally offset the CCS cost. If this technology is proven and applied, then it should mitigate the alleged impacts of CO2 on global warming.

Coal to Liquids. The technology to convert coal to liquid fuels (diesel and gasoline) has been in commercial-scale applications since World War II. During the apartheid era in South Africa, essentially all the diesel and gasoline was produced from coal. Today it still remains a major source of diesel and gasoline in South Africa. There are several patented processes to convert coal to liquid fuels. The conversion of coal to liquid fuels becomes competitive with traditional petroleum refining costs when crude oil prices are around $60/barrel. The development of coal to liquid plants would tend to divert PRB coal use from power plant fuel to coal to liquid plant fuel. The increased demand would generally result in slightly higher prices. Alternately, this new source of diesel fuel would tend to lower the price of diesel which is a major component in mining and transportation costs.

Renewal of Nuclear Power Generation. It has been more than two decades since new nuclear power capacity has been constructed. The high up-front capital costs and lengthy time required to construct a nuclear plant are the greatest obstacles to resurgence in nuclear power. The standardized design of a modular nuclear plant has been proposed to address the noted obstacles. Other challenges continue to be long-term disposal of nuclear waste materials and public sentiment in view of the idled Japanese nuclear units following the tsunami earlier this year. Over the longer term, nuclear power should experience a resurgence. At that time, it will compete head on with coal-fired power generation.

Renewable Power Sources. Renewable power sources, particularly wind and solar, will continue to increase over the term of this study and beyond. Currently, renewable power sources are not competitive with conventional coal-fired power generation. Renewable power expansion presently relies on mandates to install some percentage of renewable power or user willingness to pay higher prices for “green” energy. Advances in renewable power technology will improve its competitiveness against traditional power sources, though we do not see renewable power becoming the least costly source of power over the term of this study (through 2040).

4.7.5 Potential Political Influences

Perhaps the greatest uncertainty to long term PRB coal viability arises from potential legislation aimed at reducing greenhouse gases – notably CO2. The burning of coal in power plants is a major source of CO2. If CO2 emissions were taxed via a “cap and trade” scheme, coal-fired generation would become more costly. The magnitude of the tax would influence whether alternate sources of power would be more economic than coal-fired power generation. It is quite difficult to project when such a tax may be legislated. It seems the most likely time would have been during the initial years of the current administration when the congress and executive office were controlled by individuals that seemed sympathetic to the environmental agenda. Proposed CO2 emission legislation was not able to gain the required minimum votes. It does not appear such favorable control of the congress and presidency will again be aligned over the near term to force the environmental agenda.

The regulatory requirements to open new mines and continue to operate existing mines have increased over the years. Both the time and cost to obtain the necessary permits and licenses has continually increased. Some of these increases arise from the orchestrated campaign of numerous groups to block or at least delay mine development. Almost all of the proposed mines eventually come online, albeit at a higher cost to obtain permits and licenses. While such groups are free to engage in such delay tactics, it should be recognized that the additional permitting costs are merely rolled into the coal sales price which is ultimately passed on to the electric rate payer.

Following this page are Tables:

4.1; Coal Supplier Summary, Powder River Basin
4.2: Projected Annual Production, Cash Cost and Production Costs, Powder River Basin Mines

TABLE 4.1

COAL SUPPLIER SUMMARY
POWDER RIVER BASIN
Prepared For
XCEL ENERGY
By
John T. Boyd Company
Mining and Geological Consultants
September 2011

Mine/Property	Primary Owner (Opera ing Company)	Mine Type	2010 Production (M Tons)	Transportation Logistics	Available Resources* (M Tons)	As Received Quality Ash (%)	Sulfur (%)	Btu/Lb	Comments
8,800 Btu (Southern) Mines									
Antelope	Cloud Peak Energy	Surface, Dragline & Truck/Shovel	35.9	On-Site Loadout, UP or BNSF	1,138	5.3	0 22	8,850	Highest quality mine in the Gillette area. Increasing strip ratios will impact this mine before the other 8,800 Btu coal producers.
North Antelope Rochelle	Peabody Energy (Powder River Coal Co)	Surface, Dragline & Truck/Shovel	105.8	On-Site Loadout, UP or BNSF	3,437	4.5	0 20	8,800	Combination of Peabody's North Antelope mine and Rochelle mine. Has previously been the largest mine in US on a tonnage basis.
School Creek	Peabody Energy (Powder River Coal Co)	Surface, Dragline & Truck/Shovel	-	On-Site Loadout, UP or BNSF	1,041	5.0	0 30	8,800	The mine is fully permitted and mining can commence from the old North Rochelle mine pit. This will be the next PRB mine to come online.
Black Thunder/Jacobs Ranch	Arch Coal Inc. (Thunder Basin Coal)	Surface, Dragline & Truck/Shovel	116.2	On-Site Loadout, UP or BNSF	5,189	5.4	0 30	8,800	Arch acquired the Jacobs Ranch Mine in 2009 and integrated hat operation into the overall Black Thunder Complex. Current largest US coal mine.
8,400 Btu (Northern) Mines									
Cordero Rojo	Cloud Peak Energy (Cordero Mining Co)	Surface, Dragline & Truck/Shovel	38.5	On-Site Loadout, UP or BNSF	1,668	5.4	0 30	8,400	Combination of the Cordero and Caballo Rojo Mines.
Belle Ayr	Alpha Natural Resources (Alpha Coal West)	Surface, Truck/Shovel	25.8	On-Site Loadout, UP or BNSF	900	4.5	0 32	8,500	Formerly Foundation Coal Inc. - Merged with Alpha Natural Resources in 2009.
Caballo	Peabody Energy (Caballo Coal Company)	Surface, Truck/Shovel	23.5	On-Site Loadout, UP or BNSF	1,055	5.0	0 32	8,500	
Wyodak	Black Hills Corporation (Wyodak Resources Inc.)	Surface, Truck/Shovel	5.9	Conveyor Delivery to Power Plant, On-Site Truck & Rail Loadouts, BNSF	262	5.5	0.40	8,000	Primarily captive to on-site power plants
Eagle Butte	Alpha Natural Resources (Alpha Coal West)	Surface, Truck/Shovel	23.2	On-Site Loadout, BNSF	823	4.7	0 36	8,400	Formerly Foundation Coal Inc. - Merged with Alpha Natural Resources in 2009.

TABLE 4.1 - Continued

Mine/Property	Primary Owner (Opera ing Company)	Mine Type	2010 Production (M Tons)	Transportation Logistics	Available Resources* (M Tons)	As Received Quality Ash (%)	Sulfur (%)	Btu/Lb	Comments
Dry Fork	Western Fuels	Surface, Truck/Shovel	5.4	On-Site Loadout, BNSF	111	4.9	0 30	8,100	Will increase production to supply Basin Electric's Dry Fork Station.
Rawhide	Peabody Energy (Caballo Coal Company)	Surface, Truck/Shovel	11.2	On-Site Loadout, BNSF	1,778	5.1	0.40	8,300	Historically Rawhide has been Peabody's swing producer with production ranging between 0.0 and 18.4 Mtpy, but has worked continuously since 2001.
Buckskin	Kiewit Mining	Surface, Truck/Shovel	25.5	On-Site Loadout, BNSF	1,535	5.1	0.40	8,300	Acquired by Kiewit Mining Group in 2007. Blends to meet a variety of specifications but does not generally produce an average 8400 Btu/Lb product.
Coal Creek	Arch Coal Inc. (Thunder Basin Coal)	Surface, Dragline, Truck/Shovel	11.4	On-Site Loadout, UP or BNSF	478	5.7	0 35	8,400	Historically a swing producer, but has worked continuously since 2006.
Wyoming Total			428.3		19,415				
Montana Mines									
Decker	Kiewit Mining and Cloud Peak Energy (Decker Coal Company)	Surface, Dragline, Truck/Shovel	3.0	On-Site Loadout, BNSF	12	4.2	0 50	9,500	Available resources are nearly depleted. Significant resources of +5 0 BCY/T coal remain within the lease area. High sodium - 6.4% in ash.
Spring Creek	Cloud Peak Energy (Spring Creek Coal Co)	Surface, Dragline, Truck/Shovel	19.3	On-Site Loadout, BNSF	600	4.3	0 30	9,300	High sodium in ash - 8.5%
Absaloka	Westmoreland Resources	Surface, Dragline, Truck/Shovel	5.5	On-Site Loadout, BNSF	180	8.9	0.60	8,600	Coal is leased from the Crow Indian Tribe. Moderately high sodium in ash - 2.0%
Rosebud	Westmoreland Resources (Western Energy Co)	Surface, Dragline, Truck/Shovel	12.2	Conveyor Delivery to Power Plant, On-Site Loadout, BNSF	360	9.0	0.70	8,575	Most of he production is delivered to the adjacent Colstrip power plant.
Montana Total			40.0		1,152				
PRB Total			468.3		20,567				

* Available Resources include controlled and permitted resources as of 12/31/2010, identified LBA properties and Future resources within the area of interest of each mine.

TABLE 4.2

PROJECTED ANNUAL PRODUCTION, CASH COSTS AND PRODUCTION COSTS
POWDER RIVER BAS N MINES
Prepared For
XCEL ENERGY
By
John T. Boyd Company
Mining and Geological Consultants
September 2011

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	TOTAL
Montana Mines																															
Rosebud Mine																															
Production (Tons-000)	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	360,000
Cash Cost ($/Ton)	15.10	14 93	15 07	15 20	15.45	15.41	15 59	14.69	12 91	12 97	14.75	16 01	16.83	18.16	18 91	19 26	20.12	17.16	17 22	17.36	17.45	17.75	17.84	17.90	17 95	18.31	18.35	18.60	18 66	18.81	
Production Cost ($/Ton)	16.10	15 90	16 07	16 22	16.47	16.42	16.62	15.66	13.71	13.77	15.68	17 04	17.93	19.34	20 36	20.74	21.68	18.42	18.48	18.63	18.73	19 04	19.14	19.21	19 27	19.63	19.68	19.94	20 01	20.17	
Absaloka Mine																															
Production (Tons-000)	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	180,000
Cash Cost ($/Ton)	12.39	12 39	12 36	12 36	12 36	12.46	12.46	12.46	12.46	12 51	12.62	12 95	12.95	13.06	13 06	13 34	13.34	13.51	13 90	13.98	13.98	14 26	14.26	14.64	14 64	14.76	14.76	15.04	15 04	15.04	
Production Cost ($/Ton)	13.13	13.13	13.10	13.10	13.10	13 21	13 21	13.21	13 21	13.25	13.36	13.71	13.71	13.83	13 83	14.12	14.12	14.35	14.75	14.83	14.83	15.13	15.13	15.56	15 56	15.69	15.69	15.99	15 99	15.99	
Spring Creek Mine																															
Production (Tons-000)	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	600,000
Cash Cost ($/Ton)	9.26	9 36	9.44	9 54	9 83	10 03	9 98	10.15	10.15	10 52	10.75	11 09	11.39	11.53	11 53	11 84	11.84	11.98	11 98	12.39	12.65	12.79	12.79	13.10	13.10	13.25	13.25	13.55	13 55	13.69	
Production Cost ($/Ton)	10.15	10 28	10 37	10.49	10 80	11 01	10 93	11.12	11.12	11.51	11.77	12.13	12.46	12.62	12 62	12 96	12.96	13.12	13.12	13.56	13.81	13 98	13.98	14.32	14 32	14.49	14.49	14.82	14 82	14.99	
Decker Mine																															
Production (Tons-000)	3,000	3,000	3,000	3,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12,000
Cash Cost ($/Ton)	14.39	14 39	14 36	14 36	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Production Cost ($/Ton)	15.39	15 39	15 36	15 36	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Wyoming Mines (8,400 Btu/Lb)																															
Buckskin Mine																															
Production (Tons-000)	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	31,700	35,800	38,200	38,500	40,000	40,000	45,000	45,000	45,000	924,200
Cash Cost ($/Ton)	8.64	8 62	8 57	8 55	8 68	8 66	7.44	7.42	7.44	7 54	7.54	11 68	11 68	11.65	11 65	11 65	11.70	12.03	12 05	12.51	12.51	12 50	13.00	13.12	13.14	13.13	13.13	12.79	12.79	12.79	
Production Cost ($/Ton)	9.55	9 53	9.47	9.45	9 59	9 57	8 27	8.25	8 28	8 37	8.37	13.44	13.44	13.41	13.41	13.41	13.46	13.79	13 82	14.30	14.30	14 28	14.85	14.98	15 00	14.99	14.99	14.65	14 65	14.65	
Rawhide Mine																															
Production (Tons-000)	14,500	20,400	20,400	20,400	23,400	25,000	25,000	25,000	25,000	25,000	25,000	28,800	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	34,000	35,000	35,000	35,000	35,000	37,000	36,700	43,500	45,000	45,000	899,100
Cash Cost ($/Ton)	7.78	7 59	7.43	7 32	7 20	7.19	7.18	7.18	7 21	7.71	8.66	9 33	9 33	9.32	9 20	9 36	9 38	9.31	9 33	9.97	10.49	10 64	10.65	11.14	12 84	13.51	13.53	13.53	13 54	13.56	
Production Cost ($/Ton)	8.44	8 24	8 08	7 98	7 86	7 84	7 83	7.83	7 86	8.44	9.55	10 21	10 21	10.20	10 06	10 82	10.84	10.77	10.79	11.49	12.07	12 22	12.24	12.81	14.75	15.42	15.44	15.44	15.45	15.47	
Eagle Butte Mine																															
Production (Tons-000)	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	-	-	-	675,000
Cash Cost ($/Ton)	8.65	8 63	9.48	9.48	9 57	9 57	9 57	9.96	9 99	10 38	10.38	10.45	9.41	9.41	9.41	9.41	9.47	13.75	13.75	14.23	14.23	14 23	14.23	14.49	14 52	14.61	14.61	-	-	-	
Production Cost ($/Ton)	9.83	9 80	10.77	10.77	10 86	10 86	10 86	11.30	11 33	11.72	11.72	11.79	10 60	10.60	10 60	10 60	10.66	15.83	15 83	16.32	16.32	16 32	16.32	16.60	16 63	16.72	16.72	-	-	-	
Dry Fork Mine																															
Production (Tons-000)	5,500	5,500	5,500	5,500	5,500	5,500	5,500	5,500	5,500	5,500	5,500	5,500	5,500	5,500	5,500	5,500	5,500	5,500	5,500	5,500	-	-	-	-	-	-	-	-	-	-	110,000
Cash Cost ($/Ton)	6.70	6 67	6 60	6 60	6 67	6 67	7 23	7.34	8 06	8.17	8.27	8 69	8 69	8.75	10 57	9 28	8.11	7.68	7 26	8.16	-	-	-	-	-	-	-	-	-	-	
Production Cost ($/Ton)	7.32	7 28	7 20	7 20	7 27	7 27	7 91	8.01	8 81	8 92	9.02	9.48	9.48	9.54	11 55	10.11	8.82	8.32	7 82	8.85	-	-	-	-	-	-	-	-	-	-	
Wyodak Mine																															
Production (Tons-000)	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	180,000
Cash Cost ($/Ton)	9.07	9 07	9 03	9 03	9 29	9 29	9 29	9.29	9 61	9.76	9.76	9 83	10.09	10.09	10 09	10 09	10 09	10.09	10 09	10.24	11.25	11 38	11.38	11.38	11 38	11.38	11.38	11.38	11 38	11.38	
Production Cost ($/Ton)	9.95	9 95	9 92	9 92	10.17	10.17	10.17	10.17	10.49	10 64	10.64	10.71	10 97	10.97	10 97	10 97	10.97	10.97	10 97	11.12	12.26	12 39	12.39	12.39	12 39	12.39	12.39	12.39	12 39	12.39	
Caballo Mine																															
Production (Tons-000)	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	30,000	30,000	30,000	30,000	31,400	33,700	34,000	34,000	35,000	35,000	35,000	35,000	35,000	35,000	35,000	40,000	40,000	40,000	918,100
Cash Cost ($/Ton)	10.22	10 22	10.19	10.19	10 27	10.65	10.65	10.65	10 80	10.86	11.32	11.41	11.39	11.41	11.43	11.44	11.50	12.10	11.77	11.99	12.00	11 94	11.92	12.52	12 60	12.62	12.64	13.30	13 50	13.51	
Production Cost ($/Ton)	11.56	11 56	11 52	11 52	11 60	12 65	12 65	12.65	12.79	12 90	13.43	13 52	13 50	13.52	13 54	13 55	13.61	14.29	13 88	14.10	14.11	14 03	14.00	14.70	14.79	14.80	14.82	15.58	15 81	15.82	
Belle Ayr Mine																															
Production (Tons-000)	25,000	25,000	25,000	25,000	25,000	25,000	25,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	635,000
Cash Cost ($/Ton)	9.51	9 51	9.47	9.47	9 95	10.03	10.29	10.99	11 33	11.54	11.62	11 82	11.82	11.95	12 06	12 62	12.62	12.62	12 65	12.88	13.09	13 09	13.09	13.34	13 34	13.43	13.58	14.03	14 03	14.03	
Production Cost ($/Ton)	10.69	10 69	10 66	10 66	11 21	11 29	12 23	13.02	13.40	13 60	13.69	13 88	13 88	14.01	14.15	14.78	14.78	14.78	14 82	15.05	15.25	15 25	15.25	15.51	15 51	15.59	15.77	16.32	16 32	16.32	
Cordero Rojo Mine																															
Production (Tons-000)	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	44,900	50,000	50,000	50,000	50,000	50,000	50,000	1,264,900
Cash Cost ($/Ton)	8.67	8 67	8 91	8 91	9 09	9 34	9 34	9.34	9 57	9.64	9.57	9 65	9.67	9.69	10.18	10 58	11.15	11.38	11.78	12.05	12.41	12.42	12.72	13.11	13 27	13.29	13.40	13.60	13 86	13.88	
Production Cost ($/Ton)	9.53	9 53	9 80	9.80	10 00	10 90	10 90	10.90	11.13	11 20	11.13	11 21	11 23	11.25	11 82	12 27	12.89	13.16	13 62	13.89	14.29	14 31	14.65	15.11	15 30	15.32	15.44	15.66	15 96	15.98	
Coal Creek Mine																															
Production (Tons-000)	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	11,900	13,900	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	445,800
Cash Cost ($/Ton)	8.43	8.45	8.43	8.45	8.78	8 80	8 81	8.83	8 90	9.10	9.04	9.11	9.44	10.48	10 92	10 94	11.14	10.88	10.79	10.97	10.99	11 01	11.03	11.05	11 06	11.08	11.10	11.12	11.14	11.16	
Production Cost ($/Ton)	9.37	9 39	9 37	9 39	9.71	9.73	9.75	9.77	9 84	10 04	9.98	10 05	10 37	12.19	12 69	12.71	12 91	12.59	12.48	12.66	12.68	12.70	12.72	12.74	12.75	12.77	12.79	12.81	12 83	12.85	

TABLE 4.2 - Continued

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Wyoming Mines (8,800 Btu/Lb)															
Black Thunder Mine															
Production (Tons-000)	122,000	130,000	130,000	130,000	130,000	130,000	130,000	125,000	125,000	125,000	125,000	125,000	125,000	128,300	131,800
Cash Cost ($/Ton)	9.51	9 68	9 94	10 21	10.48	10 58	10 63	10.75	11 02	11.11	11.49	11 93	11.91	12.15	12 20
Production Cost ($/Ton)	10.66	10 88	11.16	11 81	12.11	12 23	12.51	12.65	12 95	13.11	13.55	14 01	13.99	14.26	14 32
North Antelope/Rochelle Mine															
Production (Tons-000)	105,000	105,000	105,000	105,000	105,000	105,000	105,000	105,000	105,000	100,000	100,000	100,000	100,000	100,000	100,000
Cash Cost ($/Ton)	8.50	8 63	8.73	8 86	9 57	9.70	9 55	9.91	10 65	12.11	12.72	12 57	12.71	13.57	13.79
Production Cost ($/Ton)	9.49	9 65	9.77	9 92	11 33	11.49	11 36	11.80	12 61	14.24	14.92	14.72	14.88	15.87	16.13
Antelope Mine															
Production (Tons-000)	36,000	36,000	36,000	36,000	36,000	36,000	36,000	36,000	36,000	28,000	28,000	28,000	28,000	28,000	28,000
Cash Cost ($/Ton)	8.76	8 89	8 93	9 06	9.42	9 55	9 67	10.74	11.17	11.44	11.54	11 97	12 07	12.19	12 57
Production Cost ($/Ton)	10.08	10 24	10 30	10.46	10 84	10 99	11.15	12.65	13.10	13.37	13.49	13 93	14.05	14.19	14 59
Undeveloped Properties															
School Creek Mine															
Production (Tons-000)	-	-	3,500	14,900	17,900	26,700	26,500	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000
Cash Cost ($/Ton)	-	-	15 87	9 02	10 35	10 01	9 69	9.74	9 85	9 91	9.93	10 02	10.14	10.29	10.42
Production Cost ($/Ton)	-	-	18.14	10 04	11 56	11.42	11 02	11.07	11 22	11 29	11.56	11 64	11.77	11.94	12 09
Youngs Creek															
Production (Tons-000)	-	-	-	-	-	-	-	-	-	2,000	4,000	7,500	7,500	7,500	15,000
Cash Cost ($/Ton)	-	-	-	-	-	-	-	-	-	13 06	10.04	8 85	8 87	9.11	8.79
Production Cost ($/Ton)	-	-	-	-	-	-	-	-	-	14 54	11.55	10 39	10.42	10.69	10.43
Unidentified MT															
Production (Tons-000)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cash Cost ($/Ton)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Production Cost ($/Ton)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Otter Creek															
Production (Tons-000)	-	-	-	-	-	-	-	12,100	17,500	18,000	25,000	27,500	32,300	34,900	34,900
Cash Cost ($/Ton)	-	-	-	-	-	-	-	8.45	8 35	8 38	9.10	9.18	9 31	9.98	10 00
Production Cost ($/Ton)	-	-	-	-	-	-	-	9.01	8 92	8 96	9.75	9 83	9 99	10.69	10.72
Unidentified WY															
Production (Tons-000)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cash Cost ($/Ton)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Production Cost ($/Ton)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Production Summary															
Montana Mines	41,000	41,000	41,000	41,000	38,000	38,000	38,000	50,100	55,500	56,000	63,000	65,500	70,300	72,900	72,900
Wyoming Mines (8,400 Btu/Lb)	181,000	186,900	186,900	186,900	189,900	191,500	191,500	186,500	186,500	185,400	189,400	197,800	204,000	209,000	216,500
Wyoming Mines (8,800 Btu/Lb)	263,000	271,000	274,500	285,900	288,900	297,700	297,500	296,000	296,000	283,000	283,000	283,000	283,000	286,300	289,800
Total PRB Production	485,000	498,900	502,400	513,800	516,800	527,200	527,000	532,600	538,000	524,400	535,400	546,300	557,300	568,200	579,200

	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	TOTAL
Wyoming Mines (8,800 Btu/Lb)																
Black Thunder Mine																
Production (Tons-000)	134,100	135,000	135,000	135,000	135,000	135,000	143,000	148,000	148,000	150,000	150,000	150,000	158,000	160,000	165,000	4,093,200
Cash Cost ($/Ton)	12 33	12.37	12.39	12 09	12.16	12.18	12 34	12.41	12.59	12 64	12.74	12.78	12.60	12 62	12.65	
Production Cost ($/Ton)	14.47	14.52	14.53	14.18	14.26	14.28	14.47	14.55	14.73	14 81	14.93	14.97	14.75	14.77	14.81	
North Antelope/Rochelle Mine																
Production (Tons-000)	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	3,045,000
Cash Cost ($/Ton)	13 95	13.88	13.53	13 50	13.74	13.76	13.78	13.79	13.81	13 86	14.19	14.42	14.54	14 56	14.57	
Production Cost ($/Ton)	16 32	16.22	15.82	15.78	16.02	16.04	16 06	16.07	16.09	16.14	16.48	16.75	16.89	16 91	16.93	
Antelope Mine																
Production (Tons-000)	28,000	28,000	28,000	28,000	28,000	28,000	24,000	24,000	24,000	24,000	24,000	24,000	24,000	24,000	24,000	876,000
Cash Cost ($/Ton)	12 67	12.54	12.64	12 65	13.21	13.56	13.75	14.27	14.29	14 30	14.44	14.52	14.60	15 00	15.07	
Production Cost ($/Ton)	14.71	14.60	14.72	14.75	15.32	15.71	15 92	16.50	16.51	16 53	16.69	16.78	16.87	17 30	17.39	
Undeveloped Properties																
School Creek Mine																
Production (Tons-000)	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	35,000	35,000	35,000	35,000	799,500
Cash Cost ($/Ton)	10 60	10.98	10.90	10 98	11.44	11.02	11 02	11.07	11.16	11 29	11.38	12.42	13.82	13 94	14.05	
Production Cost ($/Ton)	12 32	12.94	12.86	12 95	13.44	12.94	12 93	12.99	13.10	13 25	13.35	14.52	16.12	16 25	16.39	
Youngs Creek																
Production (Tons-000)	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	268,500
Cash Cost ($/Ton)	9 02	9.04	9.06	9 08	9.42	9.67	9 69	9.71	9.95	10.19	10.21	10.45	10.47	10.49	10.73	
Production Cost ($/Ton)	10 69	10.72	10.76	10 80	11.17	11.46	11.49	11.56	11.81	12 05	12.09	12.36	12.39	12.43	12.69	
Unidentified MT																
Production (Tons-000)	-	-	-	2,000	4,300	13,700	16,000	16,000	16,000	16,000	16,000	16,000	16,000	16,000	16,000	164,000
Cash Cost ($/Ton)	-	-	-	16 07	15.45	10.31	9 99	10.13	10.97	11.40	11.70	11.83	12.43	12 57	13.00	
Production Cost ($/Ton)	-	-	-	17 63	17.01	11.32	10 95	11.26	12.13	12 61	12.93	13.09	13.74	13 90	14.38	
Otter Creek																
Production (Tons-000)	34,900	34,900	34,900	34,900	34,900	34,900	34,900	34,900	34,900	34,900	34,900	34,900	34,900	34,900	34,900	725,700
Cash Cost ($/Ton)	10 00	10.00	10.09	10.17	10.70	10.70	10.70	10.79	10.84	11 24	11.24	11.24	11.33	11 37	11.44	
Production Cost ($/Ton)	10.72	10.72	10.81	10 90	11.44	11.44	11 64	11.73	11.79	12 20	12.20	12.20	12.30	12 34	12.41	
Unidentified WY																
Production (Tons-000)	-	-	-	-	-	-	-	-	2,000	4,000	10,000	15,000	25,000	31,500	36,600	124,100
Cash Cost ($/Ton)	-	-	-	-	-	-	-	-	12.60	12 36	11.25	11.15	11.49	11 53	11.58	
Production Cost ($/Ton)	-	-	-	-	-	-	-	-	14.72	14.48	13.39	13.30	13.65	13.72	13.79	
Production Summary																
Montana Mines	72,900	72,900	72,900	74,900	77,200	86,600	88,900	88,900	90,900	92,900	98,900	103,900	113,900	120,400	125,500	2,165,800
Wyoming Mines (8,400 Btu/Lb)	216,500	217,900	220,200	220,500	220,500	220,000	222,700	226,800	234,100	239,500	243,000	242,700	234,500	236,000	236,000	6,320,600
Wyoming Mines (8,800 Btu/Lb)	292,100	293,000	293,000	293,000	293,000	293,000	297,000	302,000	302,000	304,000	304,000	309,000	317,000	319,000	324,000	8,813,700
Total PRB Production	581,500	583,800	586,100	588,400	590,700	599,600	608,600	617,700	627,000	636,400	645,900	655,600	665,400	675,400	685,500	17,300,100

K \Projects\3155.001 Xcel Energy - PRB Resource & Cost Study\GBG\Final Report\Tables\[Table 4.2.xls]TABLE 4.1 Production & Costs

5.0 POWDER RIVER BASIN MARKETS AND PRICES

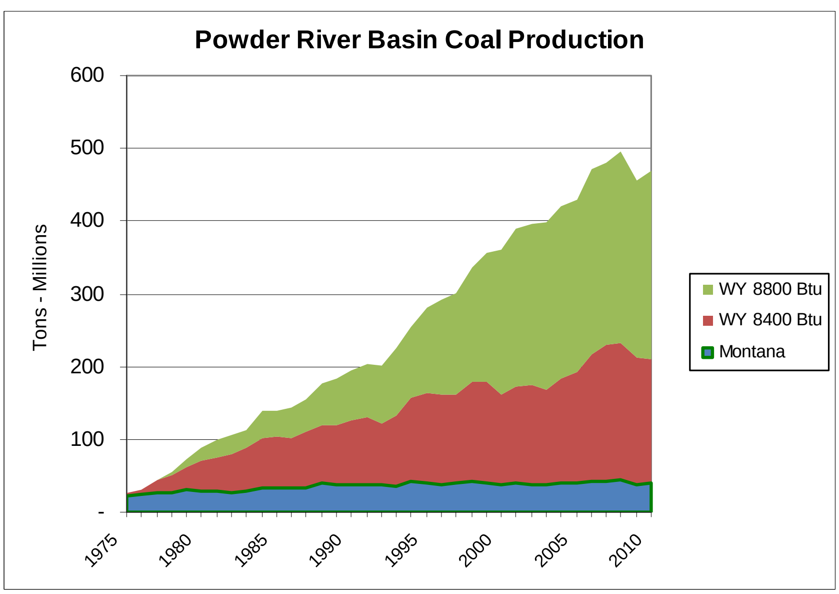
5.1 Introduction

PRB coal is marketed across the United States due to its favorable quality characteristics – notably low sulfur – and relatively low price. PRB coal is the most widely consumed coal in the U.S., supplying over 40% of the total U.S. market on a tonnage basis. Significant production began in the late 1970s, and since that time the PRB has become a large, reliable, competitive and relatively stable fuel supply source for electrical generation, and is the dominant player in coal markets across most of the U.S.

This chapter addresses PRB markets and prices in a basin-wide context based on the mine by mine analyses in the previous chapter. Supply and demand balances are addressed as are pricing considerations for PRB coal. Finally, BOYD's projection of coal prices over the study period are presented and discussed. All coal prices and price projections are expressed in constant value 2011 dollars.

5.2 PRB Coal Supplies

The Powder River Basin, as compared to other producing regions in the country, is a fairly new supply source, but one which has grown dramatically over a relatively short period, as illustrated:



Prior to about 1974, production was limited to a handful of mines in Montana and the Sheridan Field, primarily due to lack of transportation elsewhere, and the relatively low Btu content of the coal as compared to other western U.S. sources. Several factors, including the construction of numerous new power plants in the mid 1970s and early 1980s, the passage in 1978 of the Clean Air Amendments Act (which put a premium on low sulfur content), and the 1984 construction of the “Joint Line” rail access into the southern portion of the basin promoted a very rapid increase in production in the PRB.

PRB coal production peaked in 2008 at about 496 million tons, declining to about 455 million tons in 2009 due to the recession. Since that time production has recovered somewhat to about 470 million tons. Even with the 2009 decrease, PRB production has grown, on average, by approximately a 5% per year rate since the mid-1980s.

PRB supplies have historically been driven primarily by demand – geologic, environmental, operational, and logistical constraints have typically been managed successfully by mine operators and the railroads. Supply shortfalls, although rare, have occurred, but are typically not severe or sustained over an extended term. While the mines have tended to maintain some excess capacity, that excess has typically been relatively small. This is largely because given the nature of the mines and the coal deposit, adding capacity to an existing mine, within limits, is relatively straightforward and economical. Thus, the producers can respond to modest increases in demand in relatively short timeframes. BOYD expects this situation, with a relatively small but adequate excess capacity to continue for the foreseeable future.

5.3 PRB Coal Demand

Virtually all PRB production goes for power generation – industrial sales are very limited. Geographically, PRB customers are primarily to the east and south. Relatively little PRB coal moves west from the basin, although greater interest by consumers in the Southwestern U.S. and for export are likely to increase this flow.

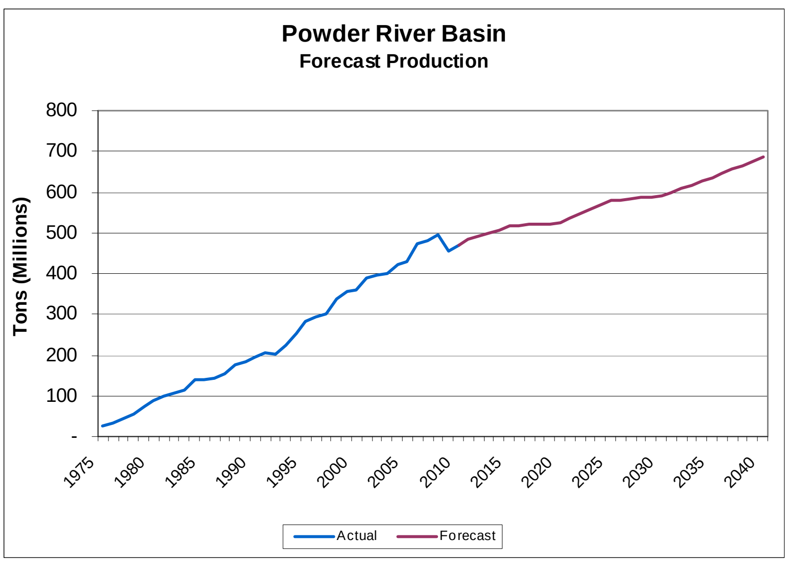
BOYD has developed a forecast of PRB coal demand in conjunction with electrical industry expert R. W. Beck Inc. (a unit of SAIC) for BOYD’s annual multiclient market study entitled – “US CoalVision 2011”. That demand forecast relies upon a market model for steam coal use in U.S. electric power generation. In the market model, coal supply choices are handled principally (but not entirely) on the basis of estimated busbar costs for each economically and technically feasible coal product on a unit-specific basis. Transportation costs from each U.S. coal supply region are used in consideration of the coal choice for each coal-fired unit.

In addition to the PRB share of the U.S. electric generation market, the model incorporates anticipated tonnages moving to export markets, and for potential coal-to-liquid (CTL) projects. Tonnage consumed by CTL development does not generally affect markets as those projects tend to be isolated and draw coal from new, dedicated sources, not established open market mines. Forecast export tonnages are uncertain due to both economics, and the lack of port facilities for such exports. Generally, while exports will be a factor in PRB markets, the tonnage is not expected to be large in the context of total PRB production.

Based on this modeling, BOYD projects PRB coal demand to continue to increase over the timeframe of this study albeit at a slower rate than experienced historically, to around 685 million tons per year in 2040, as summarized below:

Year	Annual Coal Production (Million tons)
2011	485.0
2015	516.8
2020	524.4
2025	579.2
2030	590.7
2035	636.4
2040	685.5

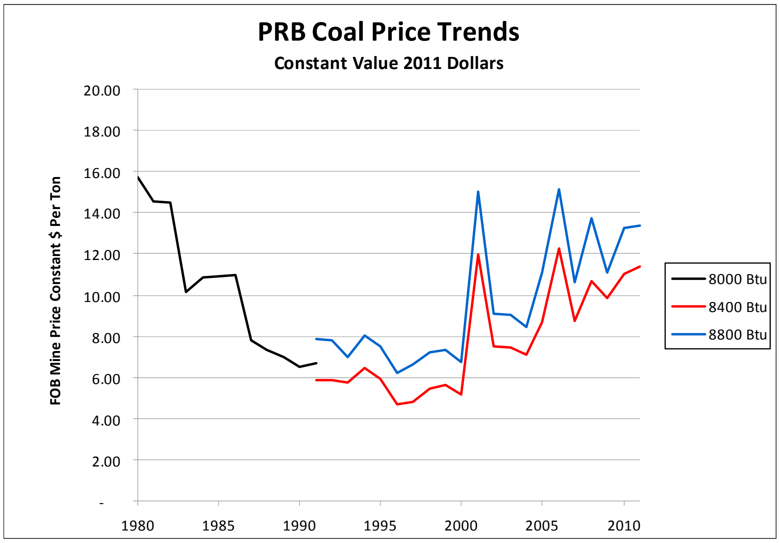
This forecast is illustrated graphically below and compared to historic production.



5.4 PRB Coal Prices

PRB coal prices are fundamentally driven by coal production cost. Market imbalances which might potentially lead to higher prices – such as a sharp increase in demand or a production shortfall – have been rare. There are occasions when PRB coal prices have "spiked" for a short period of time or a particular quality of coal. This is usually due to a brief disruption in coal supply – e.g., railroad problems, pit flooding, extreme weather events (snow) or market factors (demand for "ultra-low" sulfur coal). Oftentimes these events are so short lived that there is little or no impact on overall coal prices. PRB coal production capacity has generally expanded in step with power plant fuel needs so that coal supply and demand are typically in balance, and over the longer term coal sales price trends reasonably closely with coal production cost.

Since initial mine development in the 1970s, various parties have tracked coal market price trends [4]. The chart below reflects the indicative prices published by Coal Outlook, a daily/weekly coal market newsletter. In the early years, price was reported for a generic PRB coal, generally being the lower Btu/Lb material mined in the immediate Gillette area. As new, higher quality mines developed to the south and along the Joint Line, Coal Outlook began differentiating between the higher 8,800 Btu/Lb and lower 8,400 Btu/Lb products. The long term price trend, expressed in constant value 2011 dollars is illustrated below:



[4] For purposes of this report "market prices" are defined as the price that would be negotiated, at the relevant time, between a knowledgeable buyer and reliable seller for coal in substantial volumes to be delivered over a multi-year future period. As used herein "price" is not necessarily the same as a spot price, a forward market price, or prices that would reflect a distressed situation on the part of either buyer or seller.

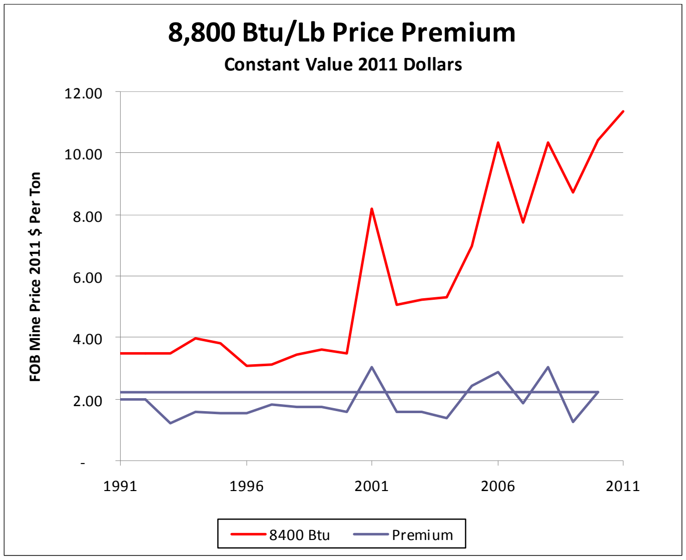
As shown, prices decreased significantly as new mines came on-line or expanded in the late 1980s and 1990s. FOB mine prices remained in the ± $6/ton range ($3 to $4/ton in nominal dollars) throughout the 1990s. During this period, increases in underlying cost drivers, including stripping ratio and haul distance, were largely offset by improvements in technology and economies of scale. Since that time coal prices have increased as the cost of diesel fuel, labor, explosives, machine parts and other consumables have increased, and as the mines have advanced westward into areas of deeper overburden with longer haul distances. This has forced an underlying increase in prices, which coupled with two price "spikes" in 2001 and 2008, have increased prices into the $11 to $14/ton range depending on quality.

Over the 1990 – 2010 period, real prices for PRB coal increased at approximately a 3% rate. However, since 2000 that growth rate has approached 7%. This growth has significantly increased the FOB mine cost of PRB coal, but has not significantly limited demand. This is understandable in the context of the coal market as a whole and as related to delivered cost to the customer. For instance, the PRB price remains very low compared to eastern U.S. compliance coal (12,000 Btu/Lb and <1% sulfur) which is presently selling for $75/ton with prices projected to trend higher.

Transportation costs are also an important consideration in evaluating PRB markets. Because of its low cost at the mine, PRB can be transported relatively large distances and still be competitive with other fuel sources at the destination. A typical delivered cost for PRB coal might total $32/ton, with $12 of that being FOB mine cost, and $20 being transportation cost. In that case, an increase in FOB mine price of, say 10%, results in only a 4% increase in the cost to the customer. A 10% increase in the FOB mine price of the eastern U.S. compliance coal noted above, and assuming a $5/ton transportation cost, would result in a 9% increase in cost to the customer.

As shown on the PRB coal price trend chart above, the higher quality 8,800 Btu/Lb PRB coal commands a disproportionate (relative to Btu content) premium over the lesser quality 8,400 Btu material. Historically, this premium has averaged about $1.90/ton, and generally varied between about $1.50 and $2.40/ton (in 2011 dollars). In times of high demand and higher prices, this premium has tended to increase, while in times of lesser demand and lower prices, the premium has decreased.

This relationship is illustrated on the nearby chart.



Currently the price premium for the 8,800 Btu/Lb coal is unusually high at about $2.70/ton, a premium that has been exceeded only during the 2001 and 2008 "spikes". Although the premium for 8,800 Btu/Lb coal is relatively high at the current time, we believe that over the longer term of this study, the premium will return to more typical levels in the $2.00/ton range.

The price premium on the higher quality coal is the result of a number of factors, the most important of which is transportation cost – fewer tons of 8,800 Btu/Lb coal must be hauled via railroad to provide the same total Btus at the power plant – thus, delivered cost for the 8,400 Btu product will be higher on a Btu basis. This is illustrated below, for a typical haul costing $20/ton.

	Product	
	8,400 Btu/Lb	8,800 Btu/Lb
Volume		
Tons per year (000)	4,000	3,818
Btu/Lb	8,400	8,800
Btu/Ton (Millions)	16.8	17.6
FOB Mine Price ($/Ton)	11.00	12.48
Transportation Cost ($/Ton)	20.00	20.00
Delivered Cost ($/Ton)	31.00	32.48
Delivered Cost per mmBtu	1.85	1.85
Fuel Cost per Year ($-000)	124,000	124,000

As shown, the customer could theoretically pay a $1.48/ton premium ($12.48/ton for 8,800 Btu/Lb coal vs. $11.00/ton for 8,400 Btu/Lb) for the 8,800 Btu/Lb product without increasing the total delivered fuel cost.

The transportation distance and cost relationships tend to bifurcate the market for PRB coal. The greater the distance the coal is transported, the greater the transportation cost, and thus the larger the premium for the higher Btu coal. This is illustrated on the nearby graph which shows the premium that would provide the 8,800 Btu product at the same delivered cost as the 8,400 Btu product at various transportation costs. As shown, the premium ranges from about $0.90/ton at a $10 transportation cost to over $1.90/ton at a $30/ton transportation cost. In this situation, a consumer that is located fairly near the PRB will tend to purchase the lower price 8,400 Btu/Lb product, while consumers that are located at significant distances will favor the higher Btu product. Those consumers in the mid-range are positioned to take advantage of whichever product can be purchased and delivered most cheaply.

While transportation cost is the most important single factor, there are other considerations that, depending on the customer, affect the 8,800 Btu/Lb coal premium. These include:

- The higher Btu PRB coals may also have lower sulfur content, particularly on a Lbs of SO2 per mmBtu basis.
- Some power plant boilers were designed to burn higher Btu coal. Burning lower Btu coal may lead to de-rates of unit capacity.
- Burning the lower Btu coal requires approximately 5% more material be dumped, stockpiled and crushed at the plant. This increases cost and may reduce capacity.

While the higher Btu PRB coal is generally perceived as the more important in terms of pricing (because it is the preferable product in most cases), we believe that over the long term, prices will be influenced more by the 8,400 Btu/Lb product because those resources are more plentiful and the competition in that segment is more robust. The PRB coal price projections developed in this chapter are therefore based on the production cost of 8,400 Btu/Lb coal more than the 8,800 Btu product. The producers of the higher Btu coal will be able to price their product at a level equivalent to the cost of the lower Btu material plus a premium for so long as the cost of the higher product remains below that (price + premium) level. Should production costs at the higher Btu mines increase beyond that level, then the price of the higher Btu coal will be forced upwards. However, as discussed in the previous chapter, we do not project this to occur within the timeframe of this study.

This report also addresses a pricing scenario for the Montana mines. As mentioned, there are four operating mines in the Montana PRB, one of which (Decker) will close in the near future. Of the other three mines, one (Spring Creek) competes in essentially the same markets as the high Btu Wyoming mines, and thus would expect to realize that price with appropriate adjustments for higher energy content and higher sodium. The other two mines, Rosebud and Absaloka, are both owned by Westmoreland Coal Company. At this time Rosebud is essentially dedicated to the mine mouth Colstrip Generating Station. Absaloka is an open market mine generally serving customers in the upper Midwest. Absaloka competes in that market against the Wyoming PRB mines, and therefore the delivered cost of coal to/from those mines will be the key factor in setting market prices for Absaloka, as well as for other potential mine developments in Montana. For this reason, we have focused on the 8,600 Btu/Lb Absaloka coal as the benchmark Montana coal product.

5.5 PRB Supply Forecast

BOYD's analysis of PRB coal supply indicates that over the study period, demand will primarily be met from existing mines which will expand production capacity as demand gradually increases. New mines will be developed when they can compete economically with the existing mines and when transportation infrastructure is extended into more remote parts of the PRB. However, new mines will not be a major factor in terms of markets or prices.

To develop projections of costs and supply, the production level of each PRB mine was projected based on our analysis of geology, resources and production capability for each such that the cumulative production of all mines met the annual projected coal demand. This process of setting the individual mine production levels was repeated for each year over the 2011 through 2040 timeframe.

Production increases were generally forecast from the lower cost mines and/or those with adequate resource availability. Production from higher cost mines was held constant or decreased as would be expected in a competitive market. The forecasts vary from this general principle in certain cases where site specific circumstances would influence production, including:

- Wyodak Mine – is a captive fuel supply to the Wyodak and Wygen power plants and is generally independent from the PRB coal market. Although the mine is relatively low cost, we consider it unlikely that the mine would sell significant tonnages into any other markets.
- Dry Fork Mine – has a limited coal resource base and focuses on supplying Western Fuels Association members. Coal resources for Dry Fork deplete around 2030, and we would not expect outside sales in that period.
- Coal Creek – has a limited coal resource base and would not be able to supply over the longer term.

Similarly, the forecast assumes certain higher cost mines will maintain current production levels for specific reasons, including:

- Rosebud Mine – is more or less captive to the Colstrip power plant and generally independent from the PRB coal market.
- Decker Mine – is nearly depleted. Although near term closure of this mine had been announced, we consider it more likely the mine will continue at a relatively low production level for some period. The forecast assumes Decker operates through 2014 and then is phased out. Decker would not have a material influence on markets in any event.

New mines were added to the projection to meet the demand increases in the following years:

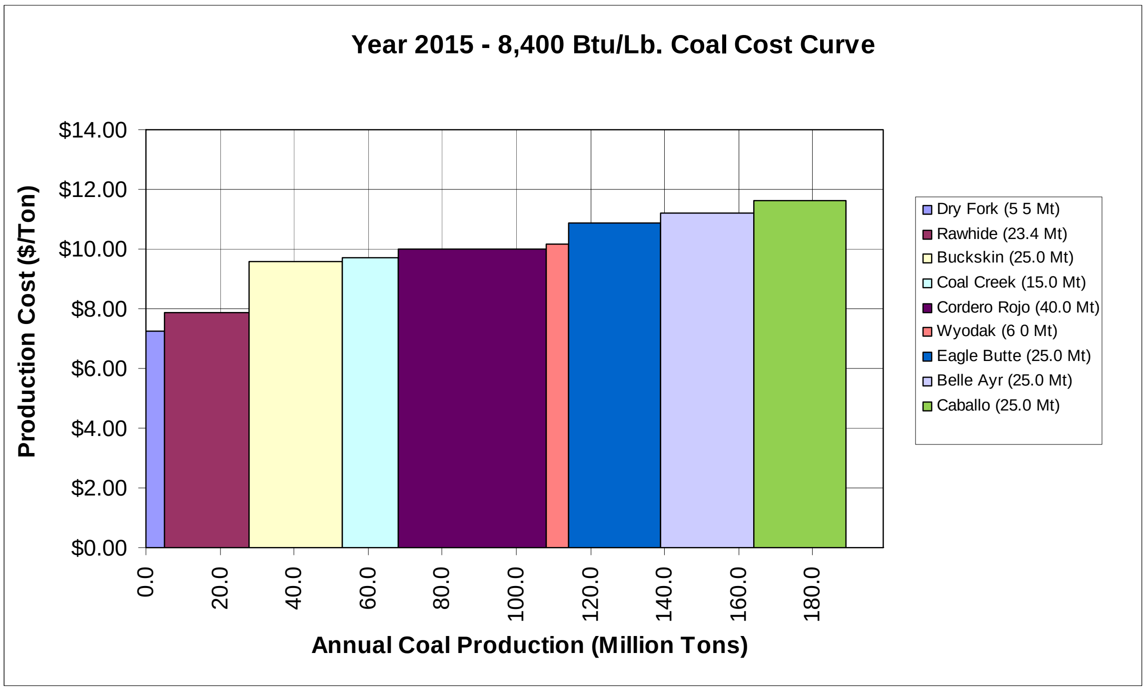
- 2013 – School Creek Mine
- 2018 – Otter Creek Mine
- 2020 – Youngs Creek Mine
- 2029 – Unidentified MT Mine
- 2034 – Unidentified WY Mine

The mines shown as “unidentified” could be any one (or more) of several prospects that may be developed in the future (as discussed in Chapter 4). The combined annual production capacity of these new mines in 2040 is just under 140 million tons.

5.6 PRB Coal Price Forecasts

Based on the supply/demand balance and resulting production schedule, a 30-year production forecast is developed for each of the PRB mines. Those forecasts are one of the inputs into BOYD's mine cost model used to develop estimates of production cost trends for each mine over the forecast period. The resulting information can then be plotted in the form of production vs. cost curves for the three product types: 1) 8,400 Btu/Lb coal, 2) 8,800 Btu/Lb coal, and 3) Montana PRB coal. We developed production vs. cost curves at 5-year intervals as a basis to project PRB coal prices.

A typical curve, with costs expressed in constant value 2011 dollars, is illustrated below:



The coal sales price is estimated as the production cost of the marginal increment of production required to meet the coal demand. That marginal increment is essentially the highest cost mine that supplies coal against the required demand.

The primary driver of PRB prices, as discussed above, has historically been 8,400 Btu/Lb product. In the price forecast, the marginal production cost of the 8,400 Btu/Lb product is used as a baseline for developing projections of price for the three primary PRB products.

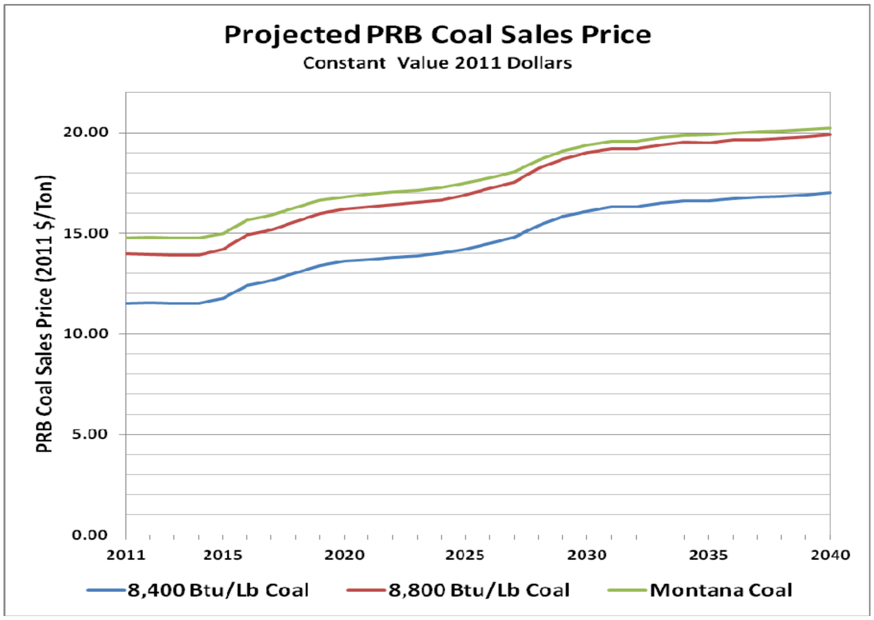
As discussed above, the 8,800 Btu/Lb Gillette Field coal carries a price premium that is related to transportation cost advantages, quality (sulfur) differentials, and operating concerns at the power plant. The forecast price of 8,800 Btu/Lb coal developed herein is based on the 8,400 Btu/Lb price plus the premium, with that premium modeled as a combination of fixed and variable (proportional to total price) components.

Montana market prices are difficult to quantify and project due to the limited number of mines, and portion of production that is essentially captive. The Montana coals can be broadly grouped into two market related categories:

- 9,300 Btu/Lb coal from mines in the Decker, MT and Sheridan, WY area. These coals generally compete in the same markets as the Gillette area coals, however, they carry a premium due to higher thermal content and sometimes a penalty due to sodium content.
- 8,600 Btu/Lb coal from mines in the Colstrip and Ashland areas along the northern border of the PRB. Westmoreland Coal Company's Absaloka Mine is the only truly open market mine in this region at this time, but Arch Coal's planned Otter Creek operation could be a significant source eventually.

As the price benchmark for Montana coal, we have focused primarily on the Colstrip and Ashland sources or potential sources. These coals would compete with Gillette area coals into upper Midwest markets, and possibly into export markets. Mines in this area have a transportation advantage in the upper Midwest markets vs. Gillette area mines which we estimate to be in the $3.00 to $4.00/ton range. The coals may however, be penalized in those and other markets due to the high sodium content in ash. Overall, we estimate the transportation benefit and quality penalties to equate to an approximate $3.30/ton premium over the Gillette area 8,400 Btu/Lb sales price. That premium with minor adjustments has been incorporated into forecast Montana PRB coal sales prices.

BOYD's price projection for the three PRB coal products is shown on the following graph (FOB mine price expressed in constant value 2011 dollars):



The projected coal sales prices, FOB rail at the mine, for the three coal products are summarized at five-year intervals in the table below:

	Projected Coal Sales Price (2011 $/Ton)		
Year	8,400 Btu/Lb	8,800 Btu/Lb	Montana
2011	11.50	14.00	14.75
2015	11.75	14.20	15.00
2020	13.60	16.20	16.80
2025	14.20	16.90	17.50
2030	15.80	17.80	18.80
2035	16.60	19.00	19.40
2040	17.50	19.50	19.90

As shown, we project a relatively steady increase in prices throughout the forecast period. That increase which equates to 1% to 2% per year is significantly less than the historic trends over the past decade. We consider this result reasonable over the long term given the large overall production volume, the relatively flat cost curves, and the competitive nature of the business. This forecast is considered inherently conservative (high) since no major technological or operational advancements are incorporated. While we would expect such improvements to be modest, historically, PRB producers have been able to partially offset less favorable geologic conditions with such improved technology, thus limiting price increases.

We would note that the forecast is intended as a long term projection – there will almost certainly be variations from the forecast due to shorter term factors that could significantly impact prices. Overall however, our evaluation of future mine costs and projection of long term price trends indicates that while prices for PRB coal will increase in real terms, that increase will not be at the pace of the past decade, and buyers will probably not experience large increases due to resource shortages within the timeframe of this study.

K:\Projects\3155.001 Xcel Energy - PRB Resource & Cost Study\GBG\Final Report\Chapters\Chapter 5 - PRB Price Projection.doc

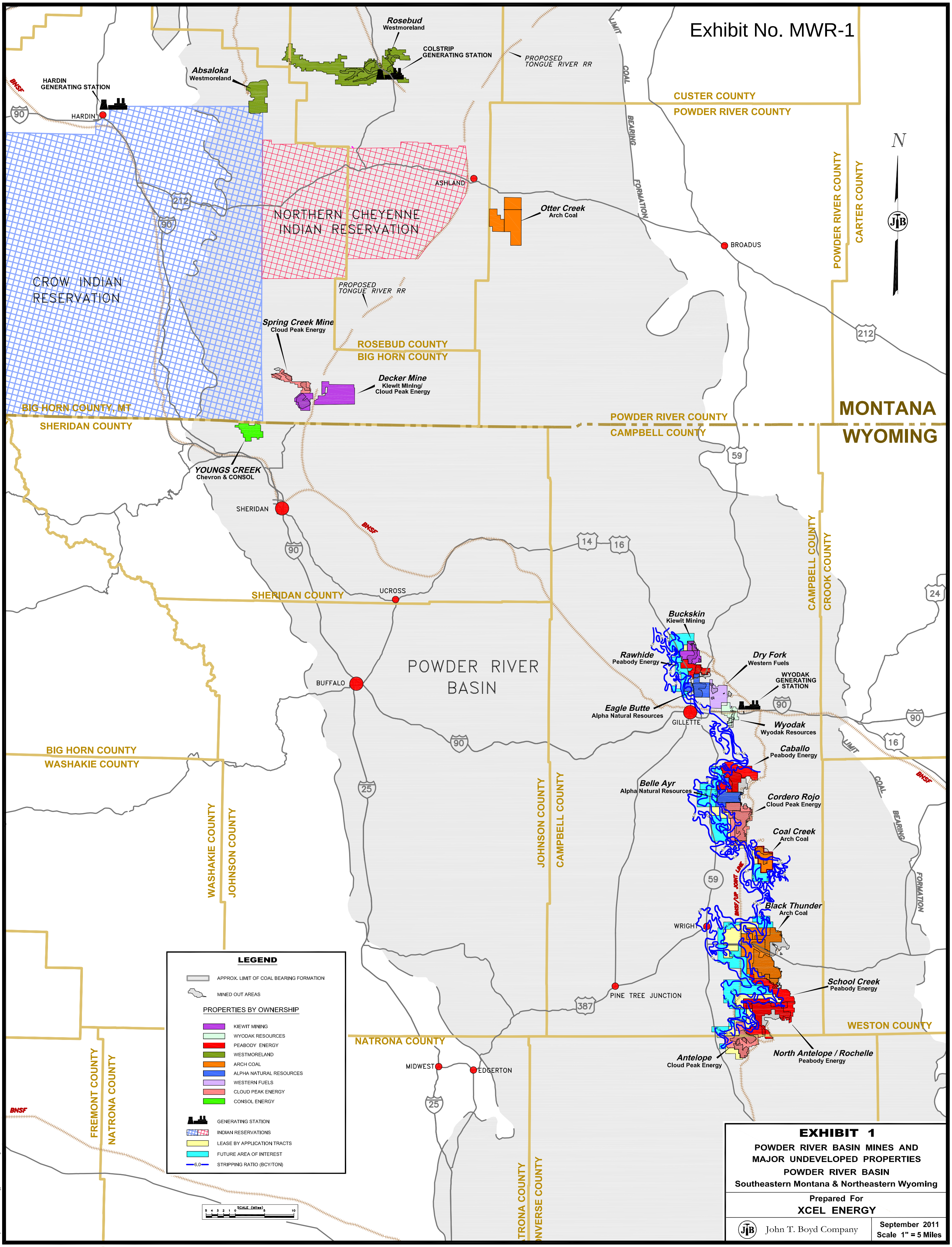


Exhibit No. MWR-1
Rosebud
Westmoreland
COLSTRIP GENERATING STATION
PROPOSED TONGUE RIVER RR
Absaloka
Westmoreland
HARDIN GENERATING STATION
HARDIN
BNSF
CUSTER COUNTY
POWDER RIVER COUNTY
ASHLAND
NORTHERN CHEYENNE INDIAN RESERVATION
Otter Creek
Arch Coal
BROADUS
CROW INDIAN RESERVATION
PROPOSED TONGUE RIVER RR
Spring Creek Mine
Cloud Peak Energy
ROSEBUD COUNTY
BIG HORN COUNTY
Decker Mine
Kiewit Mining/ Cloud Peak Energy
POWDER RIVER COUNTY
CARTER COUNTY
LIMIT COAL BEARING FORMATION
N
BIG HORN COUNTY, MT
SHERIDAN COUNTY
POWDER RIVER COUNTY
CAMPBELL COUNTY
MONTANA
WYOMING
YOUNGS CREEK
Chevron & CONSOL
SHERIDAN
BNSF
UCROSS
SHERIDAN COUNTY
CAMPBELL COUNTY
CROOK COUNTY
POWDER RIVER BASIN
BUFFALO
Buckskin
Kiewit Mining
Rawhide
Peabody Energy
Dry Fork
Western Fuels
WYODAK GENERATING STATION
Eagle Butte
Alpha Natural Resources
GILLETTE
Wyodak
Wyodak Resources
Caballo
Peabody Energy
Belle Ayr
Alpha Natural Resources
Cordero Rojo
Cloud Peak Energy
Coal Creek
Arch Coal
BIG HORN COUNTY
WASHAKIE COUNTY
WASHAKIE COUNTY
JOHNSON COUNTY
JOHNSON COUNTY
CAMPBELL COUNTY
BNSF/UP JOINT LINE
Black Thunder
Arch Coal
WRIGHT
School Creek
Peabody Energy
PINE TREE JUNCTION
WESTON COUNTY
NATRONA COUNTY
North Antelope / Rochelle
Peabody Energy
Antelope
Cloud Peak Energy
MIDWEST
EDGERTON
FREMONT COUNTY
NATRONA COUNTY
NATRONA COUNTY
CONVERSE COUNTY
LEGEND
APPROX. LIMIT OF COAL BEARING FORMATION
MINED OUT AREAS
PROPERTIES BY OWNERSHIP
KIEWIT MINING
WYODAK RESOURCES
PEABODY ENERGY
WESTMORELAND
ARCH COAL
ALPHA NATURAL RESOURCES
WESTERN FUELS
CLOUD PEAK ENERGY
CONSOL ENERGY
GENERATING STATION
INDIAN RESERVATIONS
LEASE BY APPLICATION TRACTS
FUTURE AREA OF INTEREST
STRIPPING RATIO (BCY/TON)
SCALE (Miles)
EXHIBIT 1
POWDER RIVER BASIN MINES AND MAJOR UNDEVELOPED PROPERTIES
POWDER RIVER BASIN
Southeastern Montana & Northeastern Wyoming
Prepared For
XCEL ENERGY
John T. Boyd Company
September 2011
Scale 1" = 5 Miles