The US Coal Industry—

How Much Longer?

NYU Coal Finance Workshop
March 18, 2013
Leslie Glustrom
Clean Energy Action, Boulder, Colorado

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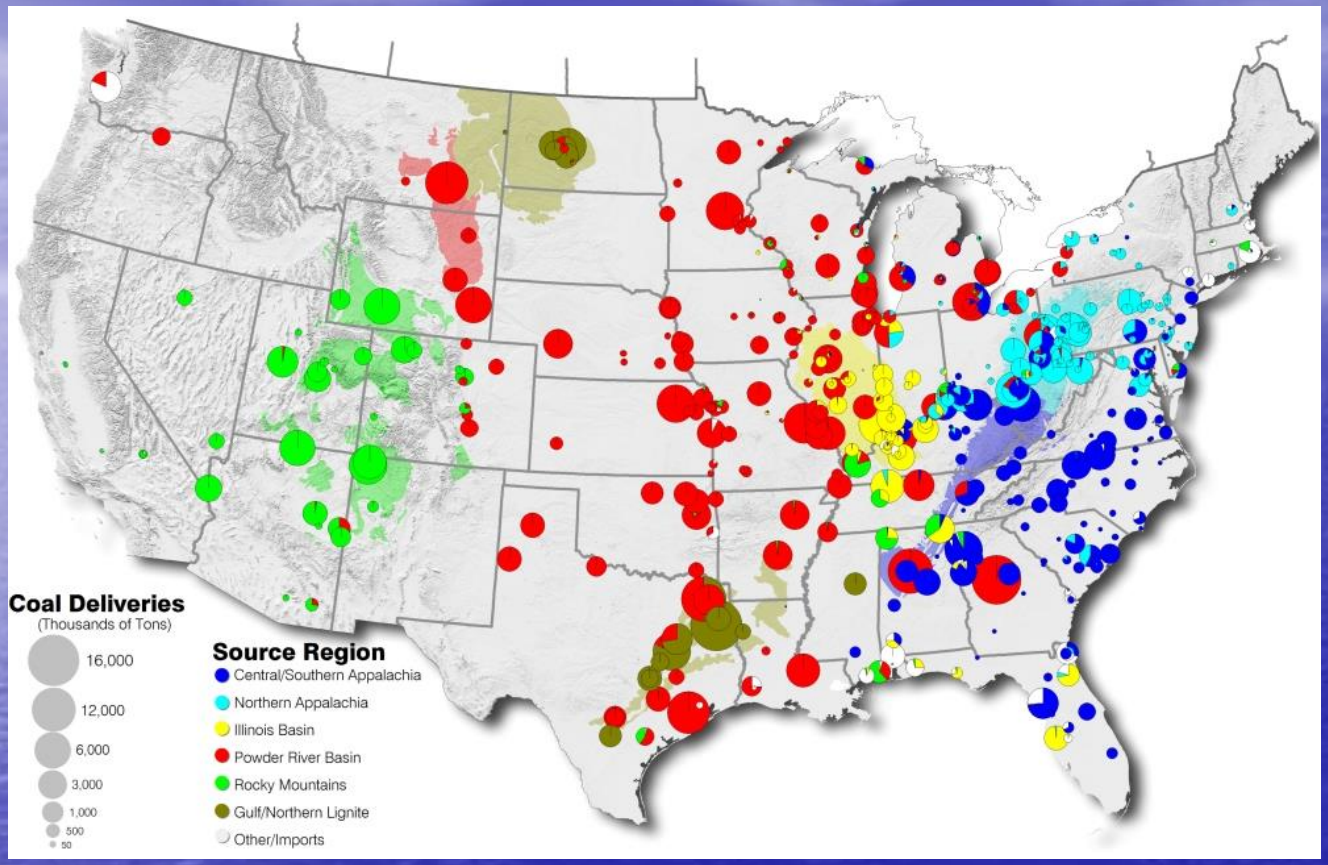


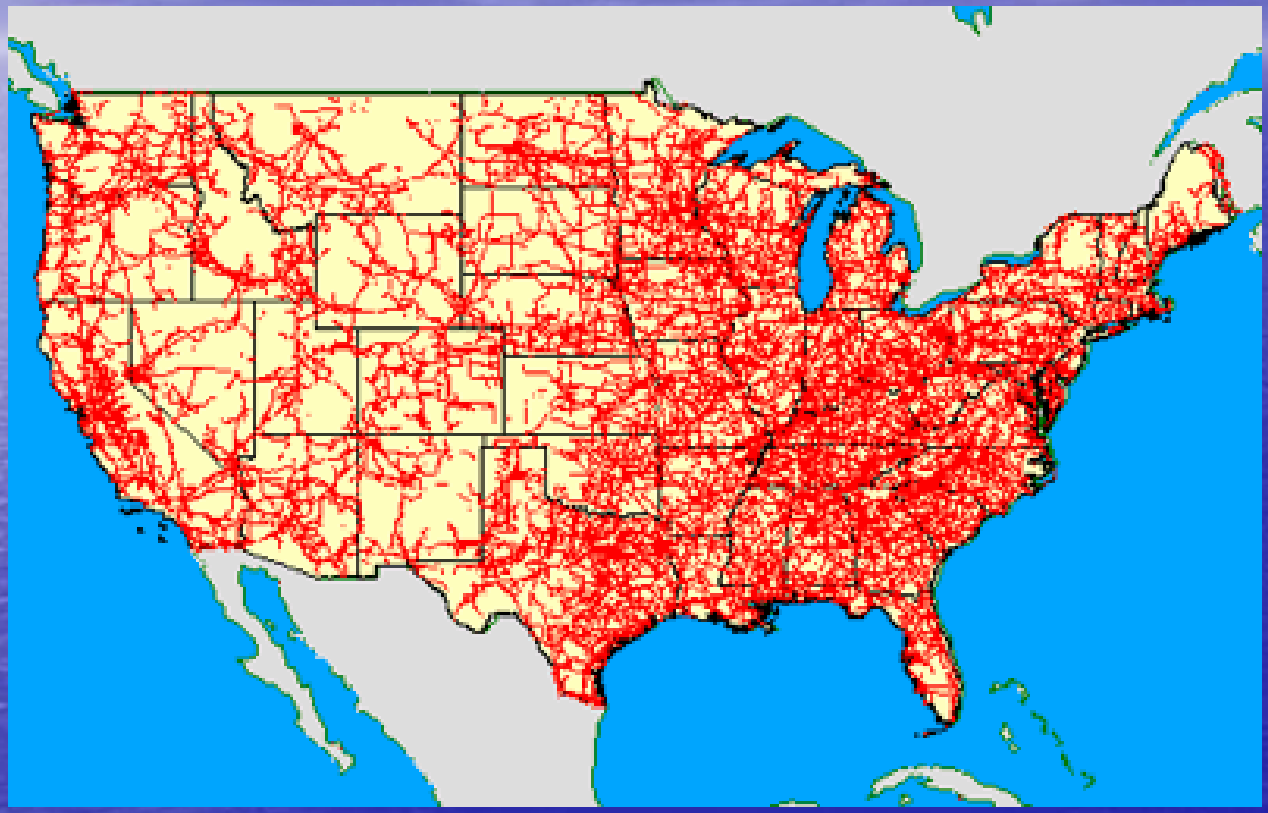
Coal Deliveries to Power Plants by Region—Graphic by Ventyx

Red = Powder River Basin

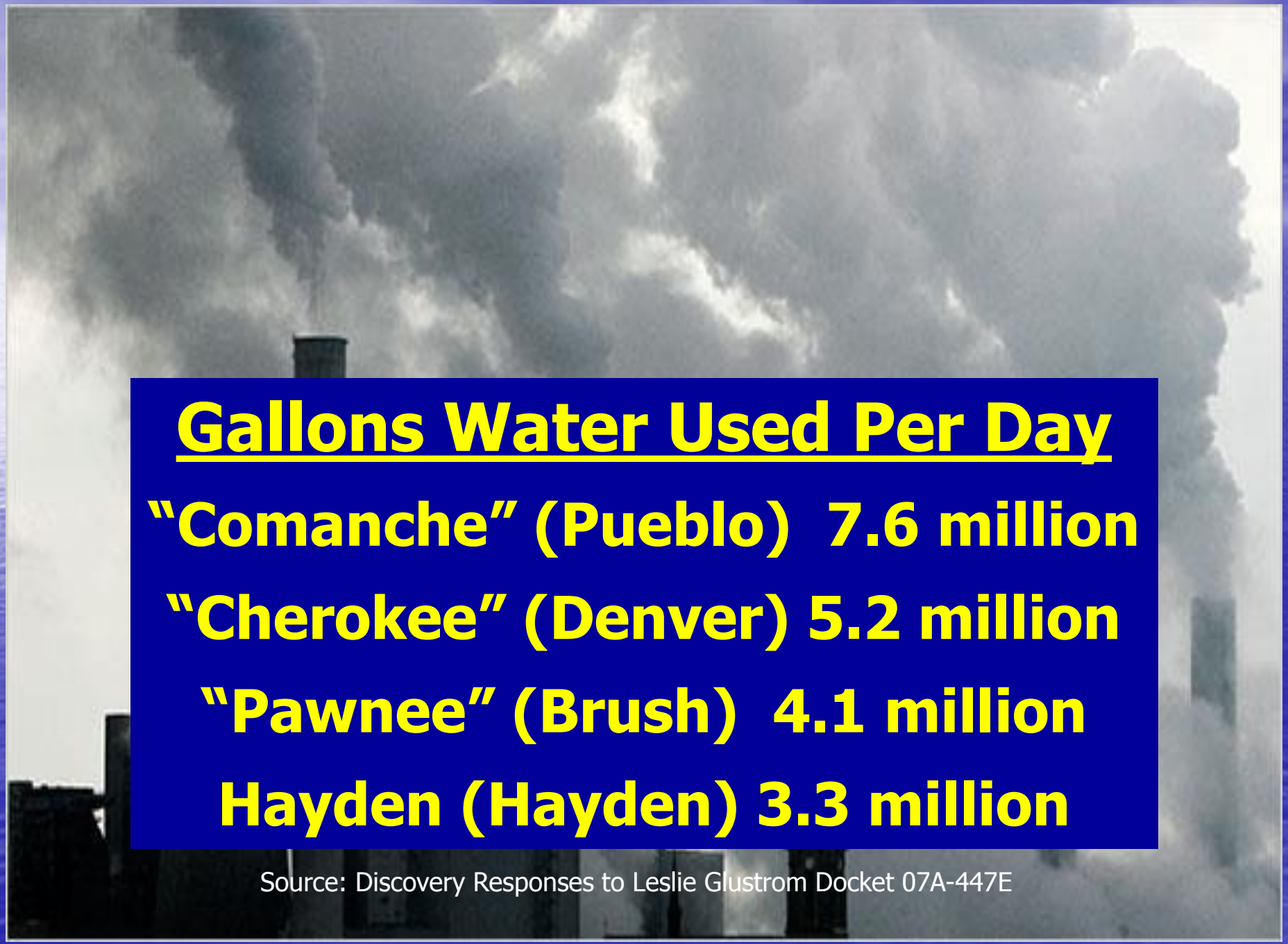
2005 Data

US Electrical Grid

(Approximate)



http://standeyo.com/NEWS/08_Sci_Tech/080121.grid.failure.causes.html



Gallons Water Used Per Day

"Comanche" (Pueblo) 7.6 million

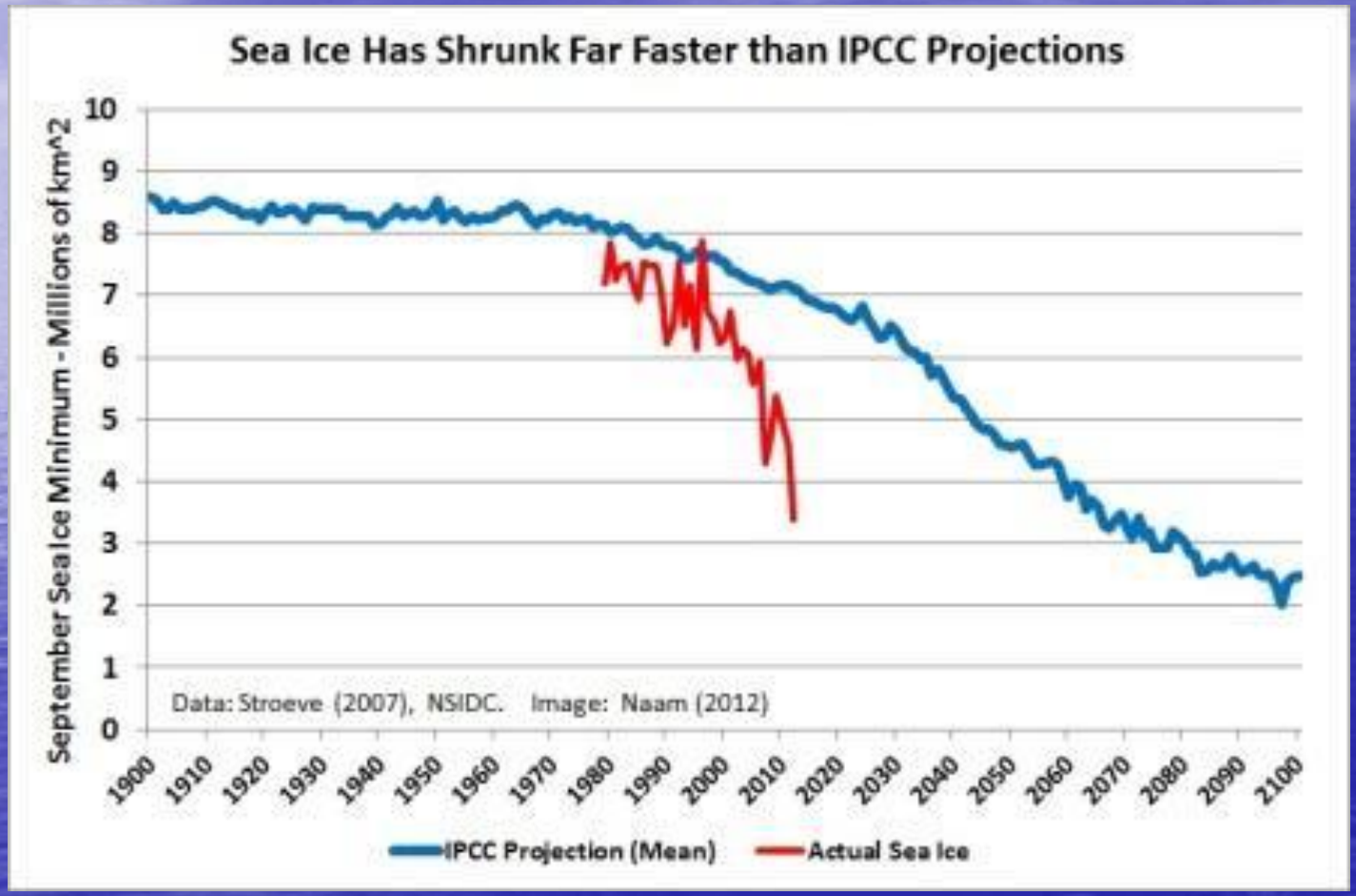
"Cherokee" (Denver) 5.2 million

"Pawnee" (Brush) 4.1 million

Hayden (Hayden) 3.3 million

Source: Discovery Responses to Leslie Glustrom Docket 07A-447E

Loss of Arctic Sea Ice….



http://blogs.scientificamerican.com/guest-blog/2012/09/21/arctic-sea-ice-what-why-and-what-next/

Mercury….

Fish

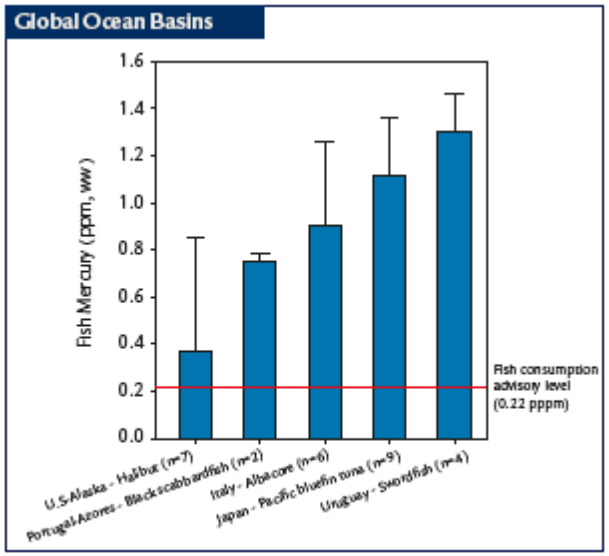


Figure 11. Mercury content in large pelagic fish.

Hair

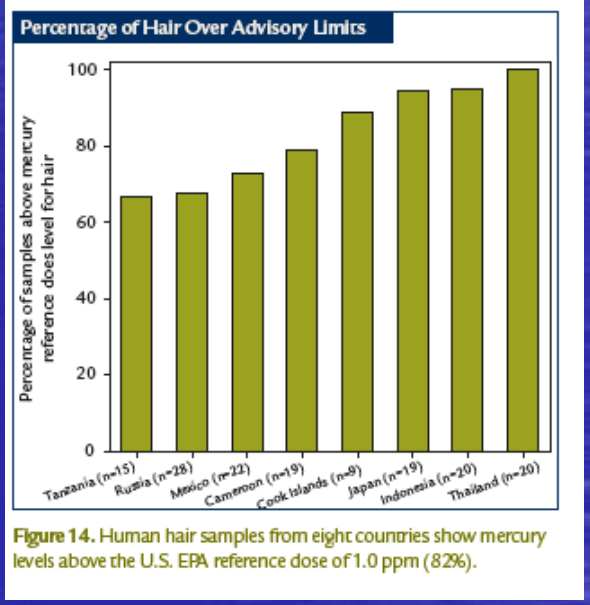
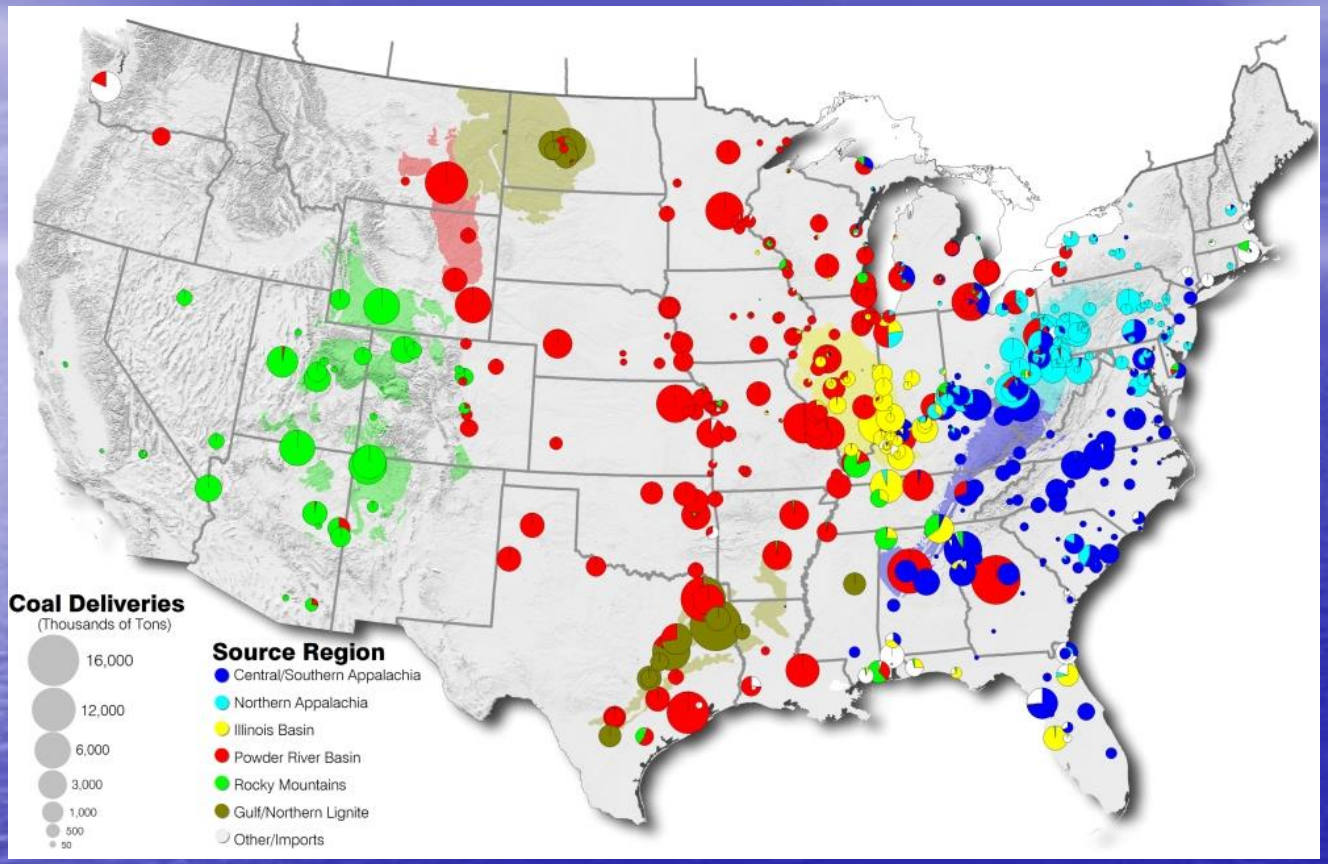


Figure 14. Human hair samples from eight countries show mercury levels above the U.S. EPA reference dose of 1.0 ppm (82%).

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.

Reserves

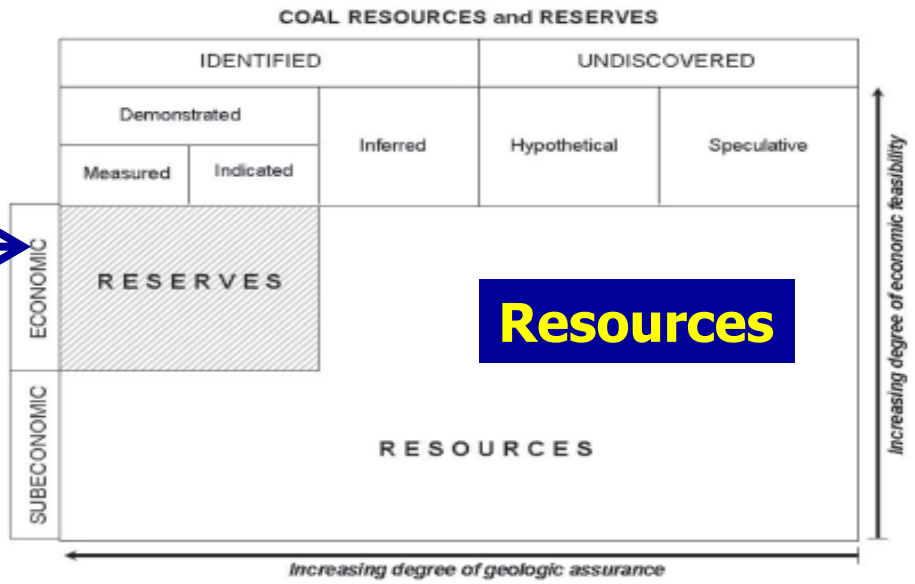


Figure 1. McKelvey-type diagram illustrating the relationship of coal resources and reserves (modified from Falkie and McKelvey, 1976).

Source: Chapter D, National Coal Resource Assessment

2012

EIA US Coal

Estimated Recoverable "Reserves"

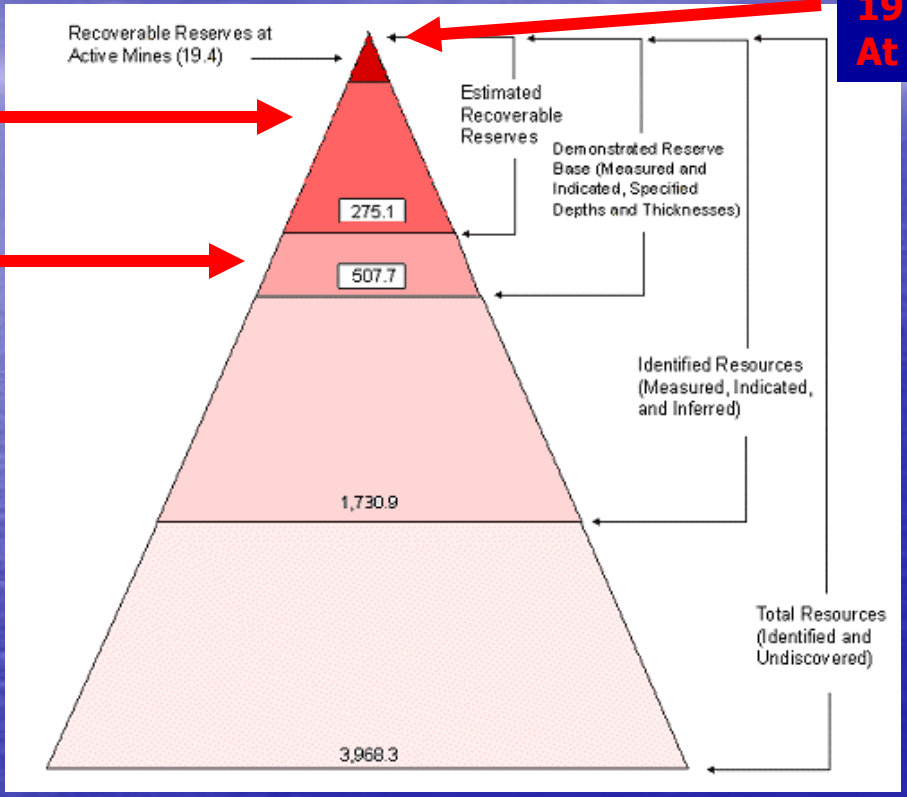
258 Billion Tons

Table 15 EIA Annual Coal Report

1997 Assessment of Coal Resources

ERR

DRB



19 Billion Short Tons At Existing Mines

Key Data Mostly Ignored…

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[illegible]h

Estimat[illegible]ecoverable [illegible]serves”

258 Billion Tons

Hog Wash

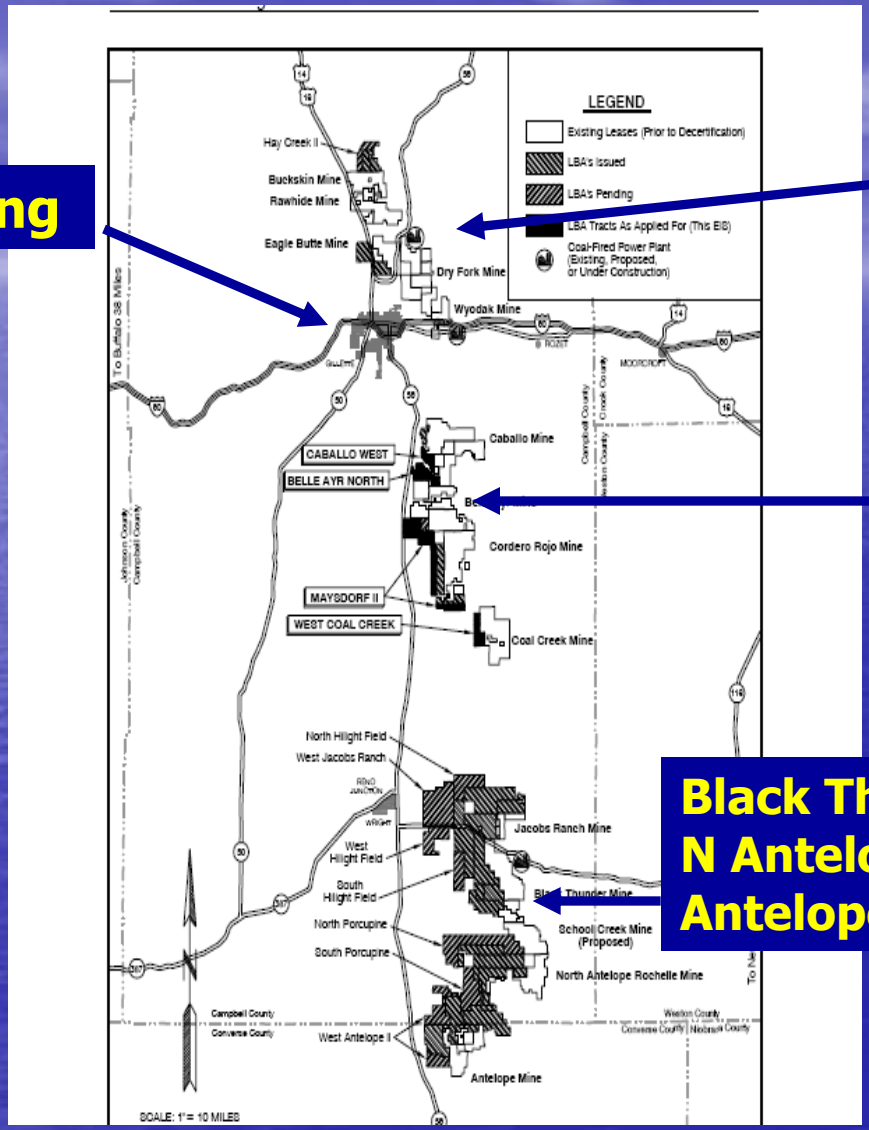
Table 15 EIA Annual Coal Report

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

Gillette,Wyoming



Bucksin
Rawhide
Eagle Butte
Dry Fork
Wyodak

Caballo
Belle Ayr
Cordero Rojo
Coal Creek

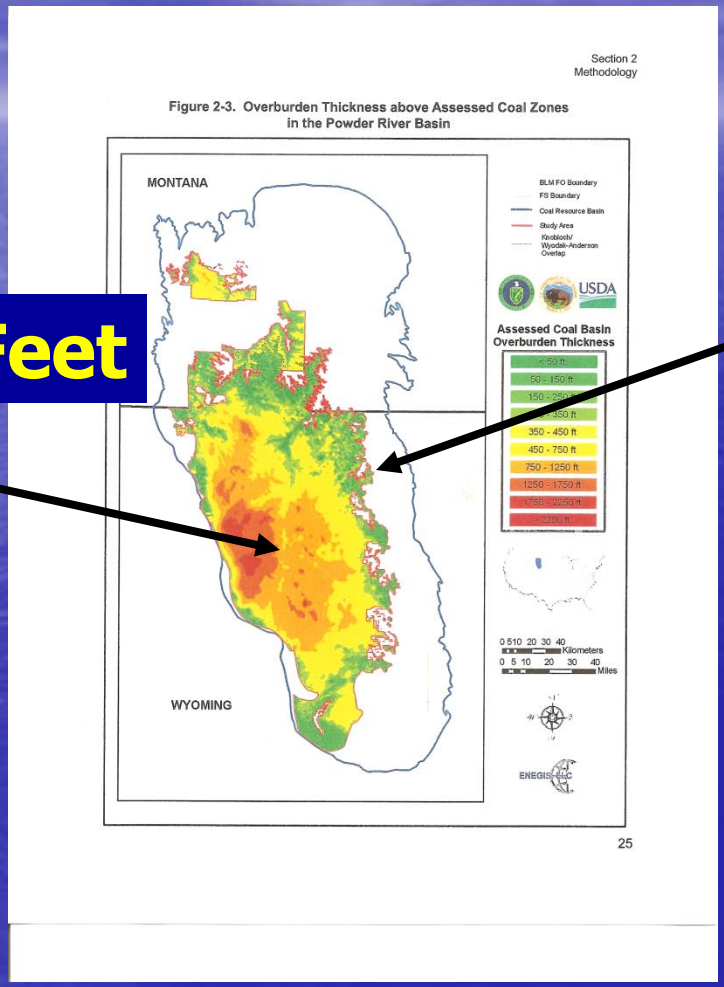
Black Thunder/Jacobs Ranch
N Antelope/ Rochelle
Antelope

Source: Draft EIS South Gillette Area Coal Lease Applications Sept 2008
Bureau of Land Management, Casper, Wyoming Field Office

"Western Coal" .....

Source: Peabody Energy.com

Overburden Above Coal in the Powder River Basin (Wyoming and Montana)

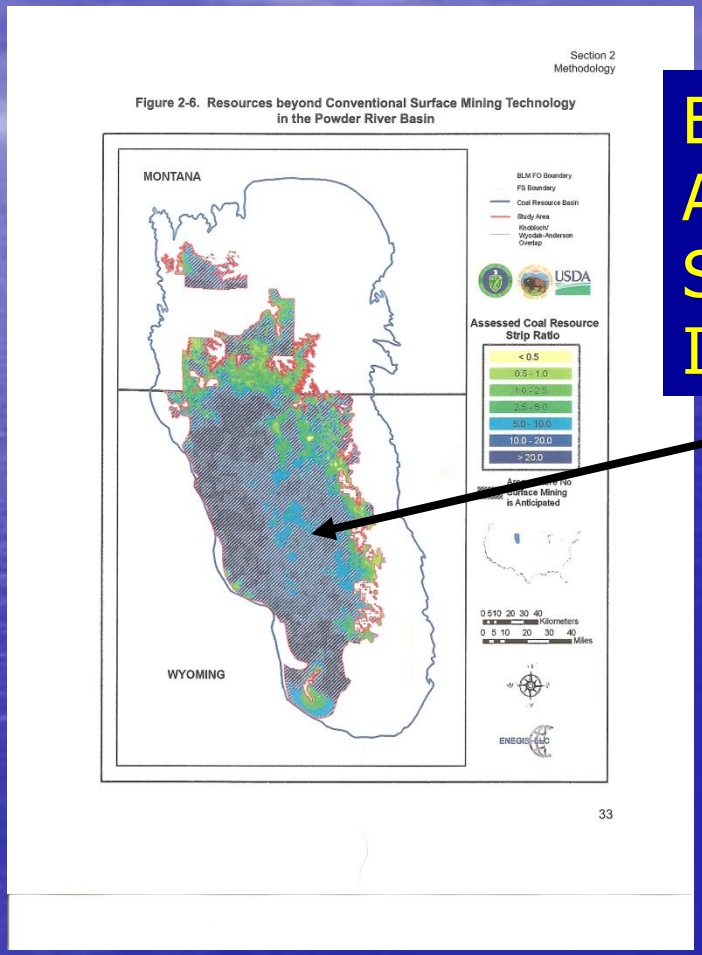


50-200 Feet

750->2250 Feet

Source: US DOE, DOI and DOA Inventory of Federal Coal Resources August 2007

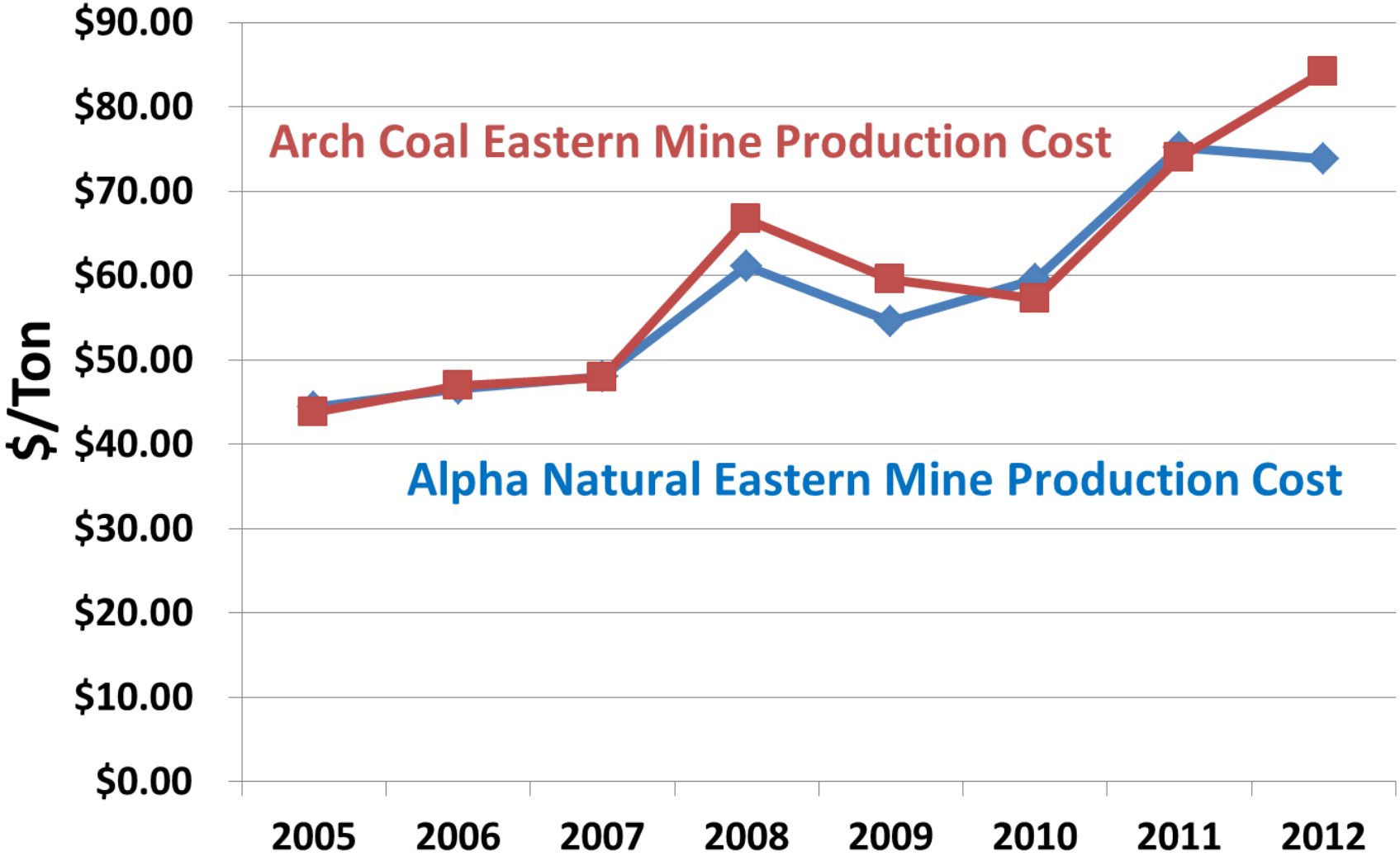
70% of the Coal In the Powder River Basin is Not Surface Accessible



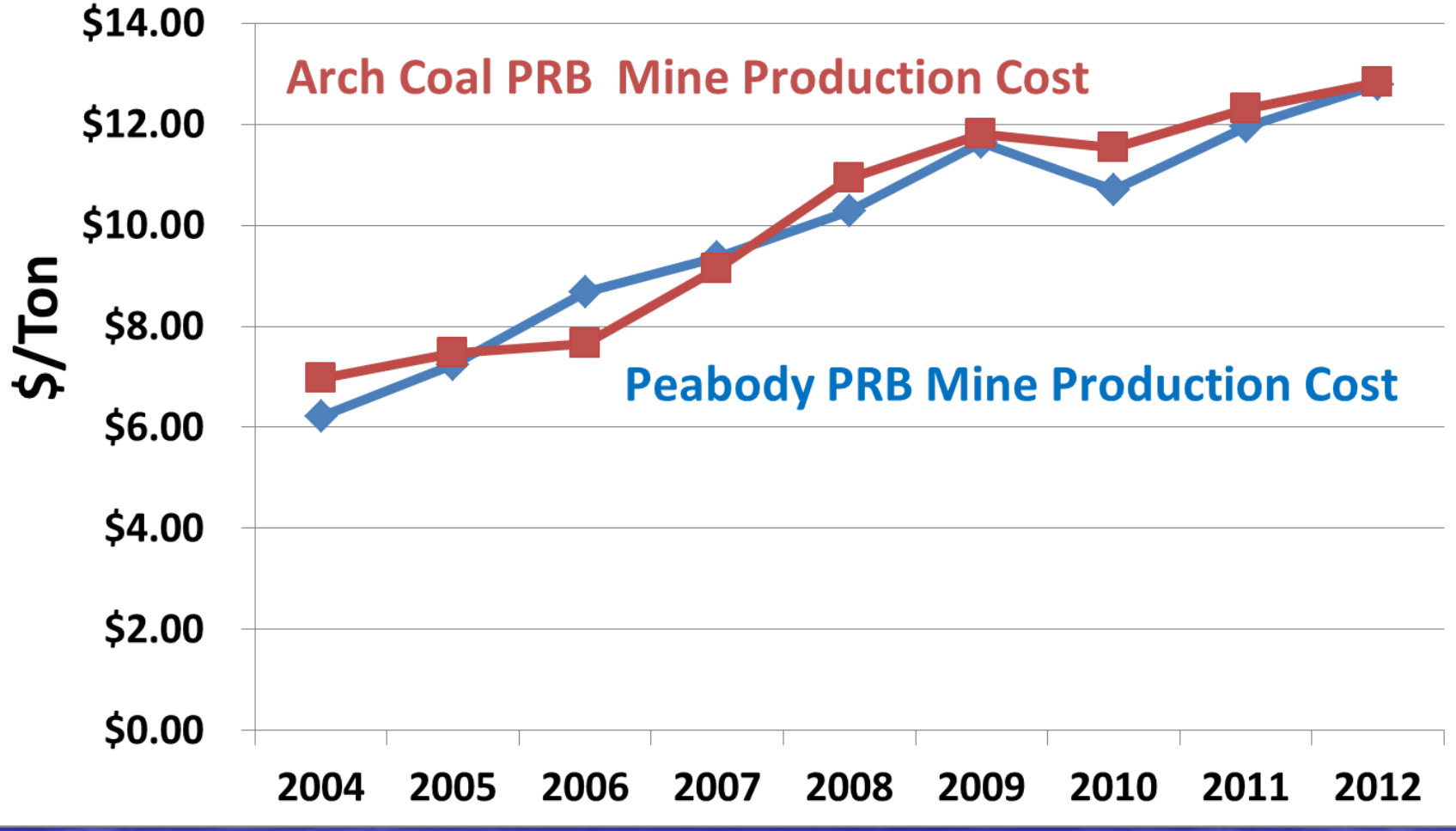
Blue Hatched Areas = Areas Where Surface Mining Is Not Anticipated…

Source: US DOE, DOI and DOA Inventory of Federal Coal Resources August 2007

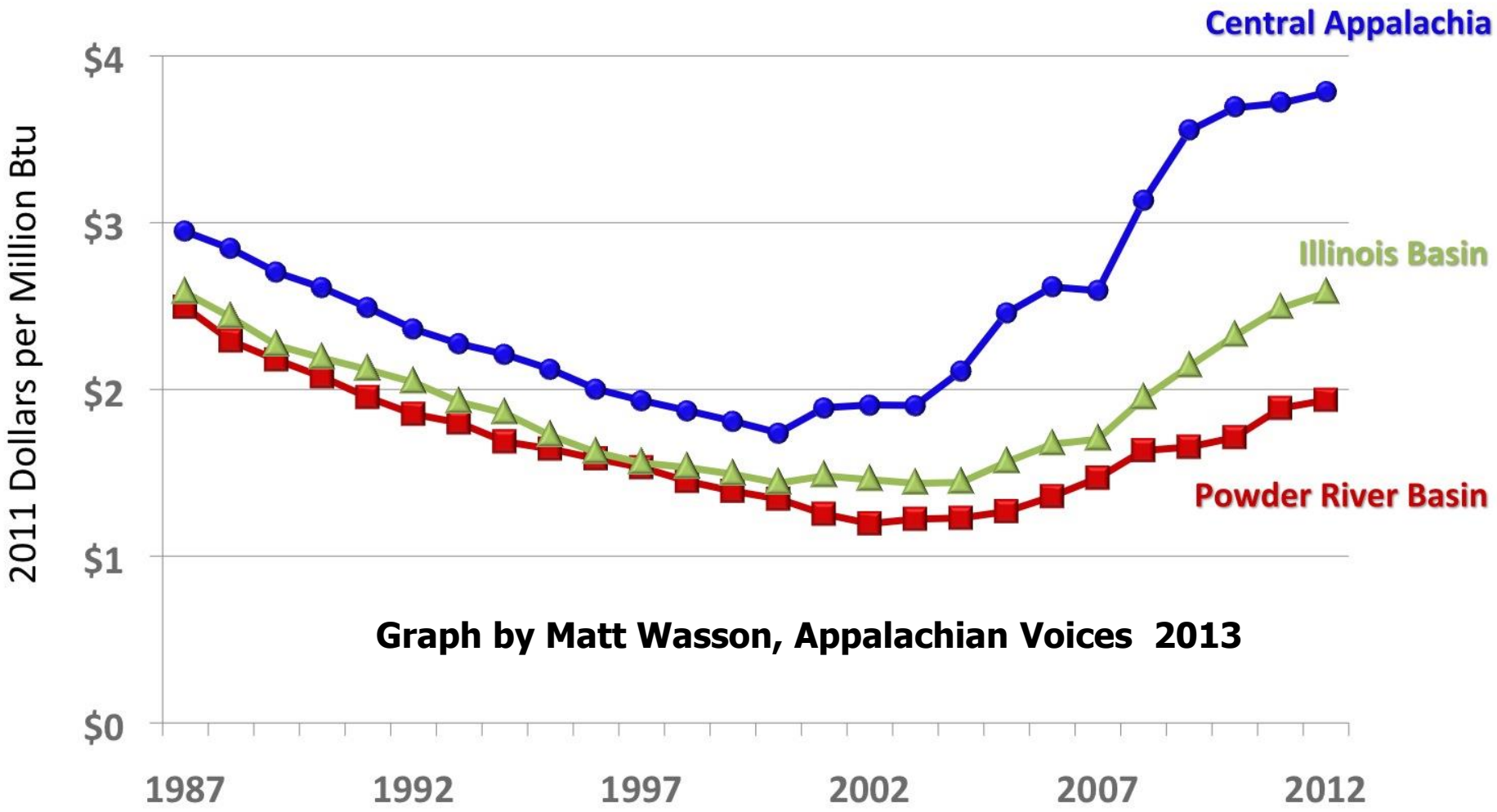
Eastern Mine Production Costs 2005-2012
Arch Coal and Alpha Natural Resoruces



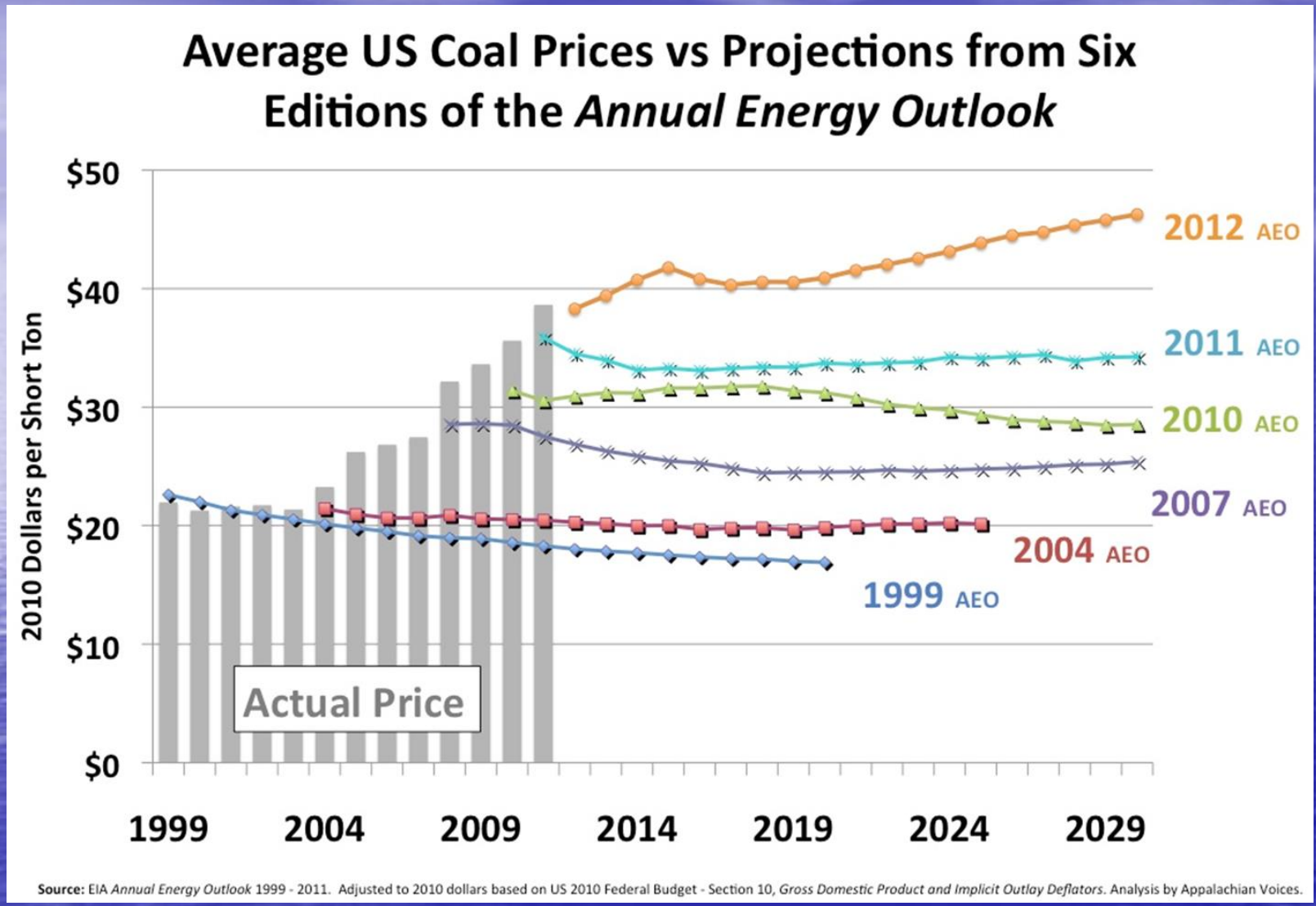
Powder River Basin Mine Production Costs
200-2012
Arch Coal and Alpha Natural Resoruces



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

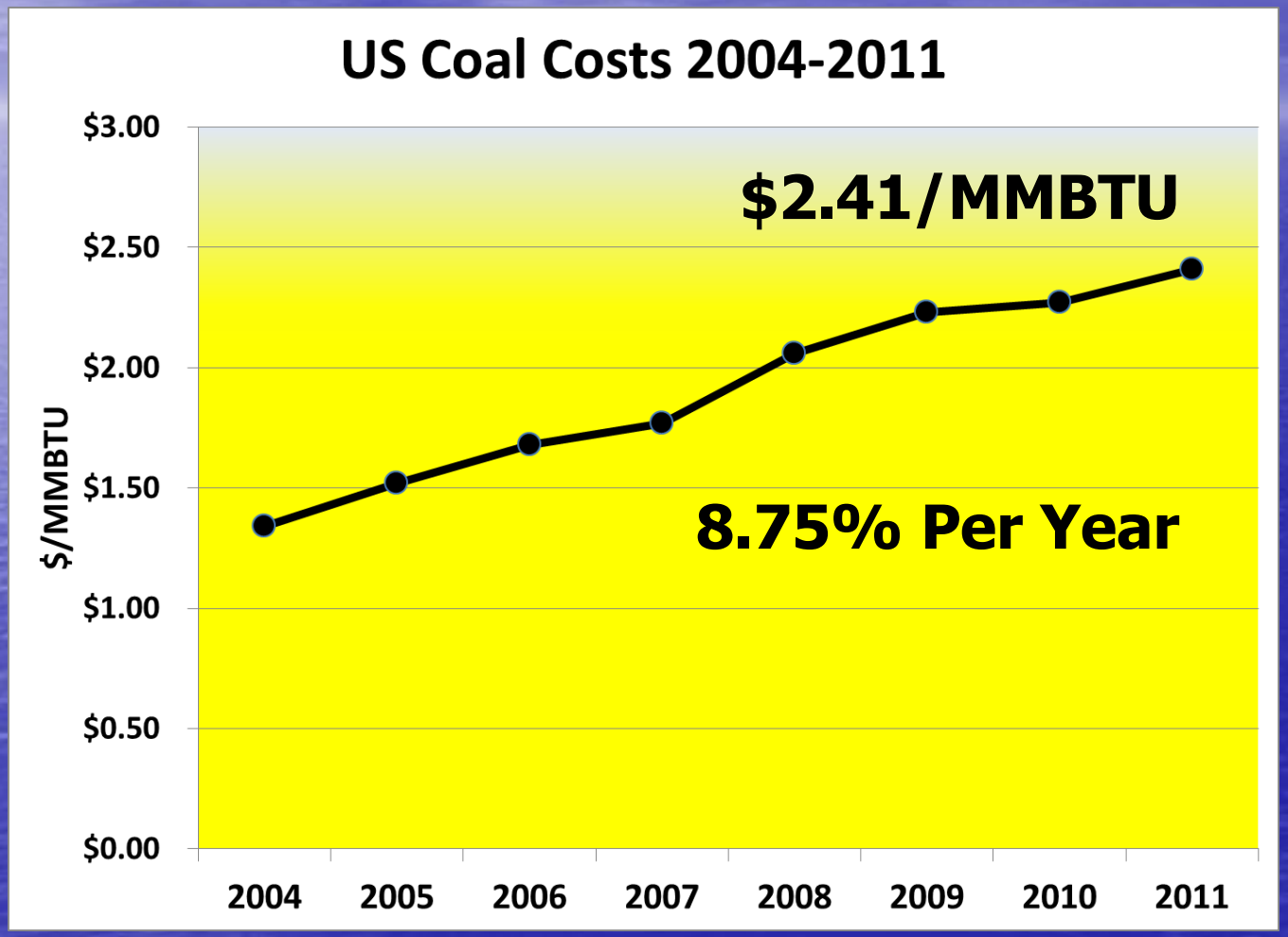


Sources: EIA Form 923 (and predecessor forms); Conversion to 2011 dollars from US Budget Section 10 - Gross Domestic Product and Implicit Outlay Deflators Analysis by Appalachian Voices, March, 2013



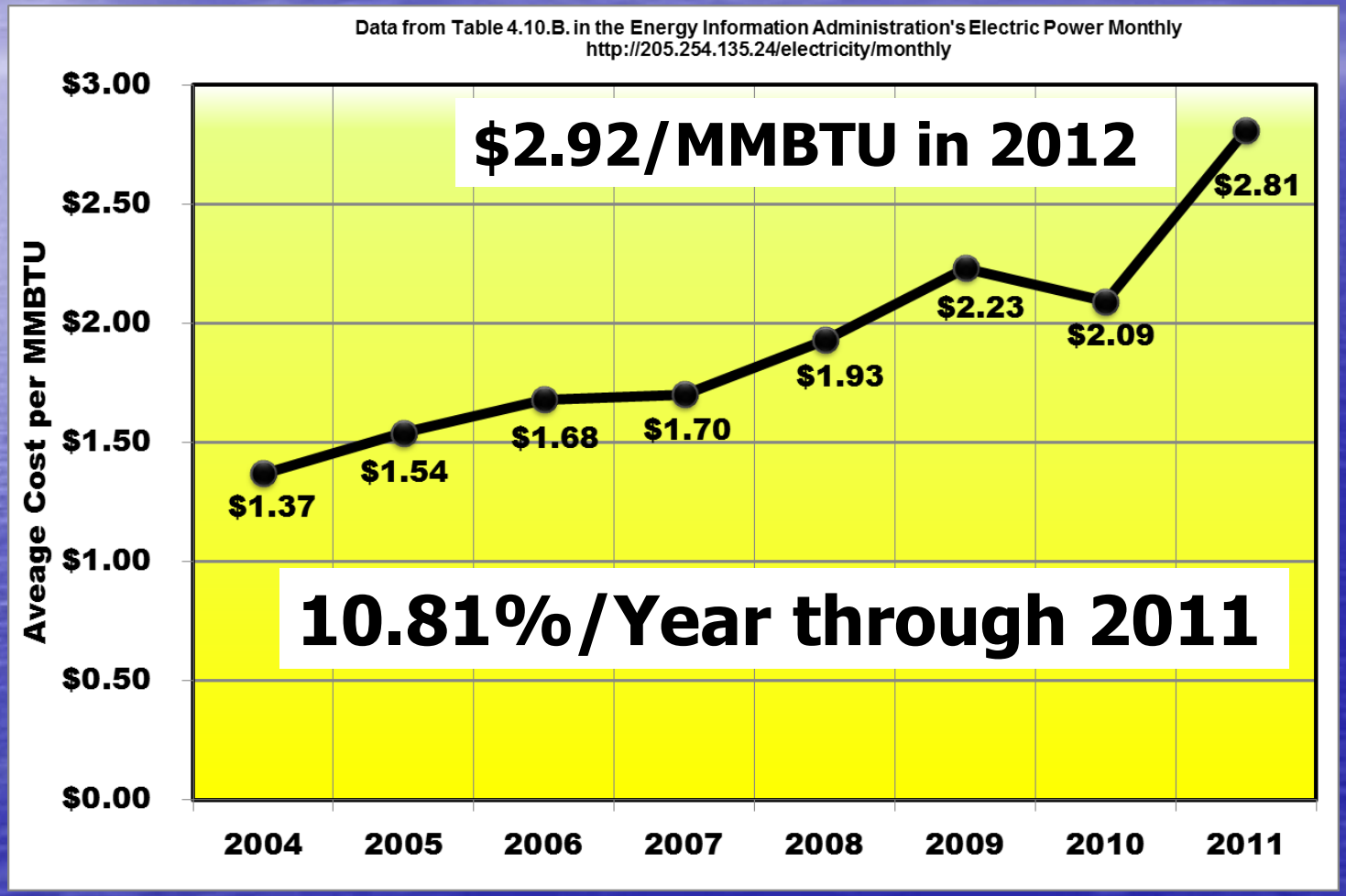
From Matt Wasson, Appalachian Voices

U.S. Coal Costs
2004-2011



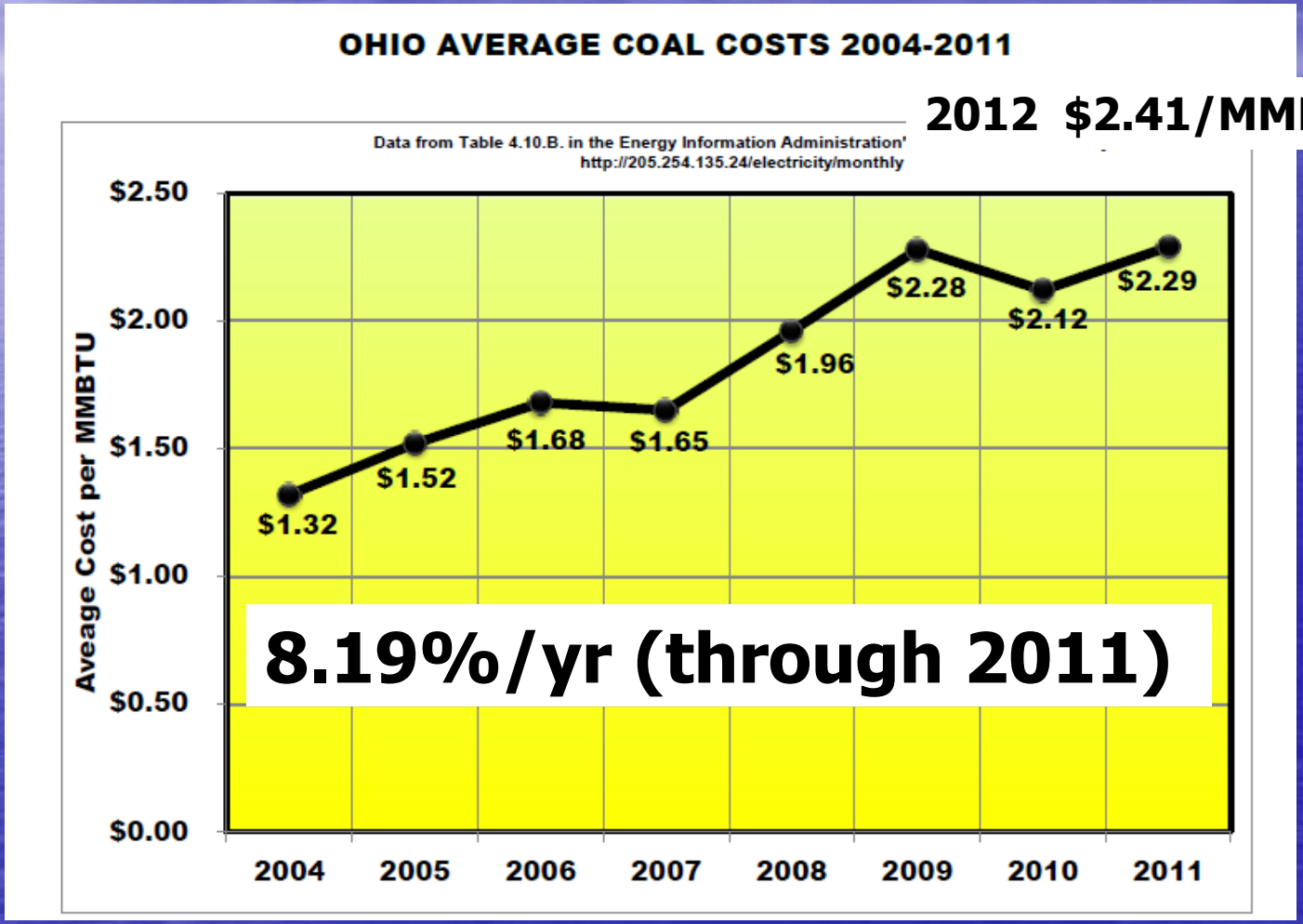
Data from Table 4.10B EIA Electric Power Monthly
http://205.254.135.24/electricity/monthly/

Michigan Delivered Coal Costs 2004-2011



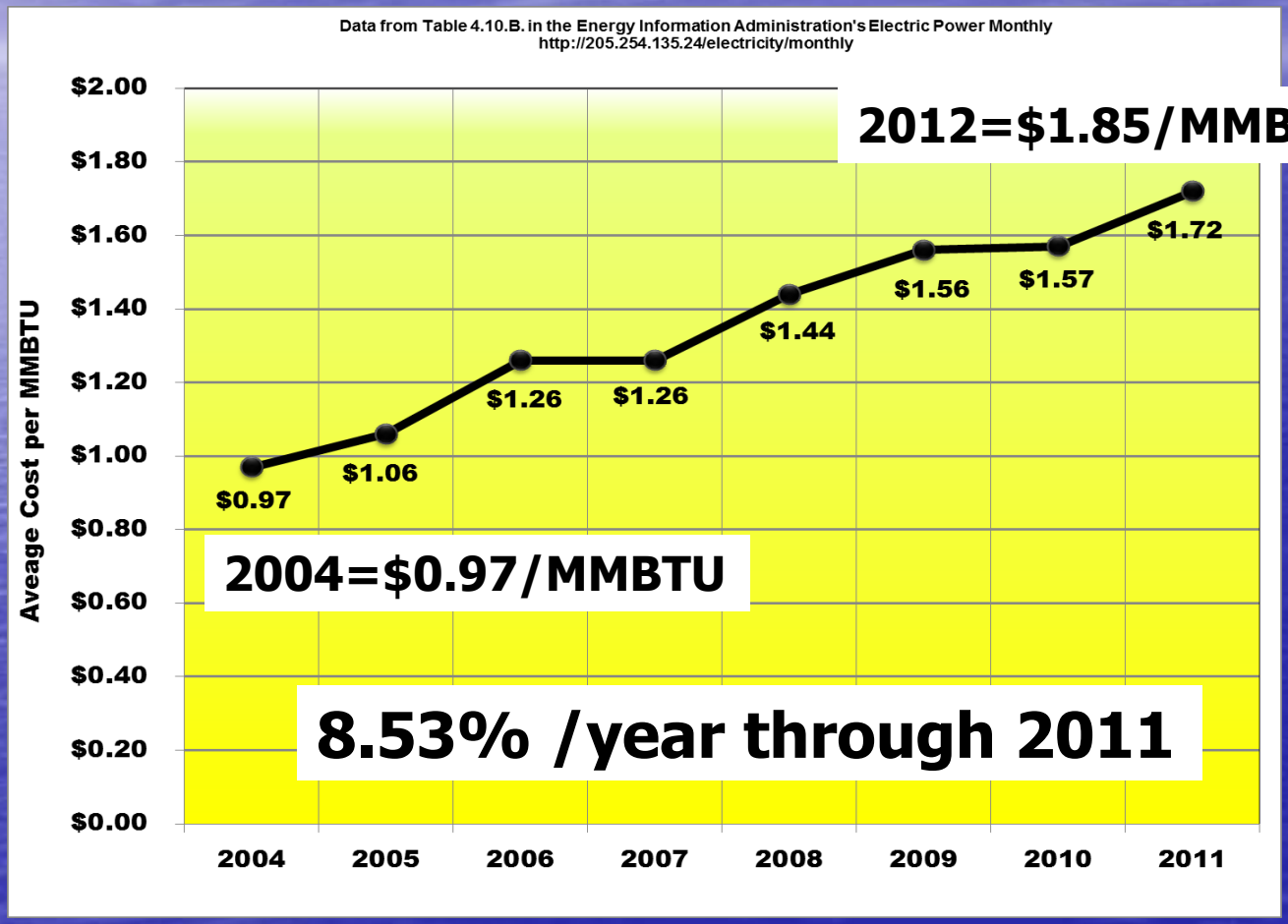
Data from EIA Electric Power Monthly, Table 4.10B

Ohio Delivered Coal Costs 2004-2011



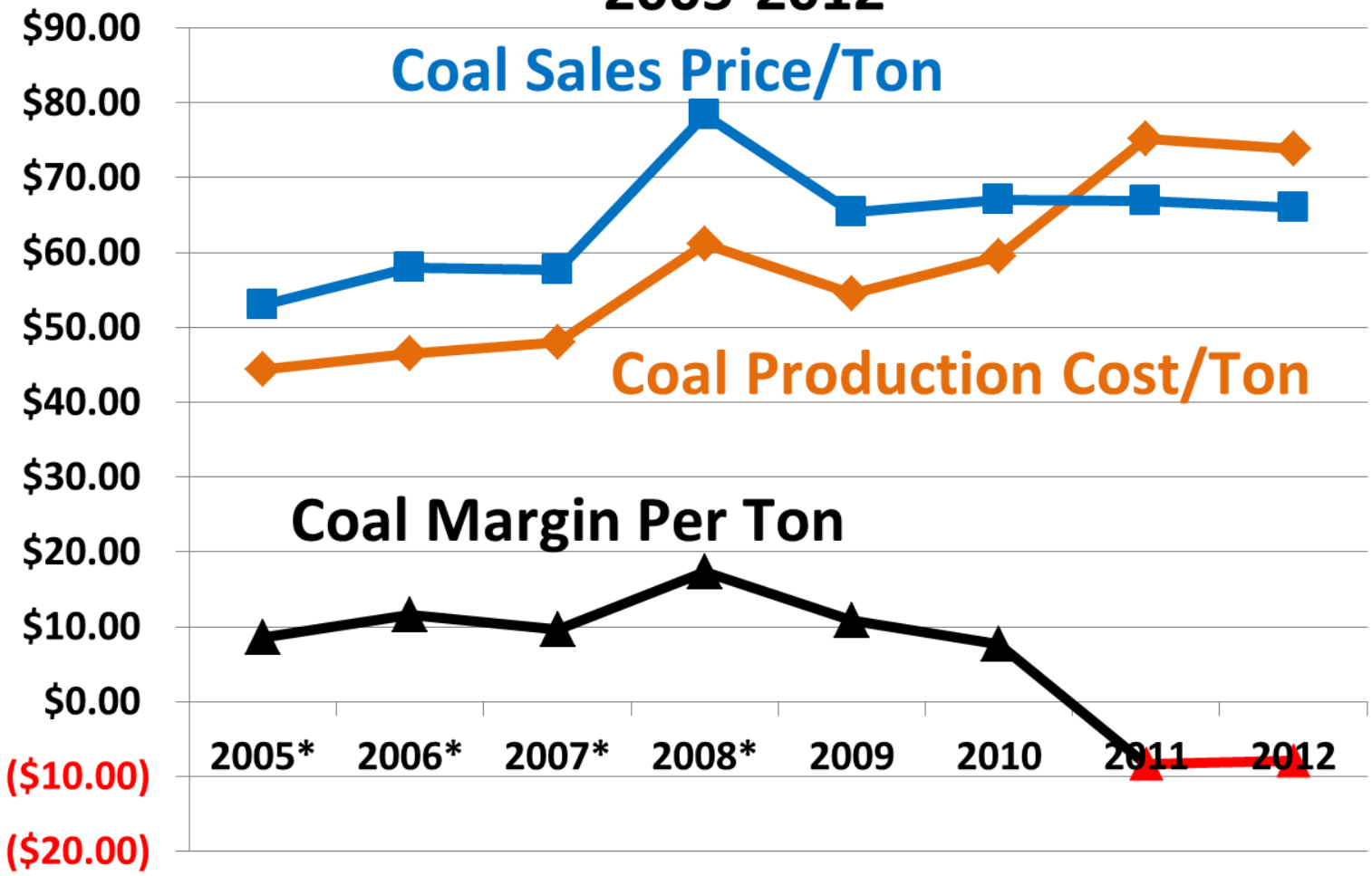
Data from Table 4.10B EIA Electric Power Monthly
http://205.254.135.24/electricity/monthly/

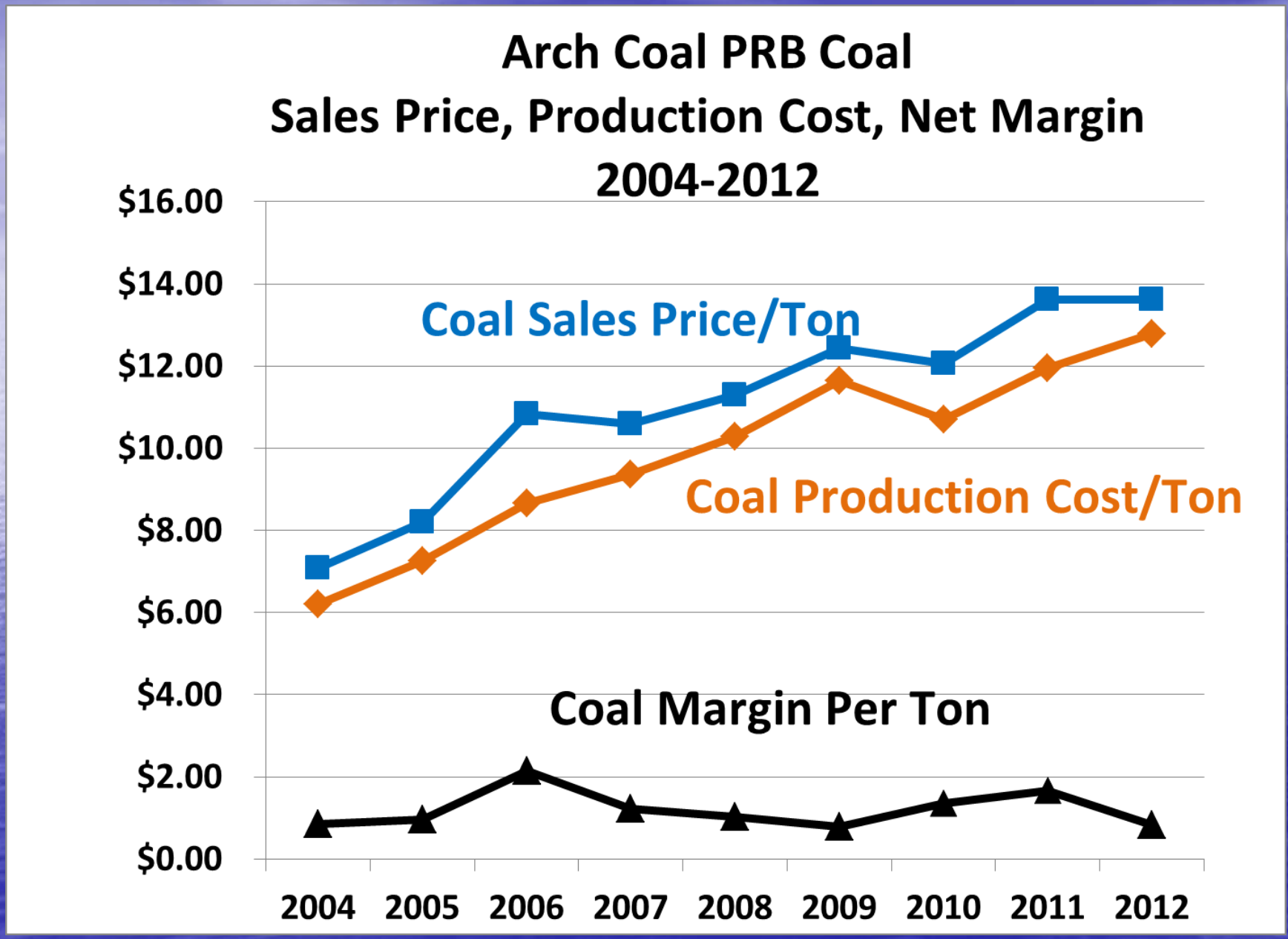
Colorado Delivered Coal Costs 2004-2011



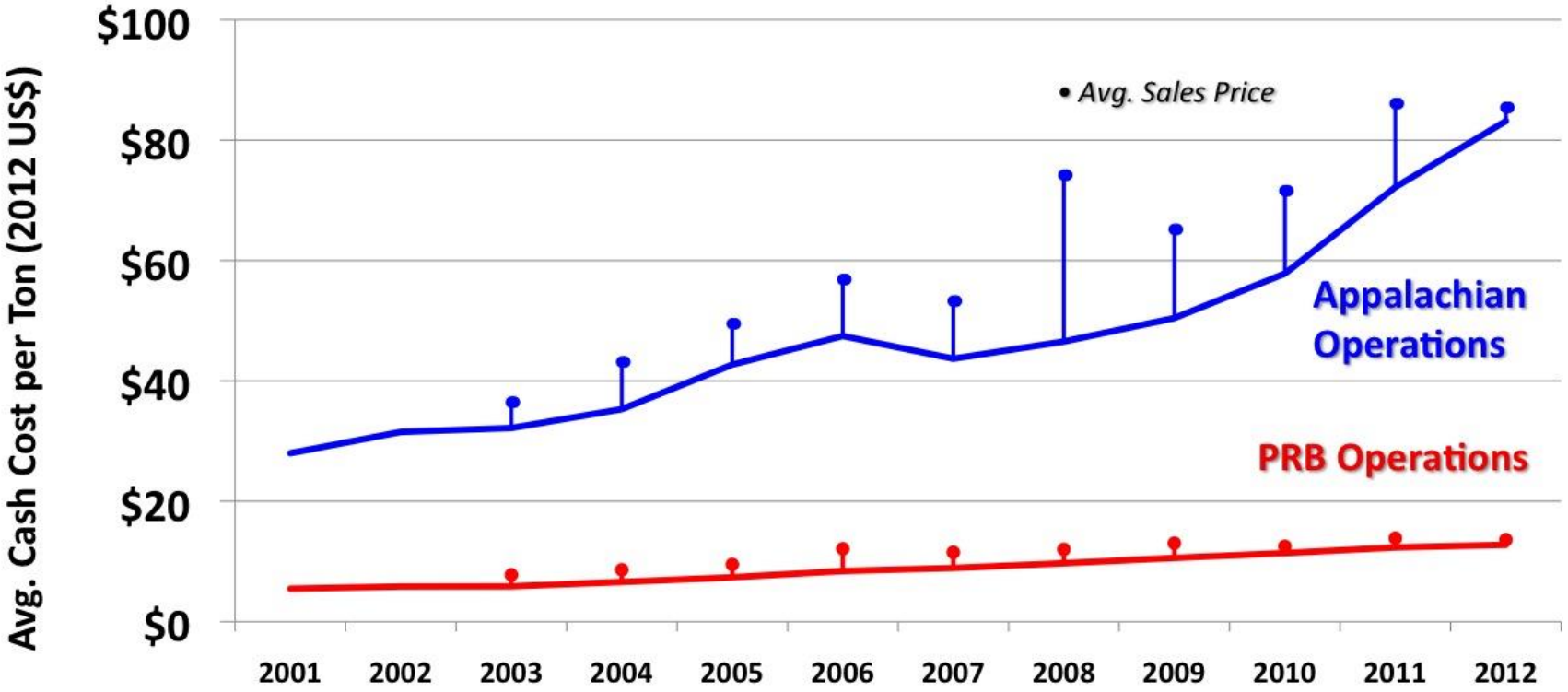
Data from Table 4.10B EIA Electric Power Monthly
http://205.254.135.24/electricity/monthly/

Alpha Natural Resources Eastern Coal Sales Price, Production Cost, Net Margin 2005-2012




Arch Coal PRB Coal
Sales Price, Production Cost, Net Margin
2004-2012
$16.00
$14.00
$12.00
$10.00
$8.00
$6.00
$4.00
$2.00
$0.00
Coal Sales Price/Ton
Coal Production Cost/Ton
Coal Margin Per Ton
2004
2005
2006
2007
2008
2009
2010
2011
2012

Cost of Coal Sales Reported by Arch Coal, 2001-2012



Source: 2012, 2009, 2007, 2005 and 2003 SEC Form 10-K Filings by Arch Coal, Inc. and US Budget FY2013, Section 10: "Gross Domestic Product and Implicit Outlay Deflators." Analysis by Appalachian Voices - March, 2013

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")

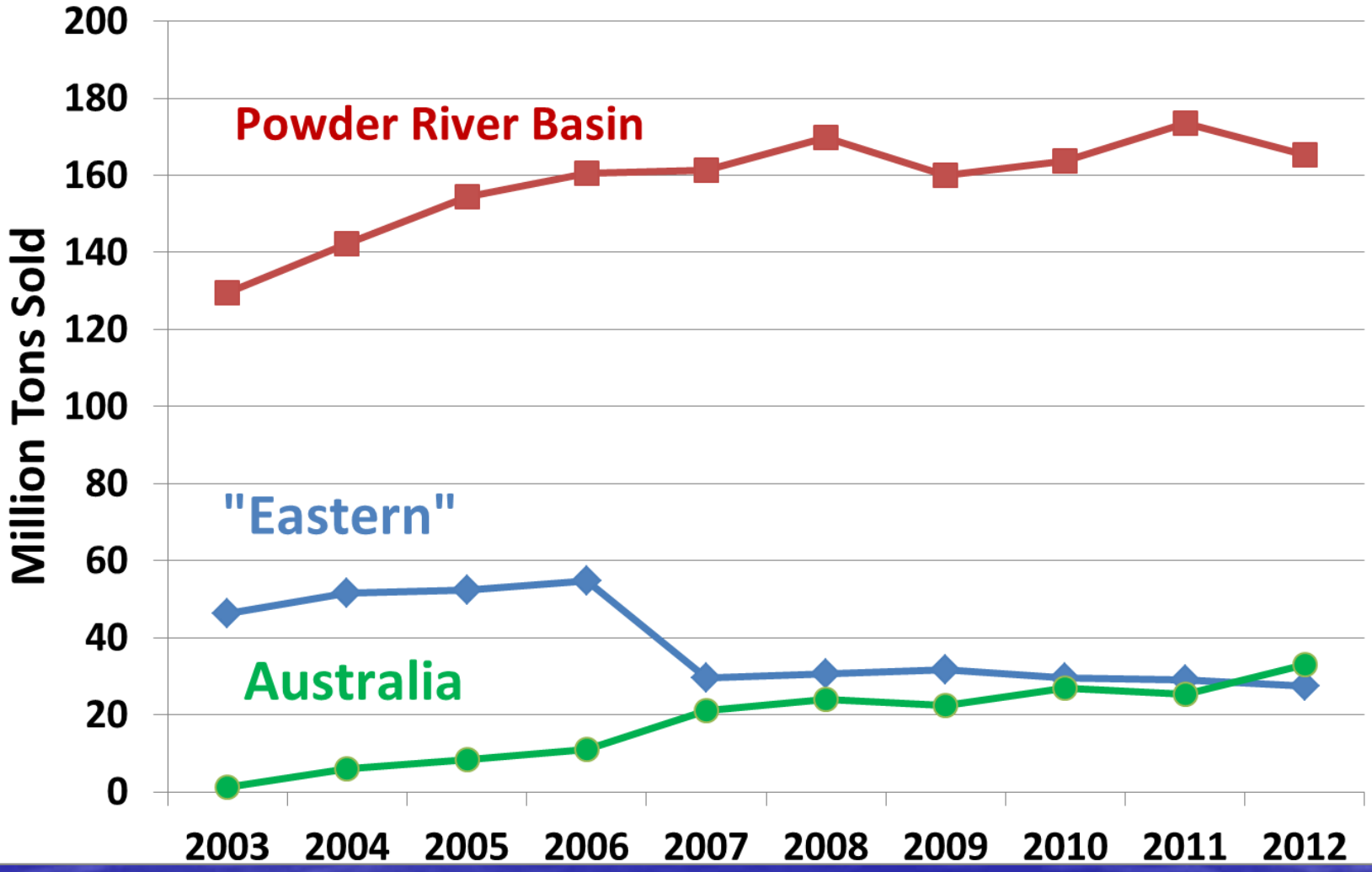
$418 Million	Term Loan
$ 912 Million	Term Loan Facility
$650 Million due 2016	(7.375%)
$1.52 Billion due 2018	(6%)
$650 Million due 2020	(6.5%)
$1.34 Billion due 2021	(6.25%)
$247 Million due 2026	(7.875%)

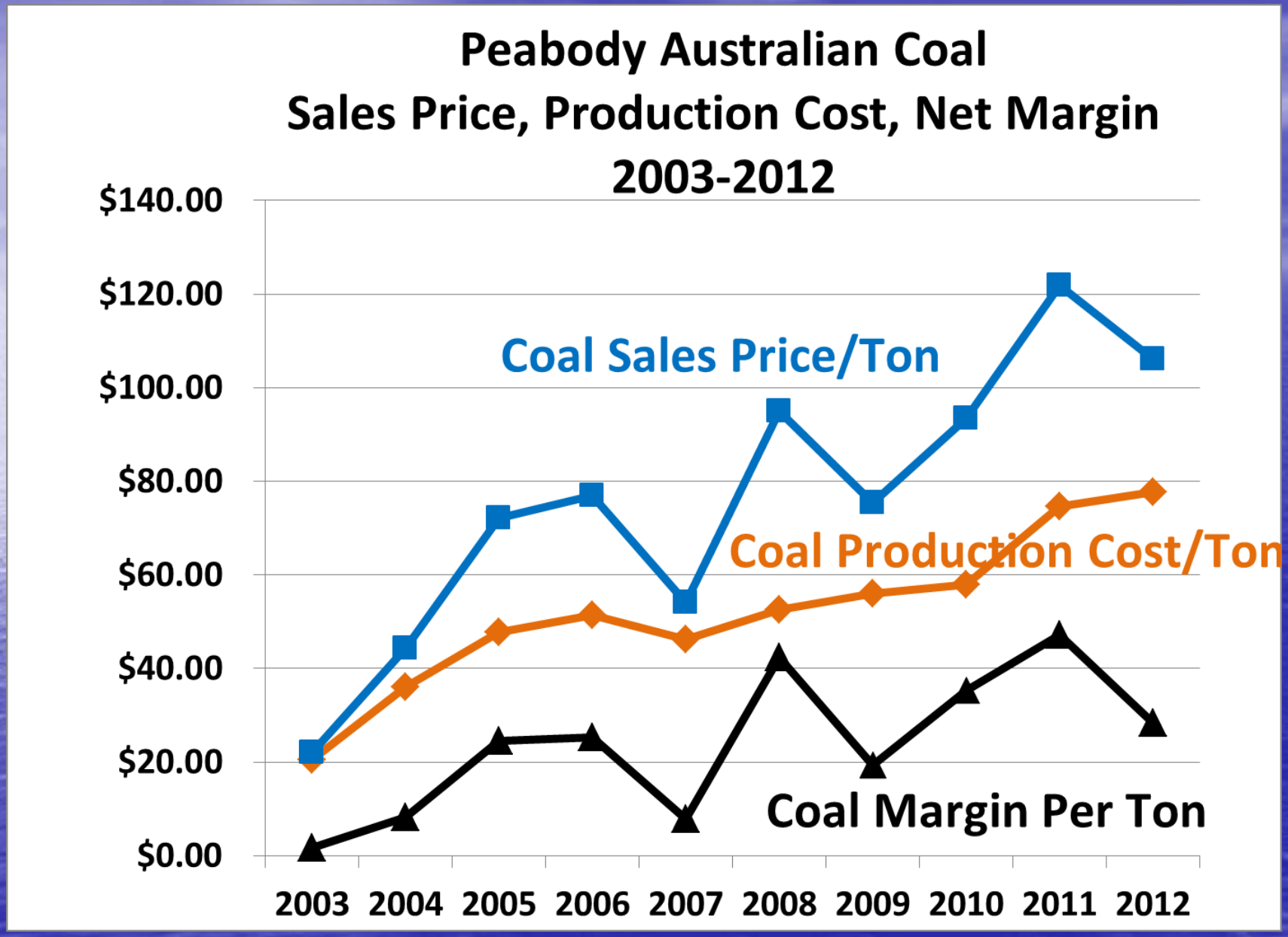
Others due later .....

Total over $6 Billion in Debt....

From Peabody 2012 10-K Annual Report, page F-35

Peabody Coal Sales by Region 2003-2012





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…."

From Arch Coal 2012 10-K Annual Report, page 70, and
http://seekingalpha.com/article/841941-arch-coal-walking-dead?source=email_rt_article_readmore&ifp=0

Coal Company Debt Coming Due

#3 Alpha Natural Resources ("ANR")

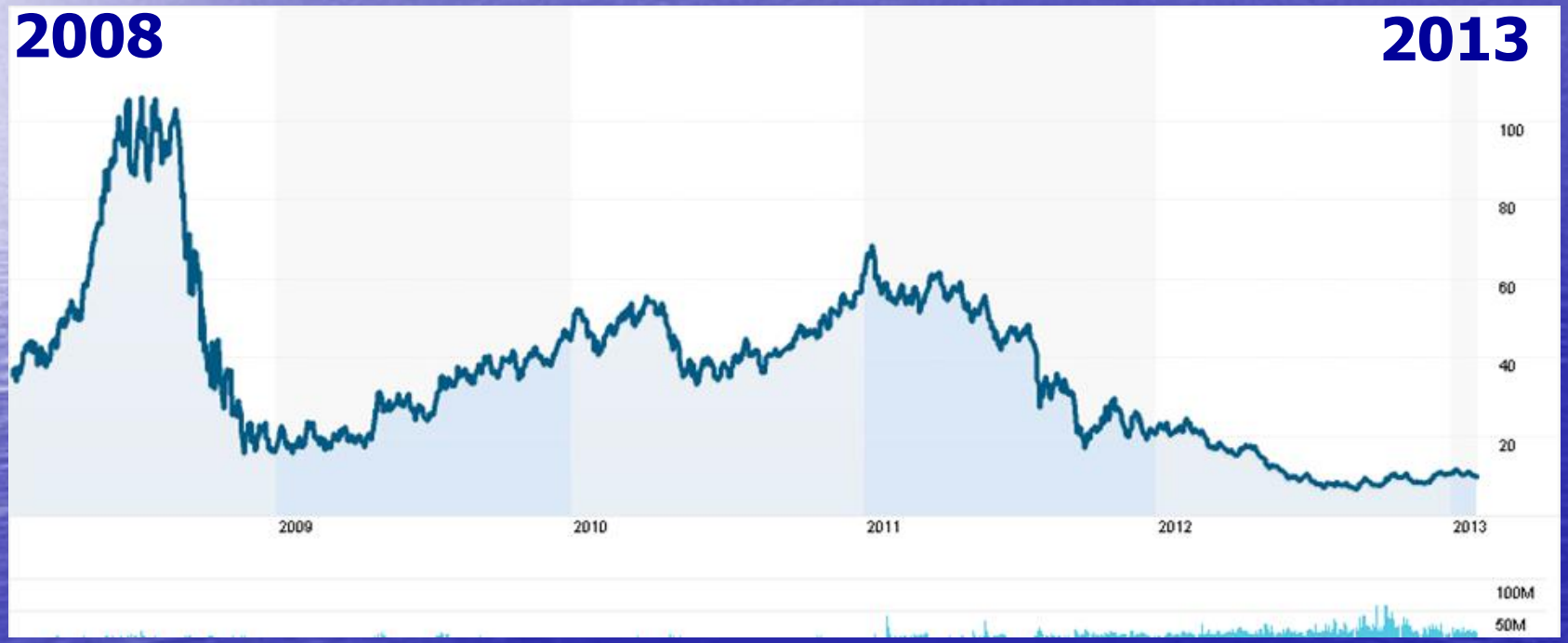
$536 Million due 2015	(3.25%)
$287 Million due 2015	(2.375%)
$540 Million due 2016	(Term loan)
$500 Million due 2018	(9.75%)
$800 Million due 2019	(6%)
$700 Million due 2021	(6.25%)

Total over $3 Billion in Debt

"ANR Poses Imminent Danger to Stockholders…"

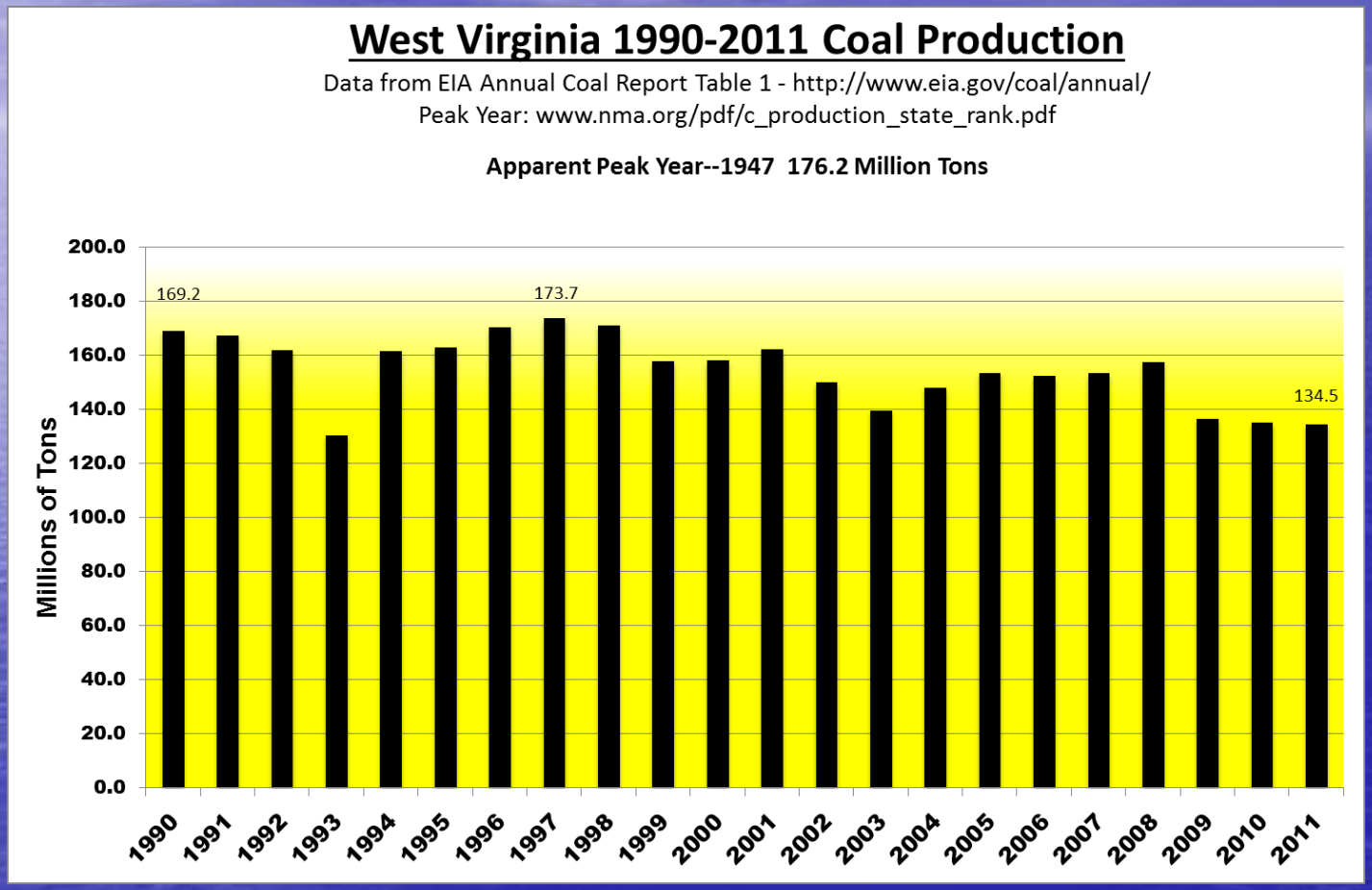
From Alpha Natural Resources 2012 10-K Annual Report, and
http://www3.gmiratings.com/home/2012/10/alpha-natural-resources-inc-poses-imminent-danger-to-shareholders/

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



http://www.reuters.com/finance/stocks/overview?symbol=ANR

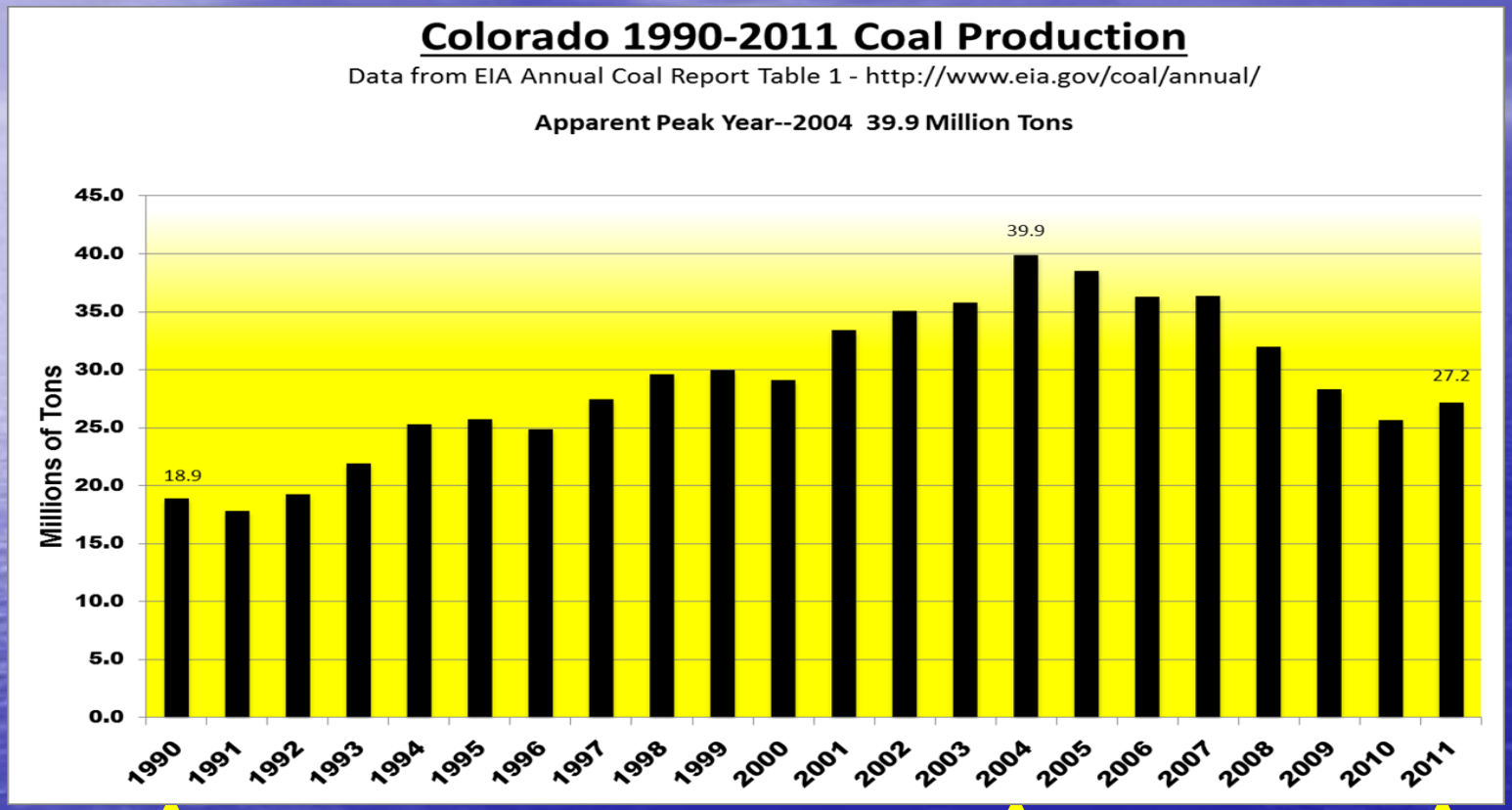
West Virginia 1990-2011 Coal Production Peak 1947



Data from EIA Coal Reports, Table 2
http://www.eia.doe.gov/fuelcoal.html

Colorado 1990-2011 Coal Production Peak 2004

Million Tons



1990
18.9
Million Tons

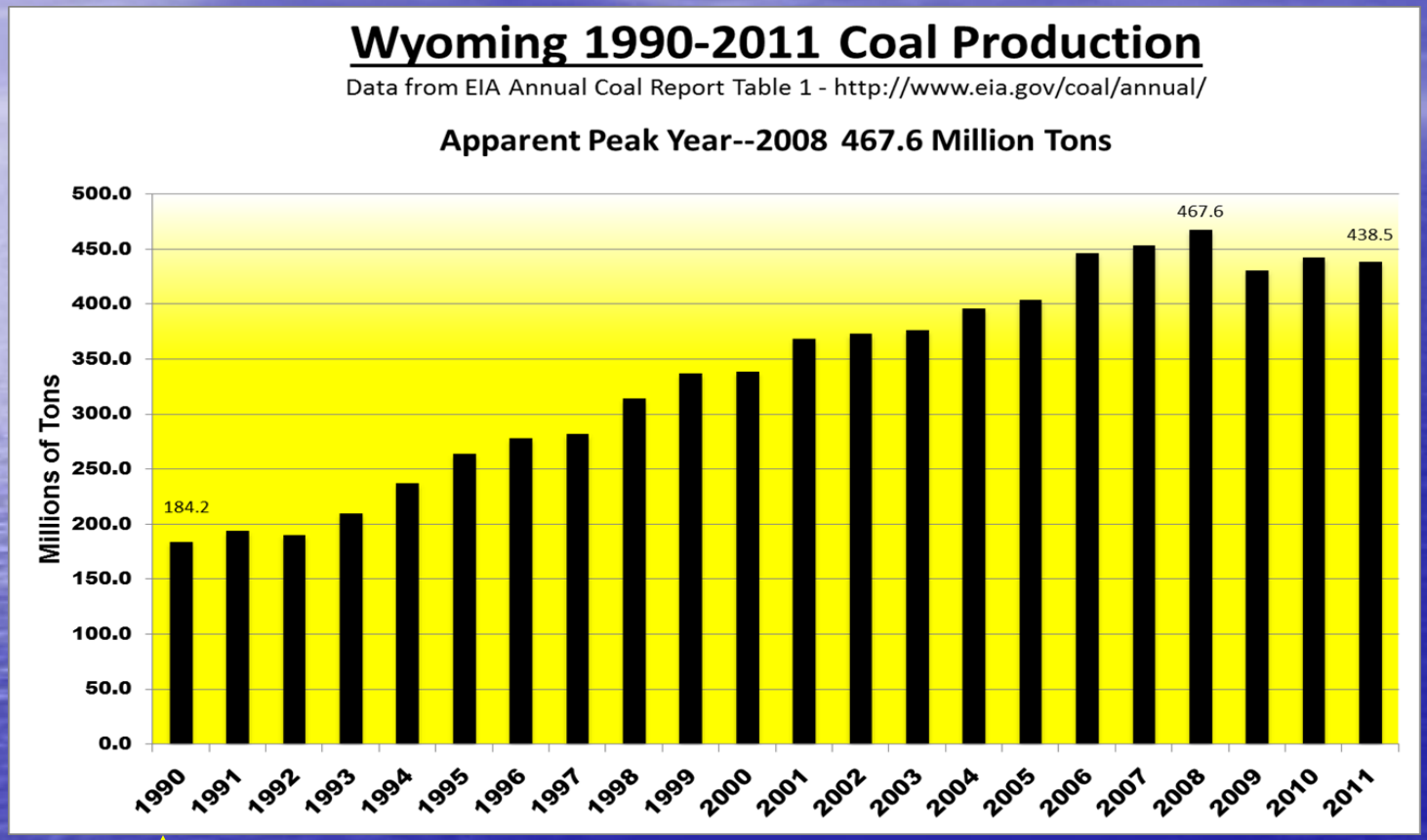
2004
39.8
Million Tons

2011
27.2
Million Tons

Data from EIA Coal Reports, Table 2
http://www.eia.doe.gov/fuelcoal.html

Wyoming 1990-2011 Coal Production Peak 2008 (??)

Million Tons



1990
184.2
Million Tons

Data from EIA Coal Reports, Table 2
http://www.eia.doe.gov/fuelcoal.html

2008
467.6
Million Tons

2011
438.5
Million Tons

UK Coal Industry 1946-1994 Nationalized

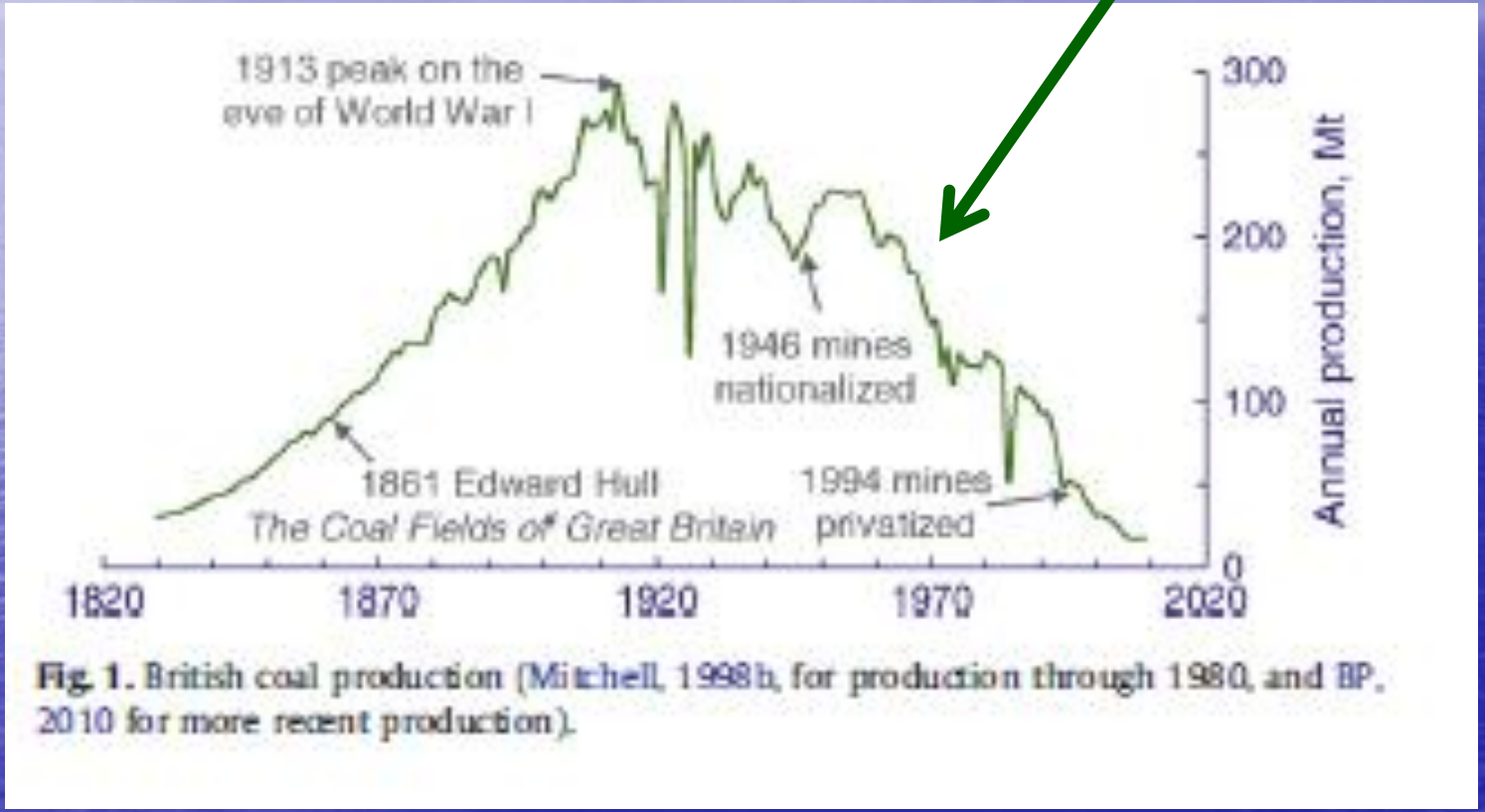
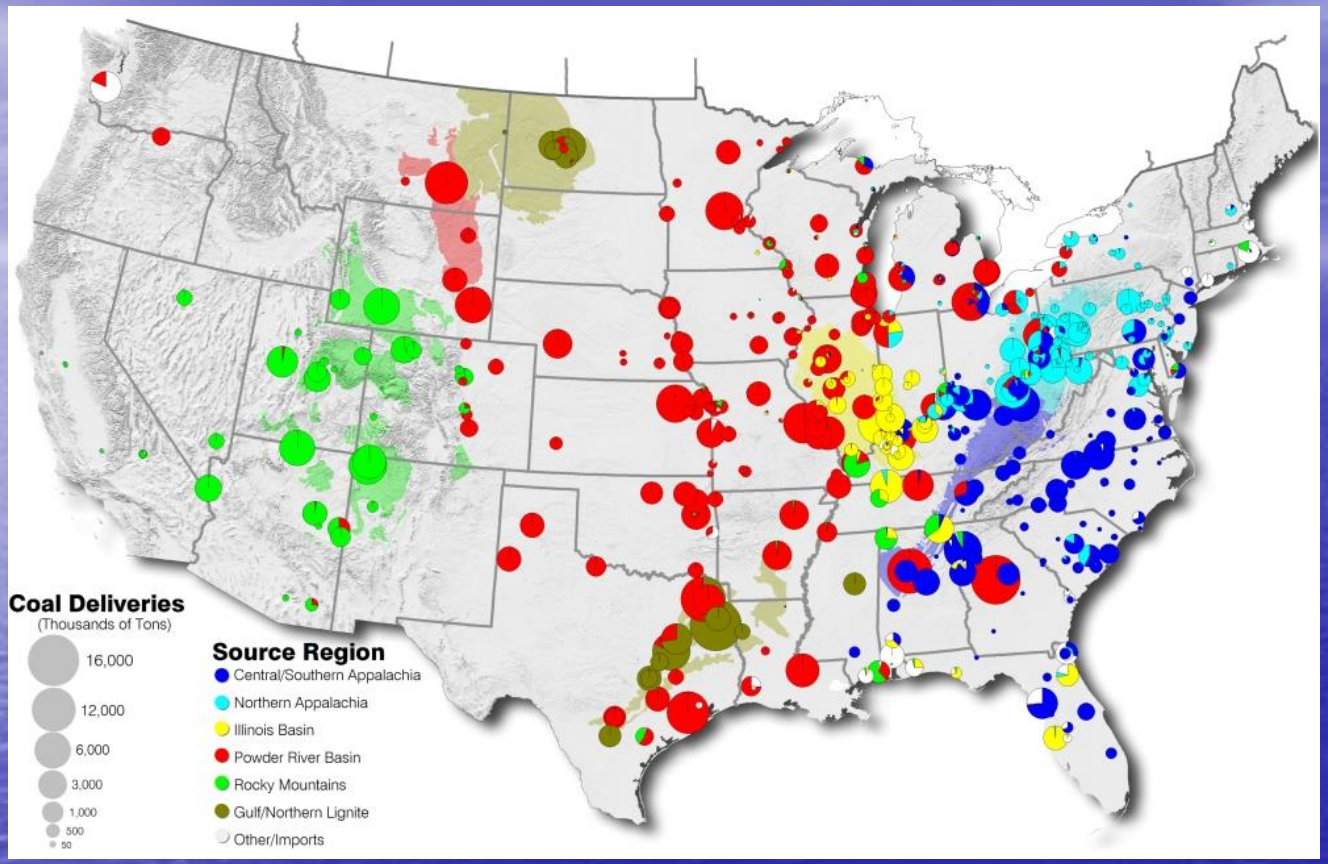


Fig. 1. British coal production (Mitchell, 1988b, for production through 1980, and BP, 2010 for more recent production).

http://www.its.caltech.edu/~rutledge/DavidRutledgeCoalGeology.pdf

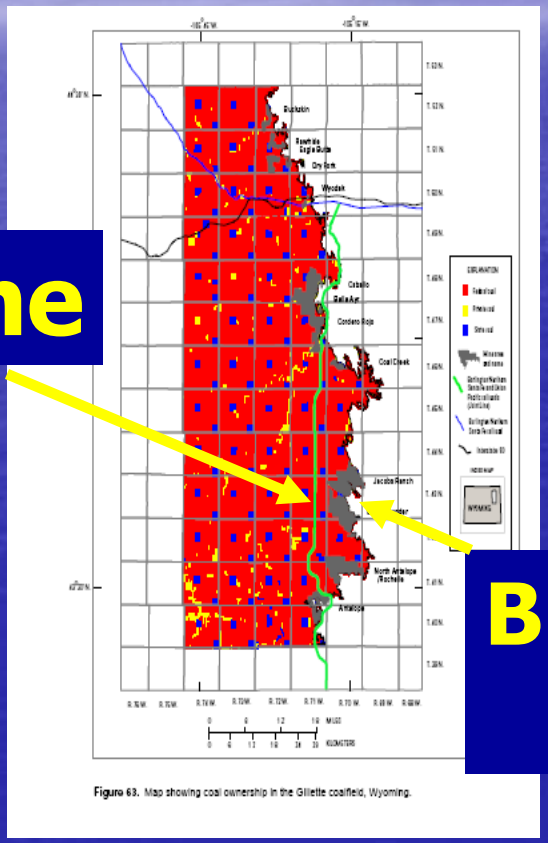


2005 Coal Deliveries to Power Plants by Region—Graphic by Ventyx

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

Powder River Basin Mines Wyoming

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*

Source: Environmental Impact Statements PRB Coal Mines
Bureau of Land Management, Casper Wyoming Field Office
and 2012 Arch Coal 10-K Annual Report

Powder River Basin Mines Wyoming

North Antelope/Rochelle Mine

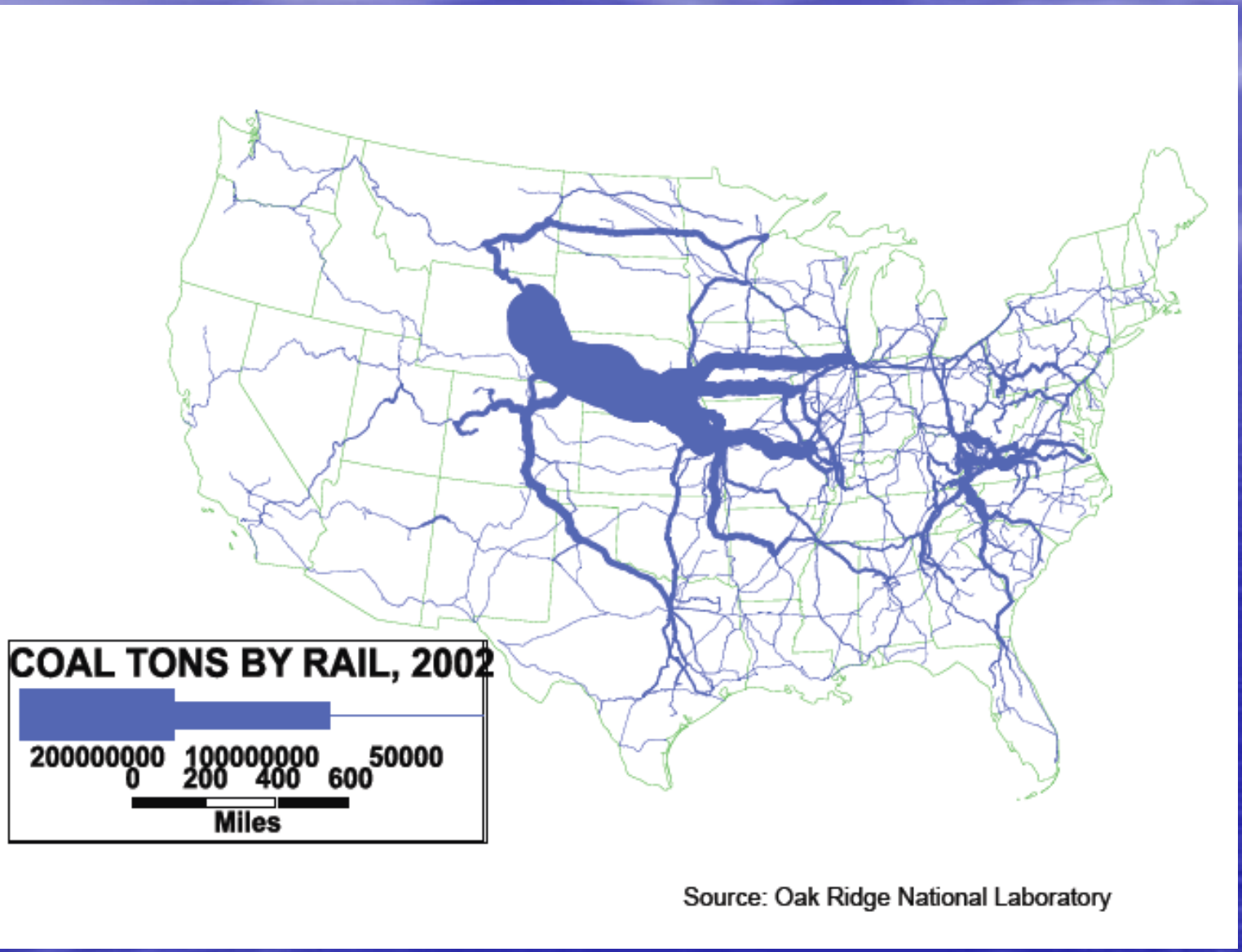
Remaining Life: *About 6 Years*

Life Extension: *10 Years*

Current Overburden: *211Feet*

Expansion O-burden: *340+ Feet*

Source: Environmental Impact Statements PRB Coal Mines
Bureau of Land Management, Casper Wyoming Field Office

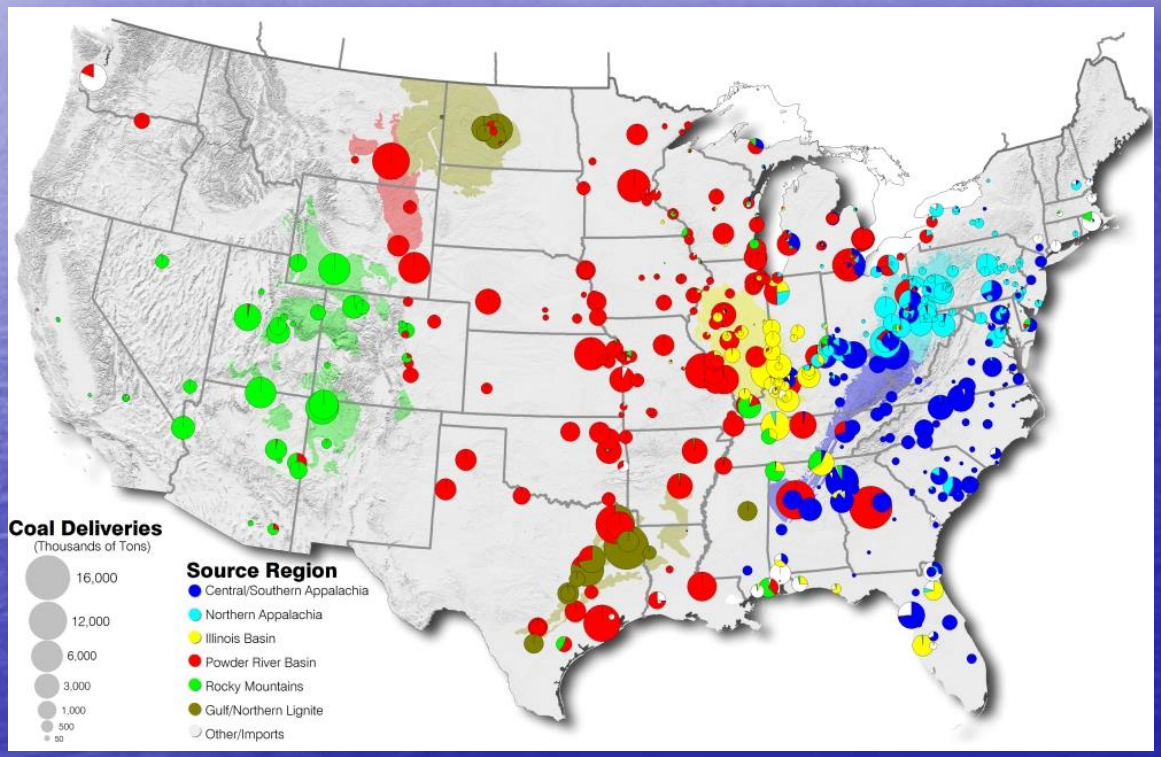


Source: Oak Ridge National Laboratory

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

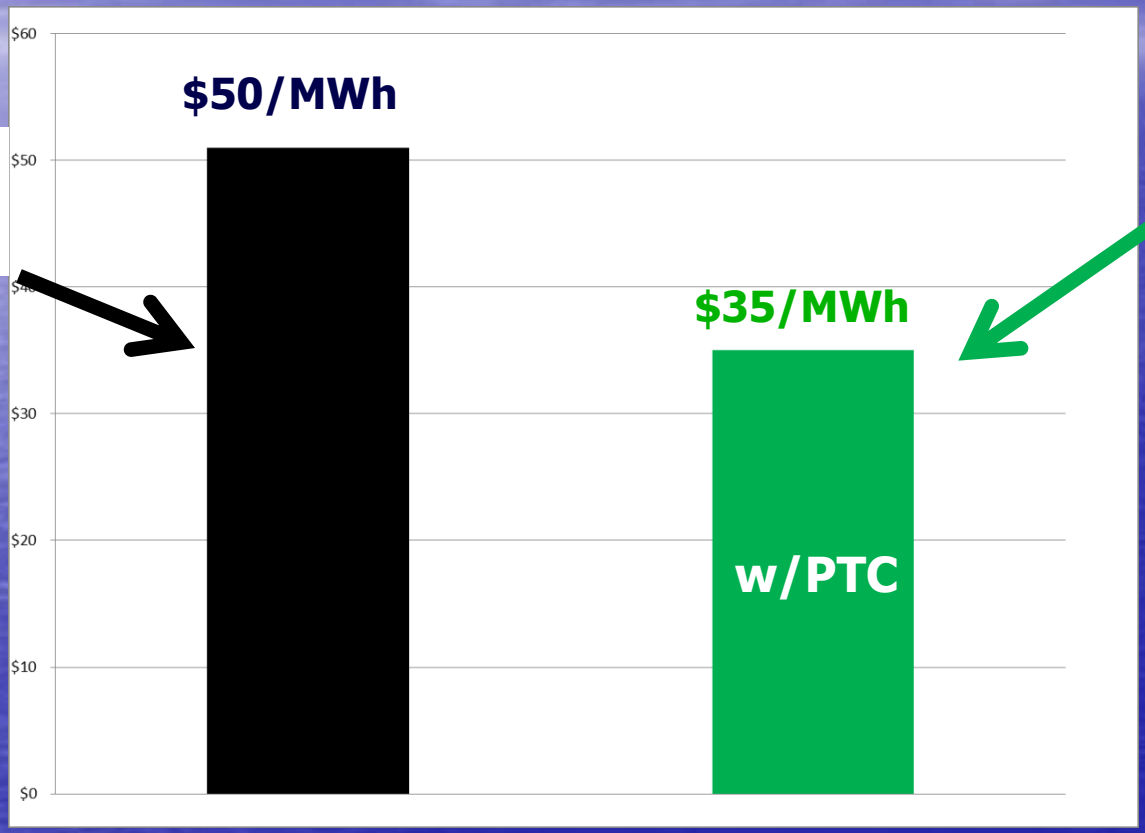
Red = Powder River Basin

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

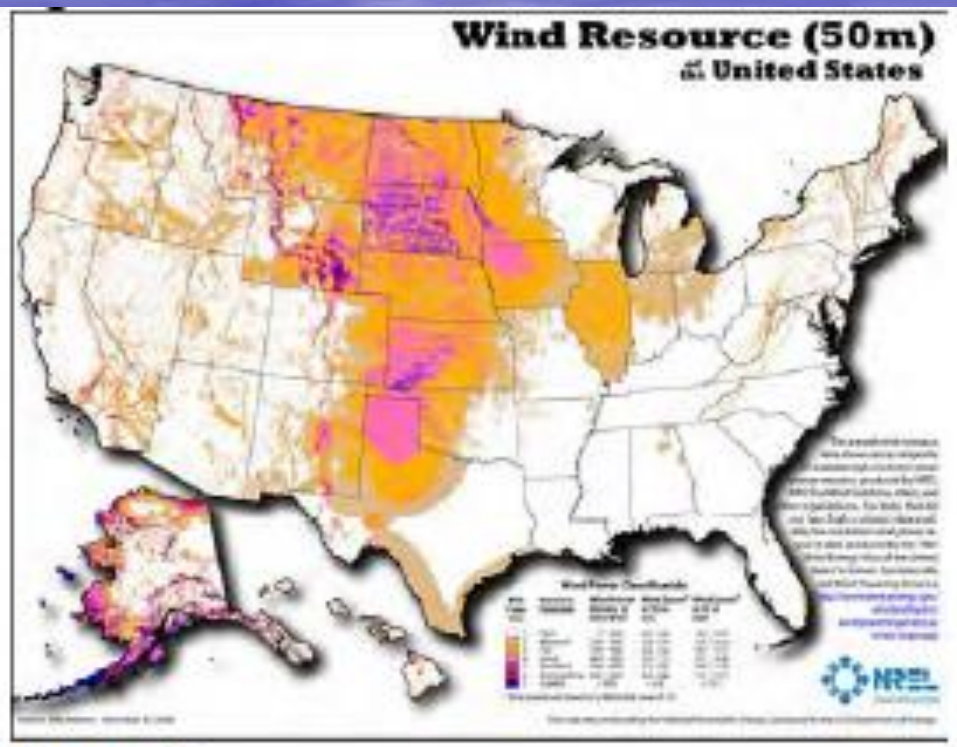


Figure 13

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

US Solar Resource

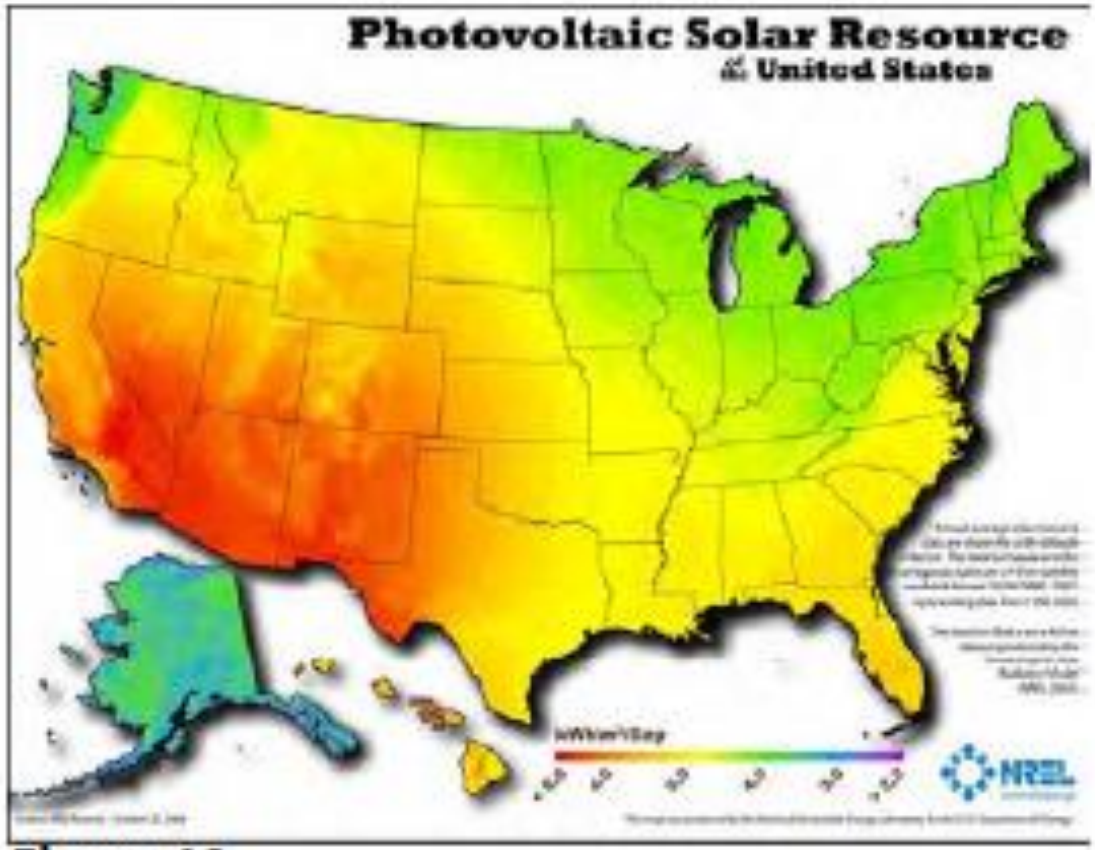
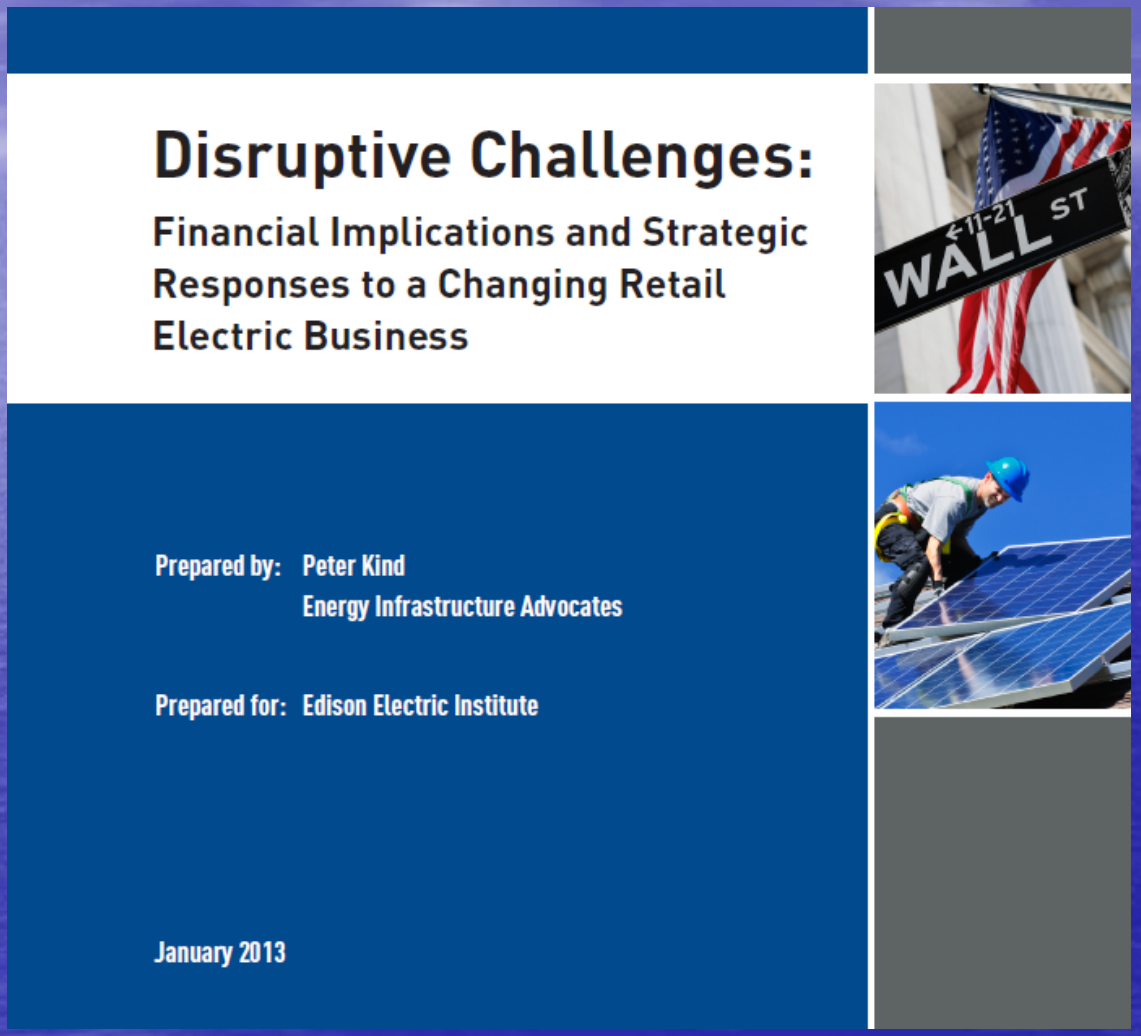


Figure 12

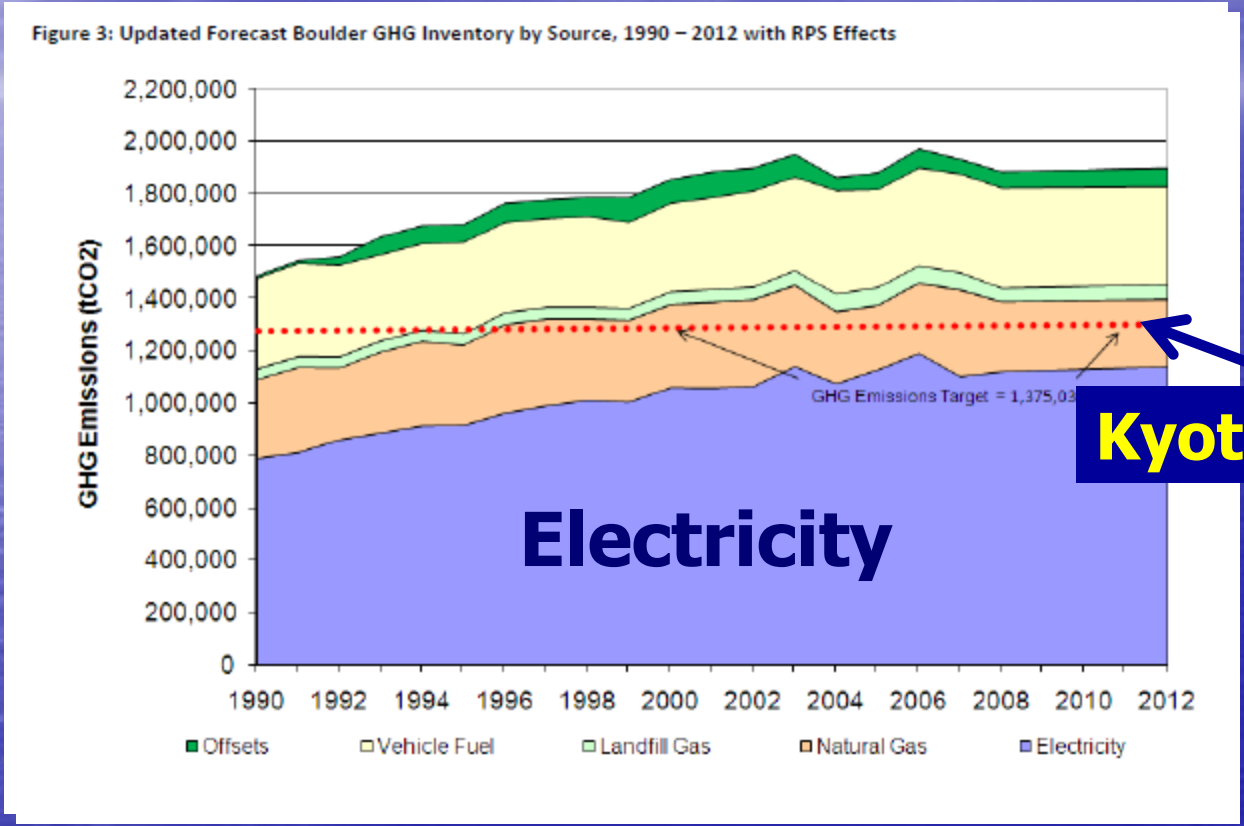
Source: National Renewable Energy Lab
Figure 12, TSGT Resource Plan Report, November 2010, Page 116

Edison Electric Institute on Disruptive Challenges to the Electric Industry



*www.**eei**.org/ourissues/finance/Documents/**disruptivechallenges**.pdf*

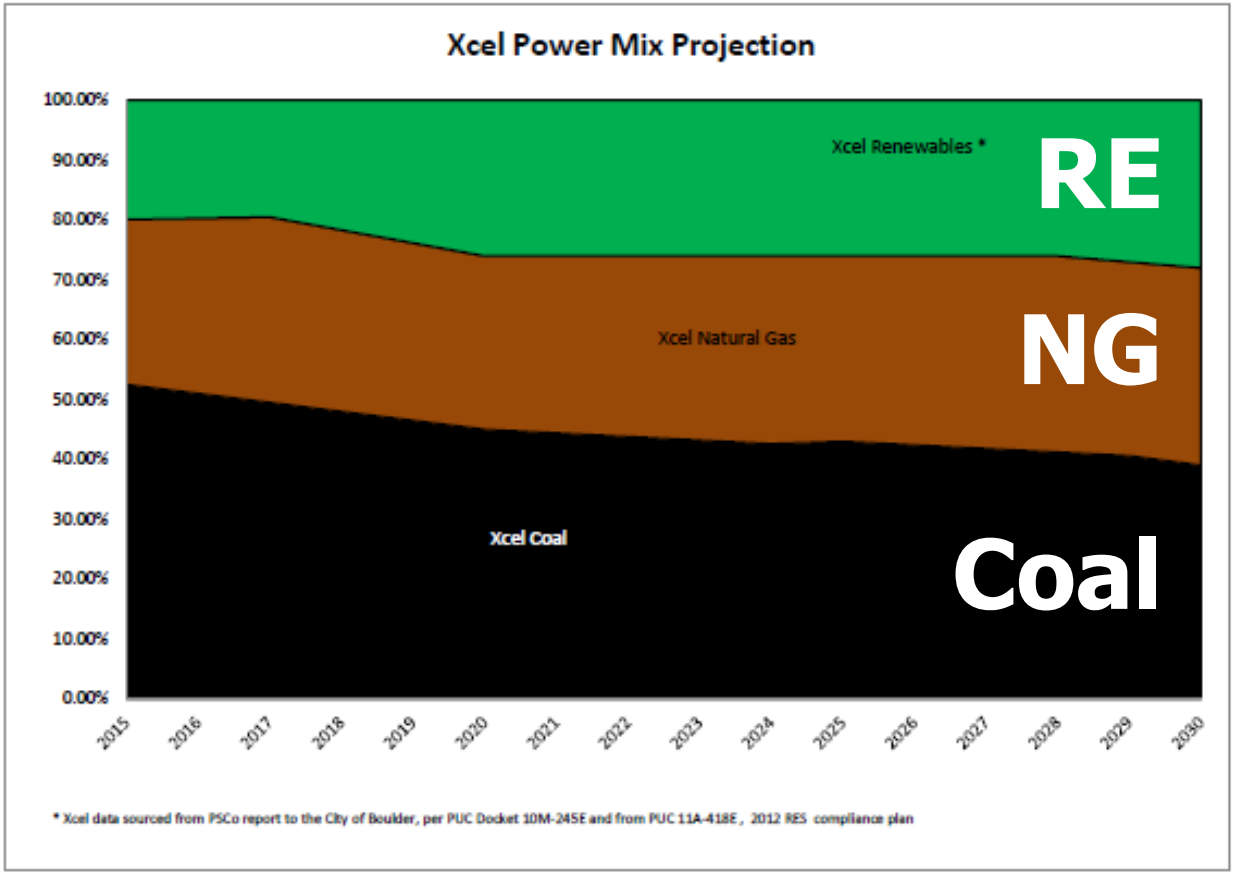
Boulder's Greenhouse Gas Inventory



Kyoto Target

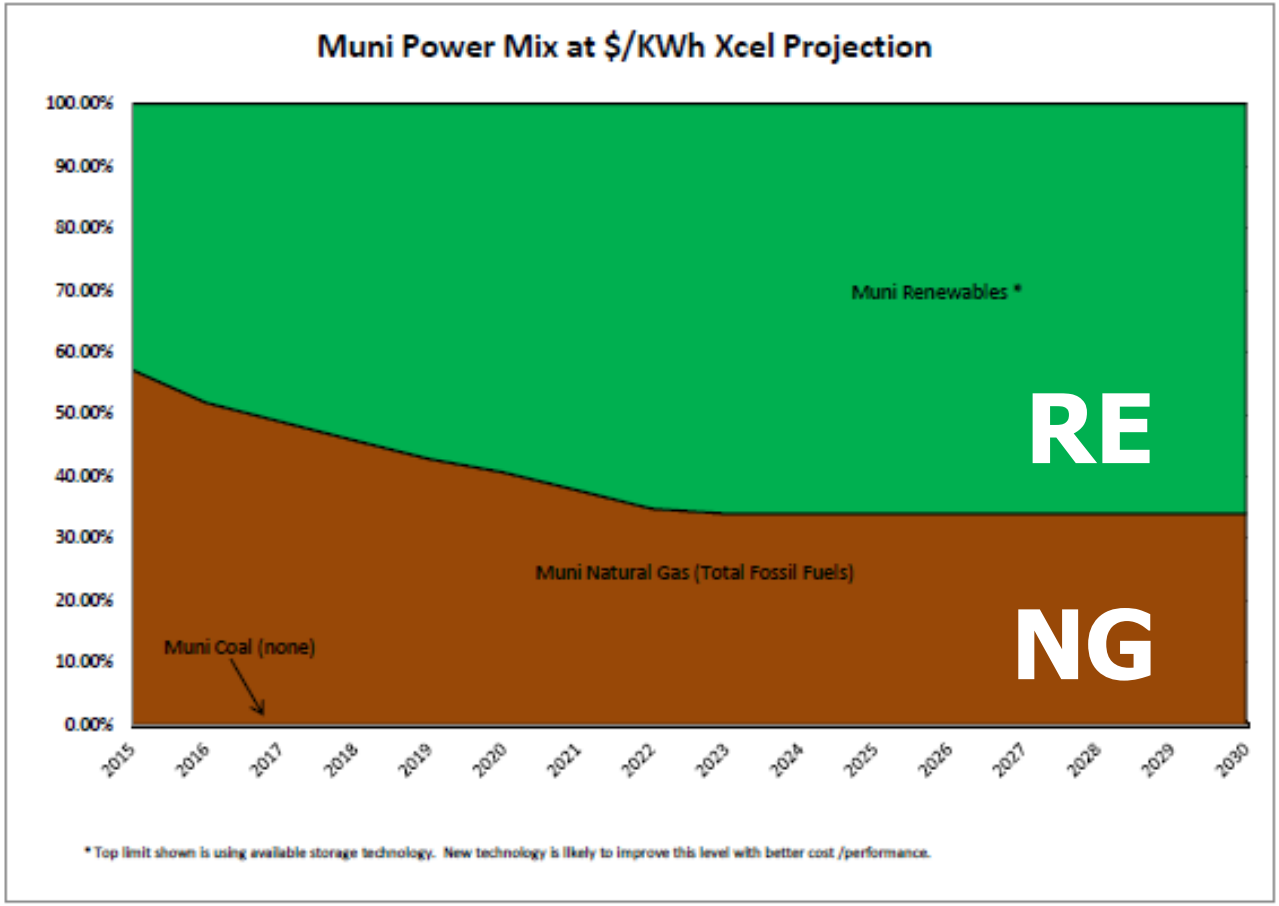
Source: City of Boulder Climate Action Plan Assessment July 2009
http://www.bouldercolorado.gov/files/Environmental%20Affairs/climate%20and%20energy/City_of_Boulder_ALL_SECTIONS_FINAL_072809_v9.pdf

Xcel's Approx. Projected Fuel Mix 2015 -2030



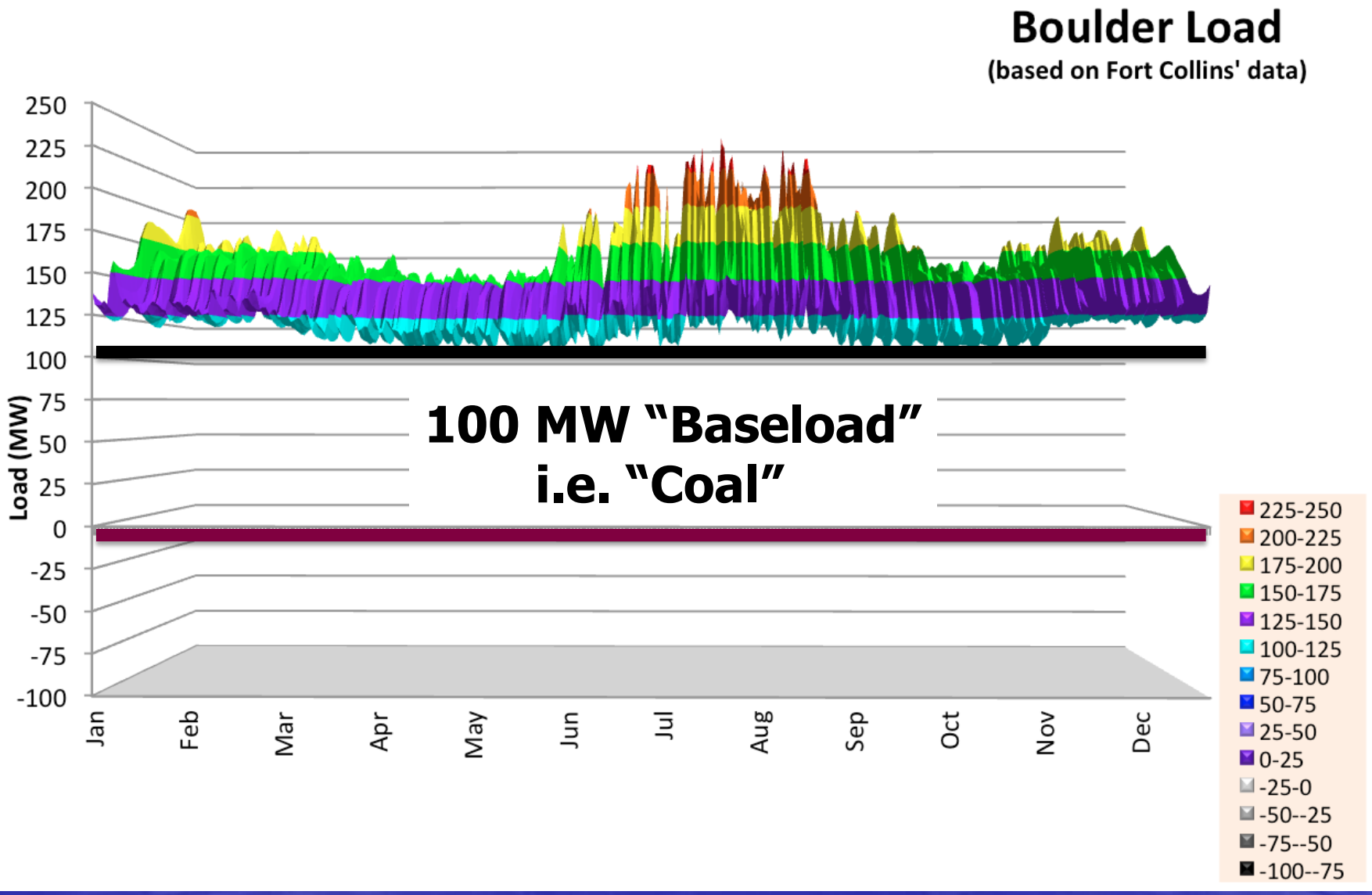
Data provided by Xcel to City of Boulder, December 2010
Graph by Tom Asprey with RenewablesYes.org

Boulder's Projected Fuel Mix Assuming Xcel Maintains 2011 Rates



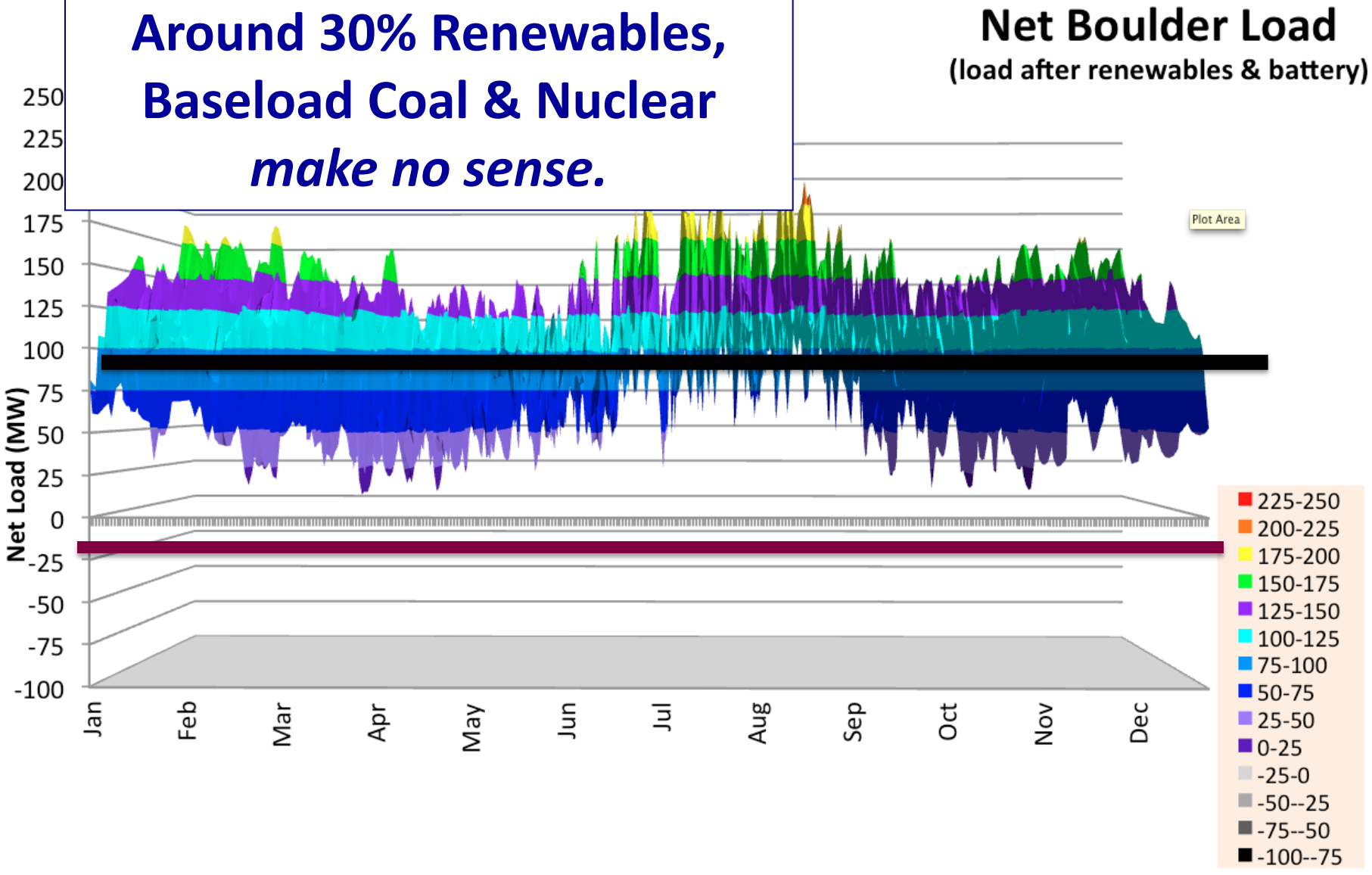
Questions on modeling and graphs to Tom Asprey
Contact through www.renewablesyes.org

Boulder's Load

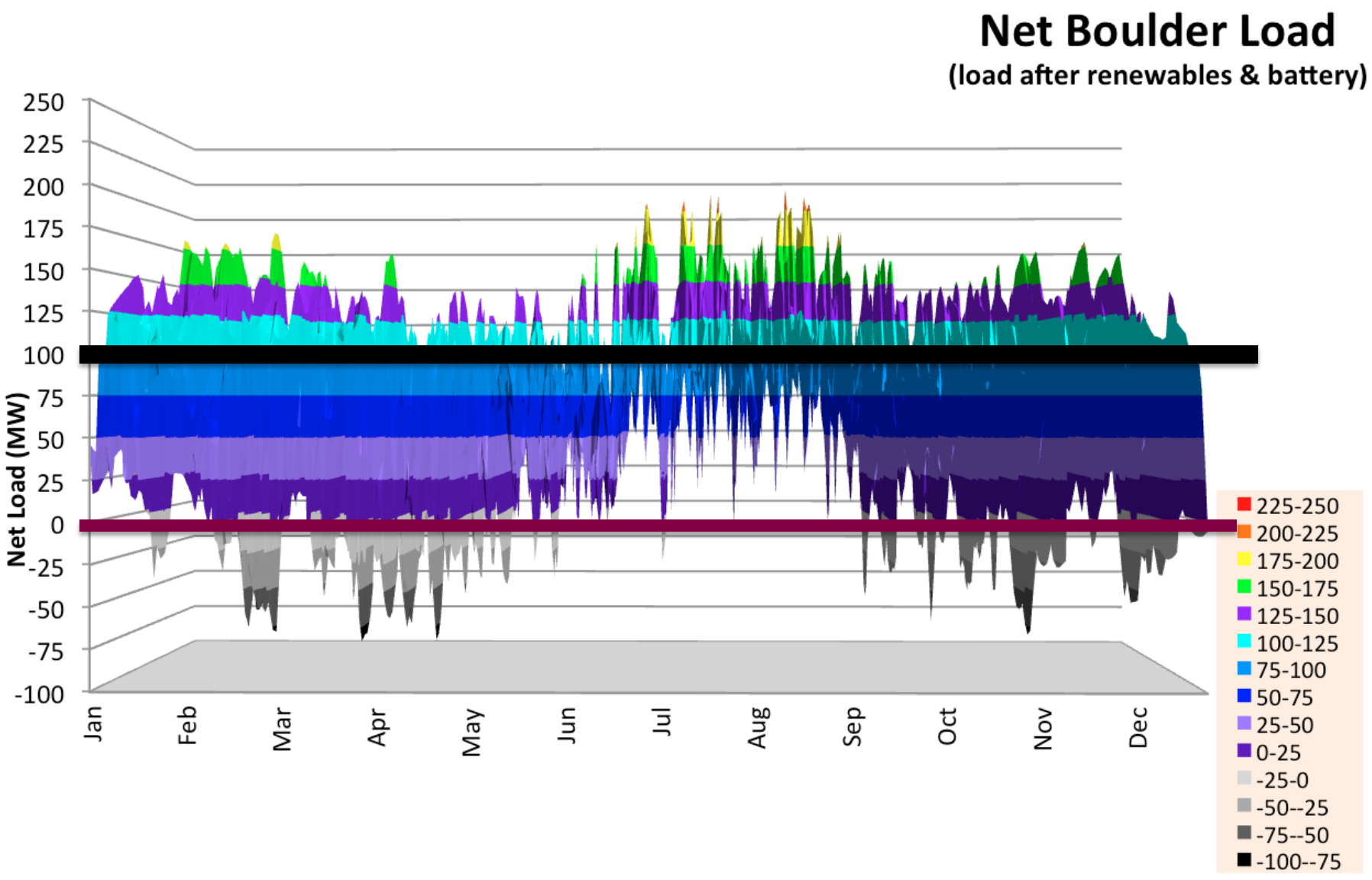


30% Renewable Electricity

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



50% RE. 0 Battery. 4% Overgeneration



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

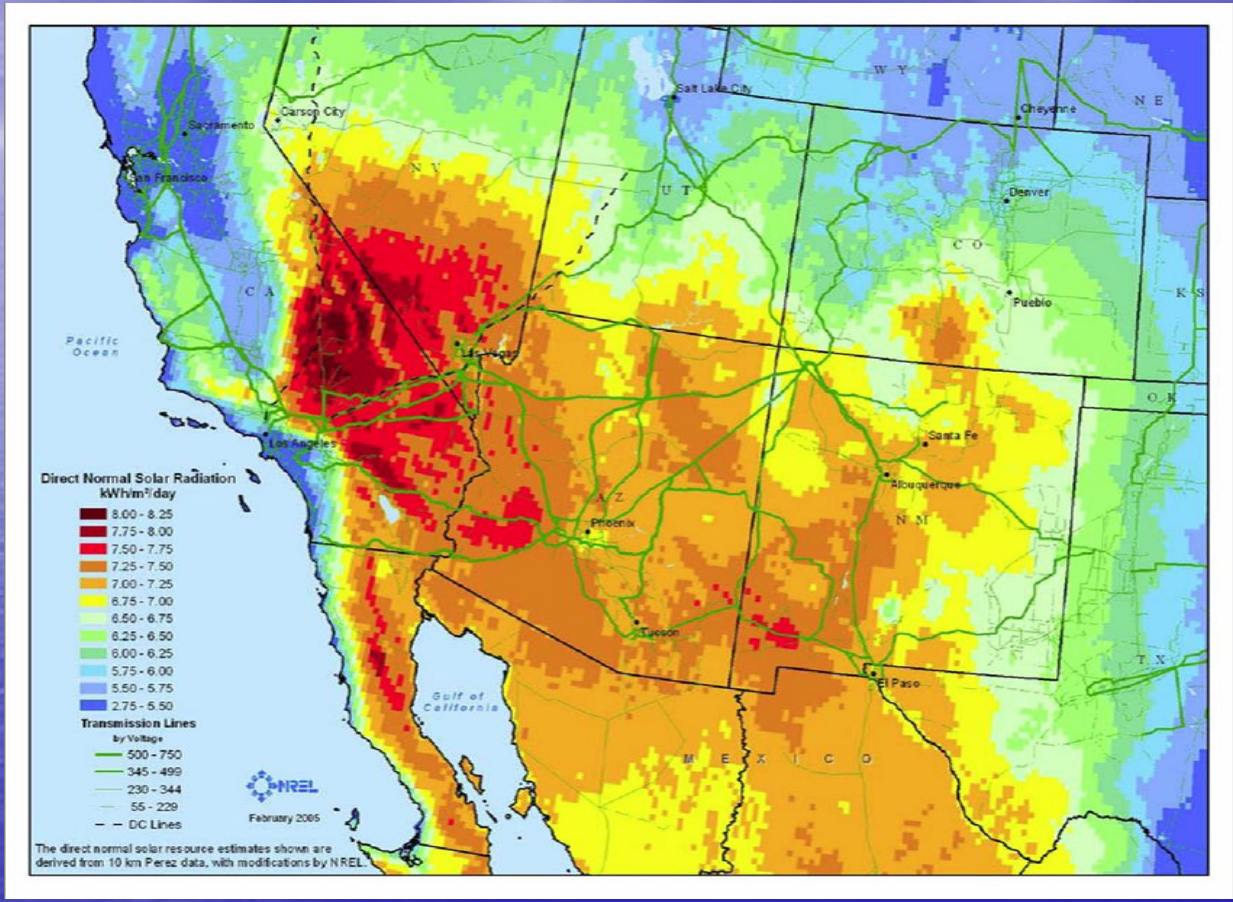
(e.g. "Electric Commodity Adjustment" riders)

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



Leslie Glustrom lglustrom@gmail.com 303-245-8637

www.cleanenergyaction.org

USGS Studies of Economically Recoverable Coal

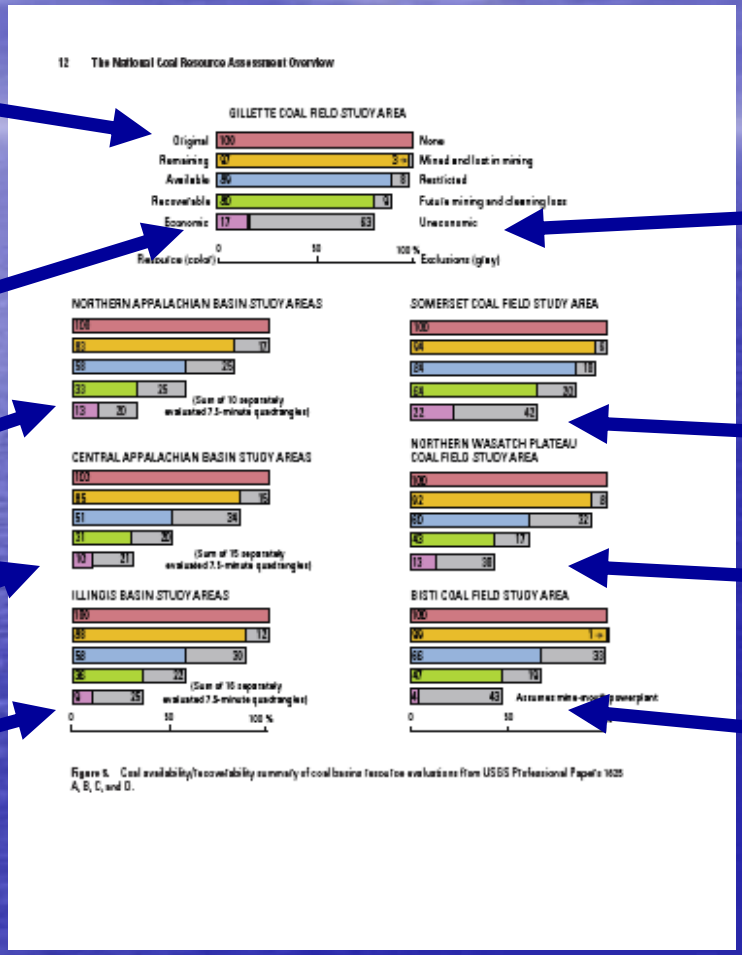
Total

Economically Recoverable

13%

10%

9%



17%

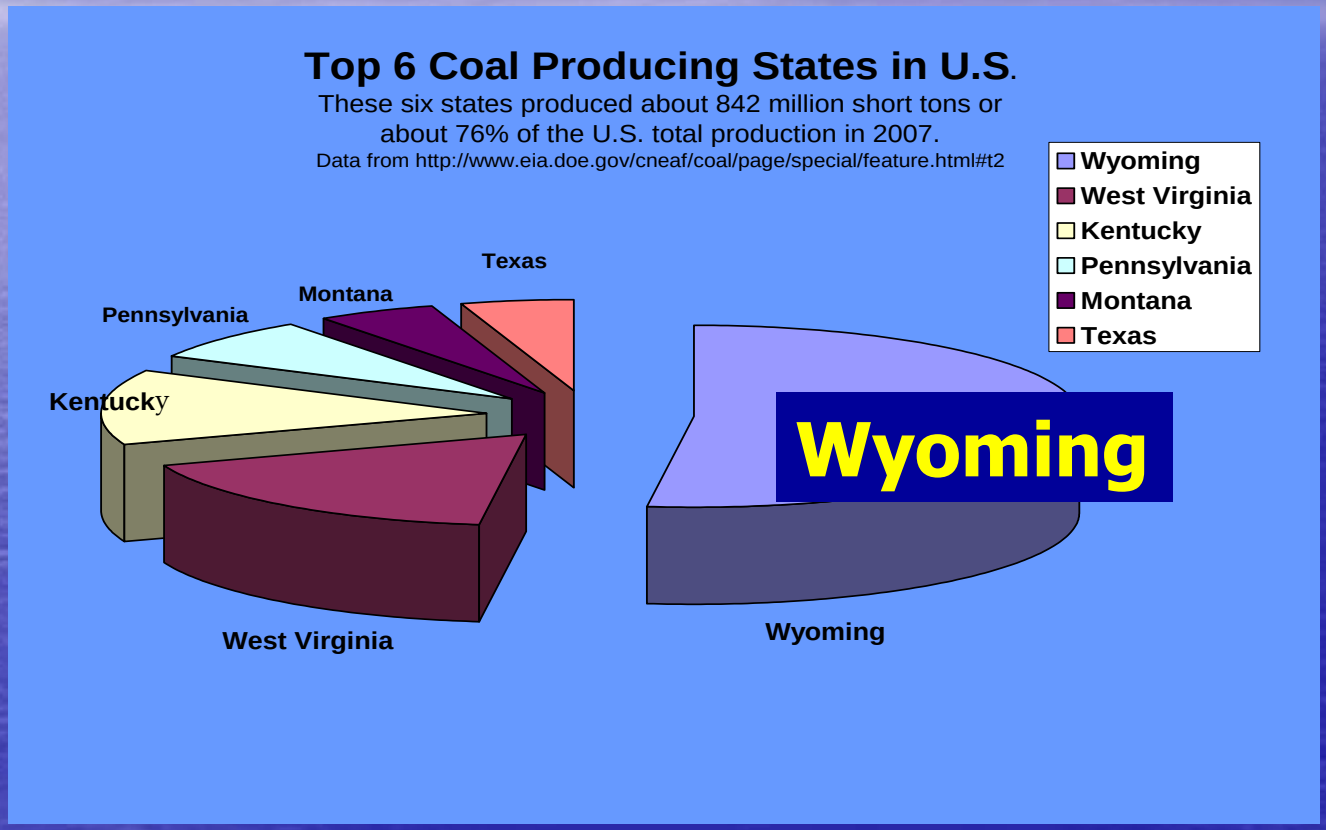
22%

13%

4%

Source: http://pubs.usgs.gov/pp/1625f/downloads/ChapterD.pdf

Top 6 Coal Producing States—Wyoming Dwarfs All Others…



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

Percentage of Economically Recoverable Coal Gillette Wyoming USGS 2002

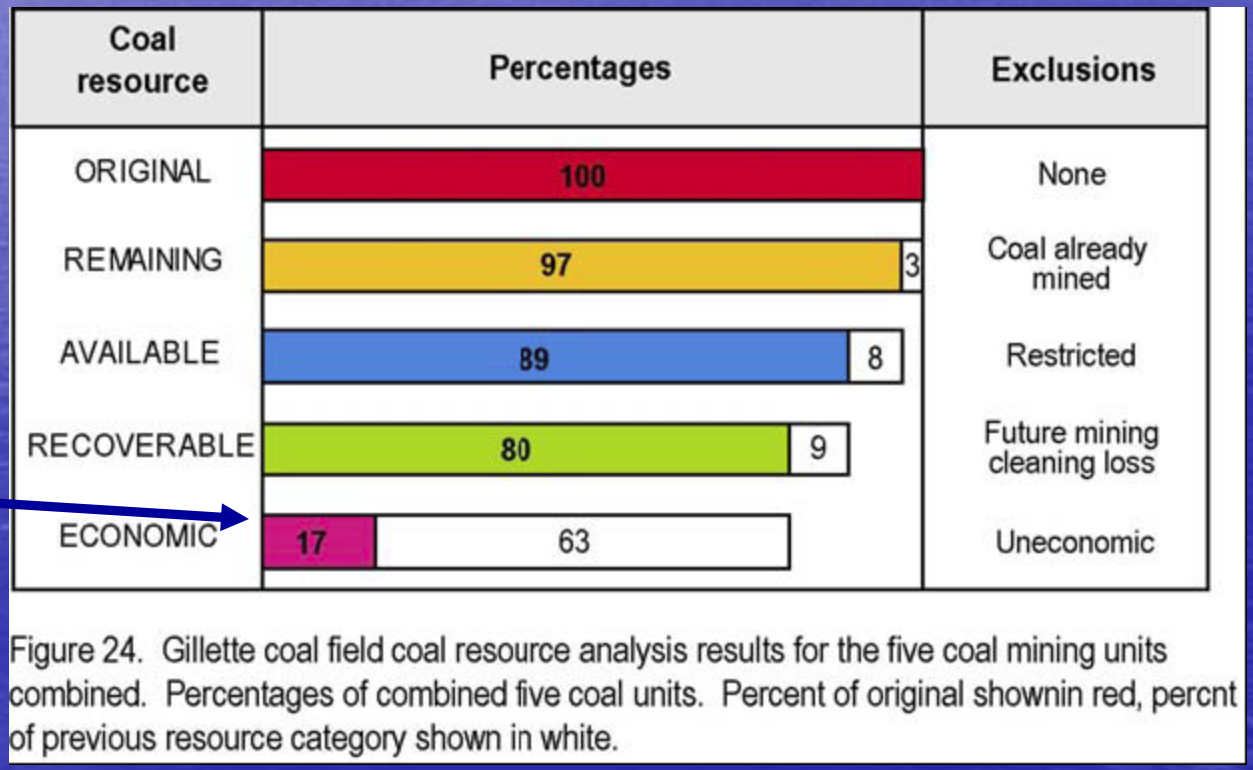


Figure 24. Gillette coal field coal resource analysis results for the five coal mining units combined. Percentages of combined five coal units. Percent of original shownin red, percnt of previous resource category shown in white.

17% Economically Recoverable

USGS Open File Report 02-180, 2002,

Percentage of Economically Recoverable Coal Powder River Basin USGS 2008

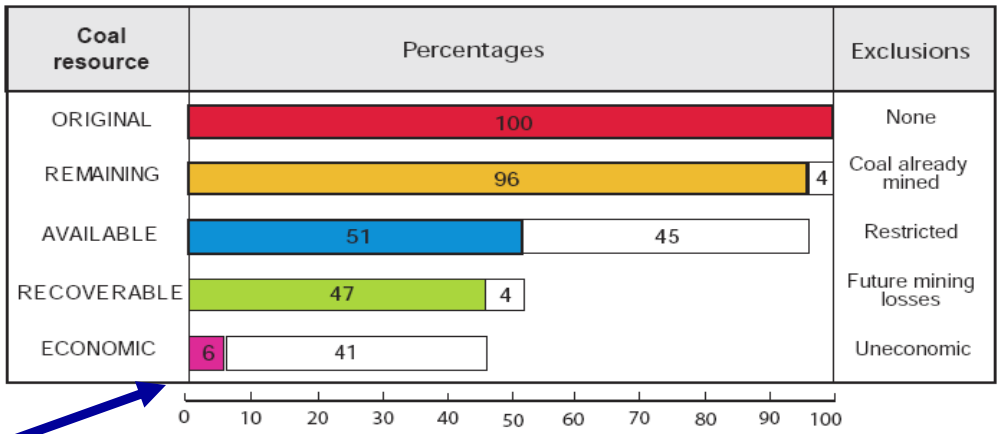


Figure 68. Bar graph showing Gillette coalfield coal resource analysis results for the six coal beds from figure 67, reported as percentages of original resources (at sales price of $10.47 as of January, 2007). Percent of remaining resources are shown in colored bars; excluded resources from the previous category are shown in white bars.

6% Economically Recoverable

Source: USGS 2008-1202 Figure 68

2008 USGS Cost Curve for the Gillette Coal Field, Powder River Basin, Wyoming

$60/Ton

77 Billion Tons

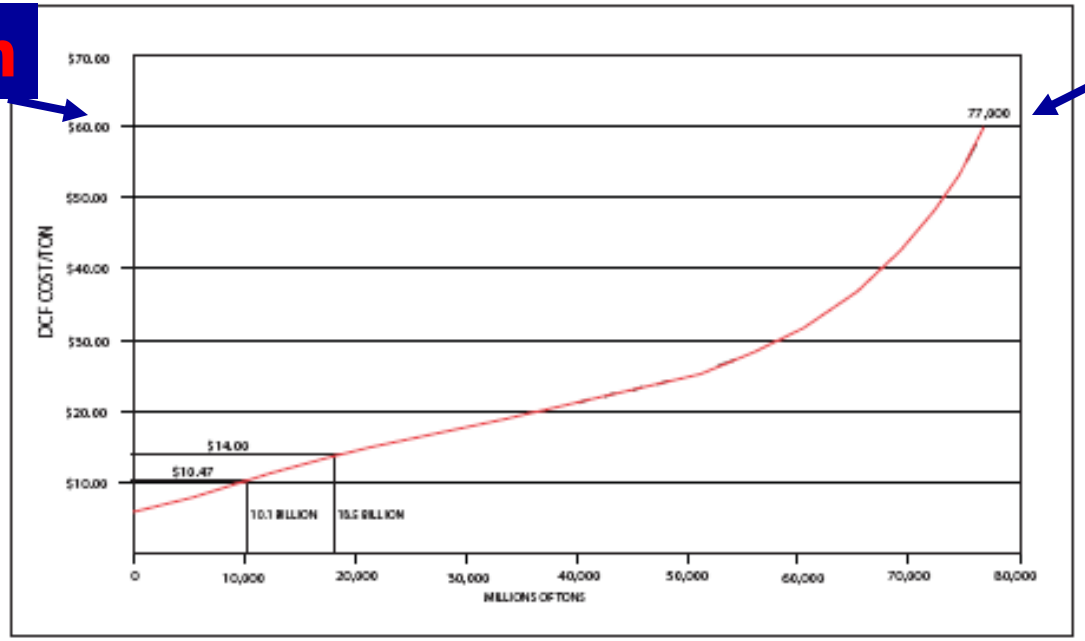


Figure 66. Cost curve showing reserve estimates at $10.47/ton (as of January, 2007) and $14.00/ton (as of March, 2008) for the Gillette coalfield.

Source: Figure 66, USGS 2008-1202

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.