The US Coal Industry—
How Much Longer?

NYU Coal Finance Workshop
March 18, 2013
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Coal Deliveries to Power Plants by Region—Graphic by Ventyx

Red = Powder River Basin
2005 Data
Gallons Water Used Per Day

“Comanche” (Pueblo) 7.6 million
“Cherokee” (Denver) 5.2 million
“Pawnee” (Brush) 4.1 million
Hayden (Hayden) 3.3 million

Source: Discovery Responses to Leslie Glustrom Docket 07A-447E
Loss of Arctic Sea Ice....

Mercury....

Fish

Hair

Figure 11. Mercury content in large pelagic fish.

Figure 14. Human hair samples from eight countries show mercury levels above the U.S. EPA reference dose level for hair. (http://www.briloon.org/uploads/documents/hgcenter/gmh/gmhFullReport.pdf)
Coal Deliveries to Power Plants by Region—Graphic by Ventyx

Red = Powder River Basin
How Much Longer For the US Coal Industry?
(Export Issue Aside)

A) 200 Years
B) 20 Years
C) 10 Years
D) 5 Years
E) 3 Years
How Much Longer For the US Coal Industry?

A) 200 Years—Vanishingly Small
B) 20 Years—Not Likely...
C) 10 Years—Maybe
D) 5 Years—??
E) 3 Years—??
How Much Longer For the US Coal Industry?

A) 200 Years—Vanishingly Small
B) 20 Years—Not Likely...
C) 10 Years—Maybe
D) 5 Years—??
E) 3 Years—??
Coal “Reserves” Should Be Economically Accessible: “Resources” are Technically Recoverable If Making a Profit is Not Required.

Figure 1. McKelvey-type diagram illustrating the relationship of coal resources and reserves (modified from Falkie and McKelvey, 1976).

Source: Chapter D, National Coal Resource Assessment
2012

EIA US Coal

Estimated Recoverable “Reserves”

258 Billion Tons

Table 15 EIA Annual Coal Report
1997 Assessment of Coal Resources

Estimated Recoverable Reserves (ERR) = 275 Billion Short Tons
Demonstrated Reserve Base (DRB) = 507 Billion Short Tons

http://www.eia.doe.gov/cneaf/coal/reserves/chapter1.html
Key Source of the Confusion About US Coal Supplies—
EIA Has Been Publishing Reserve Data as Though They
Contain Estimates of Economic Recoverability---

When They Don’t

In 1997, the EIA acknowledged that its “Estimated Recoverable Reserves” did not include an estimate of economic recoverability stating:

“The usual understanding of the term "reserves" as referring to quantities that can be recovered at a sustainable profit cannot technically be extended to EIA's estimated recoverable reserves because economic and engineering data to project mining and development costs and coal resource market values are not available. “

Source: http://www.eia.doe.gov/cneaf/coal/reserves/chapter1.html
2012
EIA US Coal
Estimated recoverable "Reserves"
258 Billion Tons

Table 15 EIA Annual Coal Report
Oops—

Faulty Reporting of US Coal Reserves...

Report to be issued mid-2013 by Clean Energy Action and....
Twelve Major Coal Mines in the Powder River Basin, Wyoming

- Buckskin
- Rawhide
- Eagle Butte
- Dry Fork
- Wyodak
- Caballo
- Belle Ayr
- Cordero Rojo
- Coal Creek
- Black Thunder/Jacobs Ranch
- N Antelope/ Rochelle
- Antelope

Source: Draft EIS South Gillette Area Coal Lease Applications Sept 2008 Bureau of Land Management, Casper, Wyoming Field Office
"Western Coal" .....
Overburden Above Coal in the Powder River Basin (Wyoming and Montana)

50-200 Feet

750->2250 Feet

Source: US DOE, DOI and DOA Inventory of Federal Coal Resources August 2007
70% of the Coal In the Powder River Basin is Not Surface Accessible

Source: US DOE, DOI and DOA Inventory of Federal Coal Resources August 2007
Eastern Mine Production Costs 2005-2012
Arch Coal and Alpha Natural Resources

Arch Coal Eastern Mine Production Cost

Alpha Natural Eastern Mine Production Cost

$/Ton

2005 2006 2007 2008 2009 2010 2011 2012
Powder River Basin Mine Production Costs 200-2012
Arch Coal and Alpha Natural Resources

Arch Coal PRB Mine Production Cost

Peabody PRB Mine Production Cost

$/Ton

Delivered Cost of Coal to Regulated Utilities from 3 Major Coal-Producing Regions over the Last 25 Years

Sources: EIA Form 923 (and predecessor forms); Conversion to 2011 dollars from US Budget Section 10 - Gross Domestic Product and Implicit Outlay Deflators. Analysis by Appalachian Voices, March, 2013
Average US Coal Prices vs Projections from Six Editions of the *Annual Energy Outlook*


From Matt Wasson, Appalachian Voices
U.S. Coal Costs 2004-2011

Data from Table 4.10B EIA Electric Power Monthly
http://205.254.135.24/electricity/monthly/
Michigan Delivered Coal Costs 2004-2011

Data from EIA Electric Power Monthly, Table 4.10B

$2.92/MMBTU in 2012

10.81%/Year through 2011

Data from EIA Electric Power Monthly, Table 4.10B
Ohio Delivered Coal Costs 2004-2011

Data from Table 4.10B EIA Electric Power Monthly
http://205.254.135.24/electricity/monthly/

2012 $2.41/MMBTU

Average Cost per MMBTU

2004 $1.32
2005 $1.52
2006 $1.68
2007 $1.65
2008 $1.96
2009 $2.28
2010 $2.12
2011 $2.29

8.19%/yr (through 2011)
Colorado Delivered Coal Costs 2004-2011

Data from Table 4.10B in the Energy Information Administration’s Electric Power Monthly
http://205.254.135.24/electricity/monthly

2004=$0.97/MMBTU
2012=$1.85/MMBTU
8.53% /year through 2011

Data from Table 4.10B EIA Electric Power Monthly
http://205.254.135.24/electricity/monthly/
Cost of Coal Sales Reported by Arch Coal, 2001-2012


Graph by Matt Wasson, Appalachian Voices 2013
Coal Company Financial Woes

#1—Peabody (BTU)
$1 Billion in Losses
(2012 Q4)

#2—Arch Coal
About $700 Million in Losses
(2012 Q2 and Q4)

#3—Alpha Natural Resources
$2 Billion in Losses
(2012 Q2)

As reported in Quarterly Earnings Reports and Annual 10-K Reports to the Securities and Exchange Commission
Coal Company Debt Coming Due

#1 Peabody ("BTU")

$418 Million Term Loan
$912 Million Term Loan Facility
$650 Million due 2016 (7.375%)
$1.52 Billion due 2018 (6%)
$650 Million due 2020 (6.5%)
$1.34 Billion due 2021 (6.25%)
$247 Million due 2026 (7.875%)
Others due later ......

Total over $6 Billion in Debt....

From Peabody 2012 10-K Annual Report, page F-35
Peabody Coal Sales by Region
2003-2012

- **Powder River Basin**
- **"Eastern"**
- **Australia**
Peabody Australian Coal
Sales Price, Production Cost, Net Margin
2003-2012

Coal Sales Price/Ton

Coal Production Cost/Ton

Coal Margin Per Ton

Data from Peabody 10-K Annual Reports
Coal Company Debt Coming Due

#2 Arch Coal ("ACI")

$1.6 Billion due 2013 (Term Loan)
$450 million due 2013 (6.75%)
$600 million due 2016 (8.75%)
$1 Billion due 2019 (7%)
$375 Million due 2019 (9.875%)
$500 Million due 2020 (7.25%)

Total over $5 Billion in Debt....

"In Land of the Walking Dead...."

Coal Company Debt Coming Due

#3 Alpha Natural Resources ("ANR")

$536 Million due 2015 (3.25%)
$287 Million due 2015 (2.375%)
$540 Million due 2016 (Term loan)
$500 Million due 2018 (9.75%)
$800 Million due 2019 (6%)
$700 Million due 2021 (6.25%)

Total over $3 Billion in Debt

"ANR Poses Imminent Danger to Stockholders..."

Alpha Natural Resources ("ANR")
5-Year Stock Price

http://www.reuters.com/finance/stocks/overview?symbol=ANR
West Virginia 1990-2011 Coal Production
Peak 1947

Apparent Peak Year--1947 176.2 Million Tons

Data from EIA Coal Reports, Table 2
http://www.eia.doe.gov/fuelcoal.html
Colorado 1990-2011 Coal Production
Peak 2004

Apparent Peak Year--2004 39.9 Million Tons

Data from EIA Annual Coal Report Table 1 - http://www.eia.gov/coal/annual/

1990 18.9 Million Tons
2004 39.8 Million Tons
2011 27.2 Million Tons

Data from EIA Coal Reports, Table 2 http://www.eia.doe.gov/fuelcoal.html
Wyoming 1990-2011 Coal Production

<table>
<thead>
<tr>
<th>Year</th>
<th>Production (Million Tons)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990</td>
<td>184.2</td>
</tr>
<tr>
<td>2008</td>
<td>467.6</td>
</tr>
<tr>
<td>2011</td>
<td>438.5</td>
</tr>
</tbody>
</table>

Peak 2008 (467.6 Million Tons)

Data from EIA Coal Reports, Table 2
http://www.eia.doe.gov/fuelcoal.html
UK Coal Industry
1946-1994 Nationalized

Fig. 1. British coal production (Mitchell, 1998b, for production through 1980, and BP, 2010 for more recent production).

http://www.its.caltech.edu/~rutledge/DavidRutledgeCoalGeology.pdf
2005 Coal Deliveries to Power Plants by Region—Graphic by Ventyx

Red = Powder River Basin
The Federal Government (Red) Owns Most of the Coal in the Powder River Basin

Joint Rail Line

Black Thunder Mine

Source: Figure 63 in USGS OFR 2008-1202

Blue Sections are State "School" Sections
Black Thunder Mine

Remaining Life:  About 8 Years
Life Extension:  About 7 Years
Current Overburden:  282 Feet
Expansion O-burden:  400+ Feet*

*For the West Hilight Major Expansion

Powder River Basin Mines
Wyoming

North Antelope/Rochelle Mine

Remaining Life: About 6 Years
Life Extension: 10 Years
Current Overburden: 211 Feet
Expansion O-burden: 340+ Feet

Source: Environmental Impact Statements PRB Coal Mines
Bureau of Land Management, Casper Wyoming Field Office
US Coal Plants:  
What will coal cost in the future? 
How many coal mines will we have in 20-30 years?

2005 Coal Deliveries to Power Plants  
by Region—Graphic by Ventyx 
Red = Powder River Basin
Repowering the US Electric Grid for the 21st Century Is an Imperative—Not a Choice
Xcel’s Recent Cost Data
(February 2012)

Coal data from Pawnee (11A-325E) and Hayden (11A-917E) Dockets Colorado PUC
Wind data from Limon I and Limon II Dockets 09A-772E and 11A-689E
These costs do NOT include any price on carbon and assume there is no societal cost for coal...
US Wind Resource

Source: National Renewable Energy Lab
Figure 12, TSGT Resource Plan Report, November 2010, Page 116
US Solar Resource

Source: National Renewable Energy Lab
Figure 12, TSGT Resource Plan Report, November 2010, Page 116
Disruptive Challenges:
Financial Implications and Strategic Responses to a Changing Retail Electric Business

Prepared by: Peter Kind
Energy Infrastructure Advocates

Prepared for: Edison Electric Institute

January 2013

www.eei.org/ourissues/finance/Documents/disruptivechallenges.pdf
Boulder’s Greenhouse Gas Inventory

Electricity

Source: City of Boulder Climate Action Plan Assessment July 2009
Xcel’s Approx. Projected Fuel Mix 2015 -2030

Data provided by Xcel to City of Boulder, December 2010
Graph by Tom Asprey with RenewablesYes.org
Boulder’s Projected Fuel Mix
Assuming Xcel Maintains 2011 Rates

Questions on modeling and graphs to Tom Asprey
Contact through www.renewablesyes.org
Boulder’s Load

100 MW “Baseload”
i.e. “Coal”

Boulder Load
(based on Fort Collins’ data)
30% Renewable Electricity

Around 30% Renewables, Baseload Coal & Nuclear make no sense.
Ontario, Canada

2007—Decide to close old coal plants
2010—Most coal plants retired
2012—Mostly off of coal
2014—Plan to be entirely off coal
(Moved Final Coal plant retirements to 2013...)

How?

Feed-In-Tariff
2-3x Wind as Colorado....
5-10 x Solar as Colorado....
Lots of efficiency and conservation....

http://www.powerauthority.on.ca/
Your Role on “Front End” Coal Issues

1) GET SERIOUS ABOUT COAL COST/SUPPLY ISSUES

2) TRACK COAL SUPPLY TO SPECIFIC MINES AND COMPANIES

3) CHALLENGE PASS THROUGH OF FOSSIL FUEL COSTS (e.g. “Electric Commodity Adjustment” riders)

4) Follow the Ontario Feed in Tariff Story
   http://www.powerauthority.on.ca/

Clean Energy Action offers no-cost help—Just be persistent.
info@cleanenergyaction.org
Thank You

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www.cleanenergyaction.org
USGS Studies of Economically Recoverable Coal

Total
- Economically Recoverable
- 17%  
- 22%  
- 13%  
- 10%  
- 9%

Top 6 Coal Producing States—Wyoming Dwarfs All Others...

Top 6 Coal Producing States in U.S.
These six states produced about 842 million short tons or about 76% of the U.S. total production in 2007.

Data from http://www.eia.doe.gov/cneaf/coal/page/special/feature.html#t2

Source: Data From Table 2 in EIA Coal Supply and Review 2007
At http://www.eia.doe.gov/cneaf/coal/page/special/feature07.pdf
17% Economically Recoverable

Figure 24. Gillette coal field coal resource analysis results for the five coal mining units combined. Percentages of combined five coal units. Percent of original shown in red, percent of previous resource category shown in white.

USGS Open File Report 02-180, 2002,
Percentage of Economically Recoverable Coal Powder River Basin
USGS 2008

<table>
<thead>
<tr>
<th>Coal resource</th>
<th>Percentages</th>
<th>Exclusions</th>
</tr>
</thead>
<tbody>
<tr>
<td>ORIGINAL</td>
<td>100</td>
<td>None</td>
</tr>
<tr>
<td>REMAINING</td>
<td>96</td>
<td>Coal already mined</td>
</tr>
<tr>
<td>AVAILABLE</td>
<td>51</td>
<td>Restricted</td>
</tr>
<tr>
<td>RECOVERABLE</td>
<td>47</td>
<td>Future mining losses</td>
</tr>
<tr>
<td>ECONOMIC</td>
<td>6</td>
<td>Uneconomic</td>
</tr>
</tbody>
</table>

6% Economically Recoverable

Source: USGS 2008-1202 Figure 68
Figure 66 fails to consider: a) increasing production costs for coal, b) the discrete nature of coal mines or c) legal issues facing coal mine expansion.