U.S. Likely Past Peak Coal??

"New" Developments in the Powder River Basin

IEEFA Coal Finance Workshop
March 17-19. 2014
New York University

Leslie Glustrom
Clean Energy Action,
Boulder, Colorado

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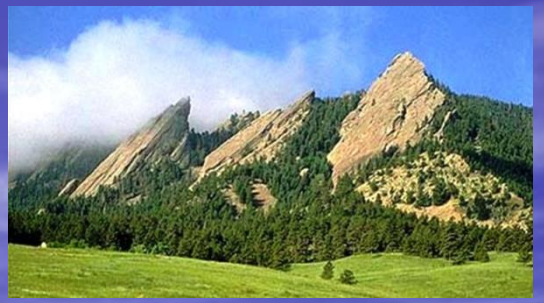
Clean Energy Action
Boulder, Colorado
Began in 2005

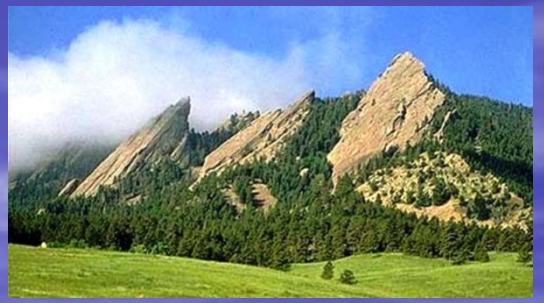


Accelerate the

Transition to the

Post-Fossil Fuel World

Clean Energy Action Boulder, Colorado Began in 2005



2005 and on—Helped Begin National Movement to Oppose New Coal Plants

2006 and on-Began Detailed Analyses of US Coal Cost and Supply Issues

2007 and on—Directed Nat'l Attention to the Powder River Basin Coal Region

2007-2008—Defeated "Clean Coal" Plant Proposed for Colorado

2008 and on—Developed Local Clean Energy Future/Franchise Strategies

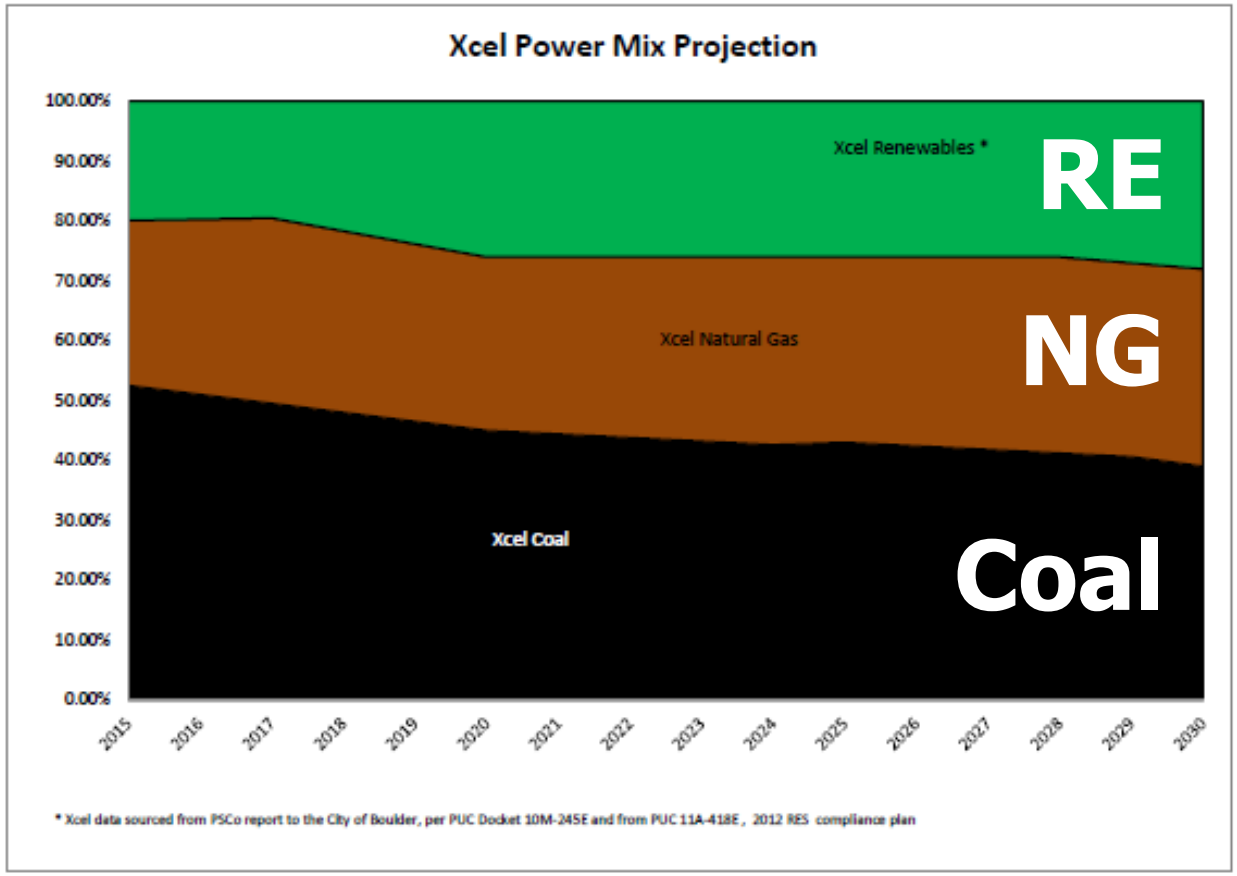
2010 and on—Opposed Old Coal Plant Retrofits under "Clean Air Clean Jobs"

2010-2013--Key Role in Winning Three Boulder Elections Against Xcel

2013 and on—Pioneering Strategies to Accelerate Decarbonization

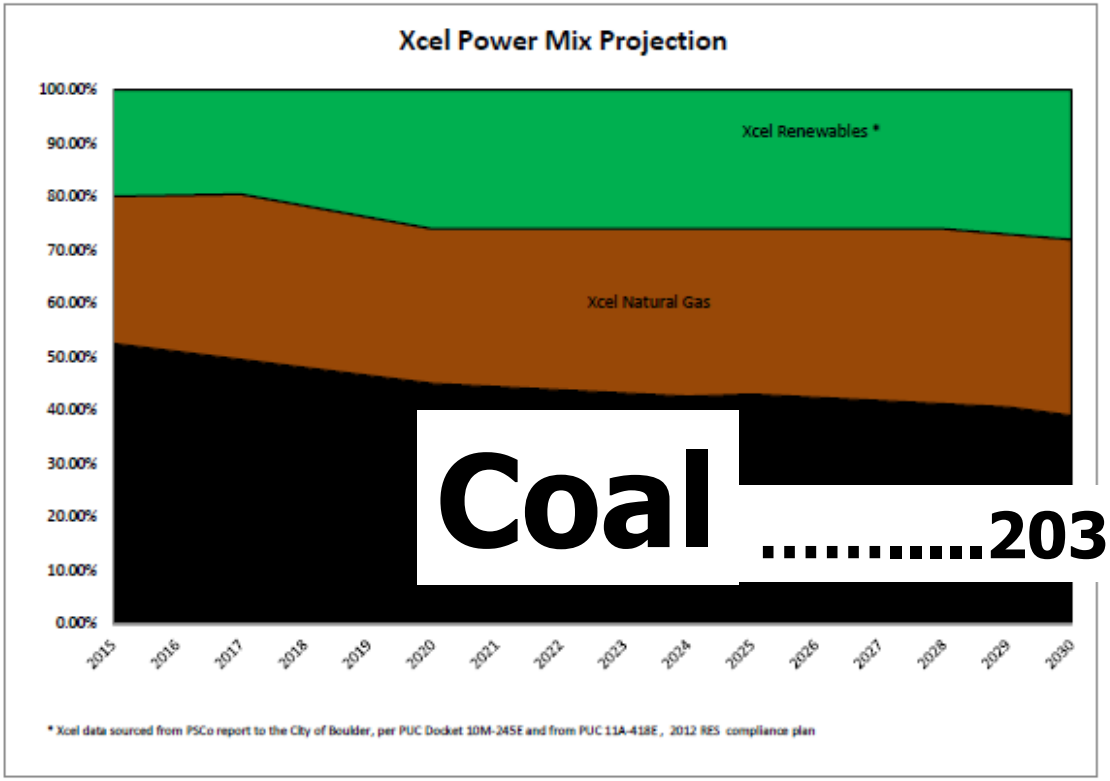
Essentially No Funding from National Foundations

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

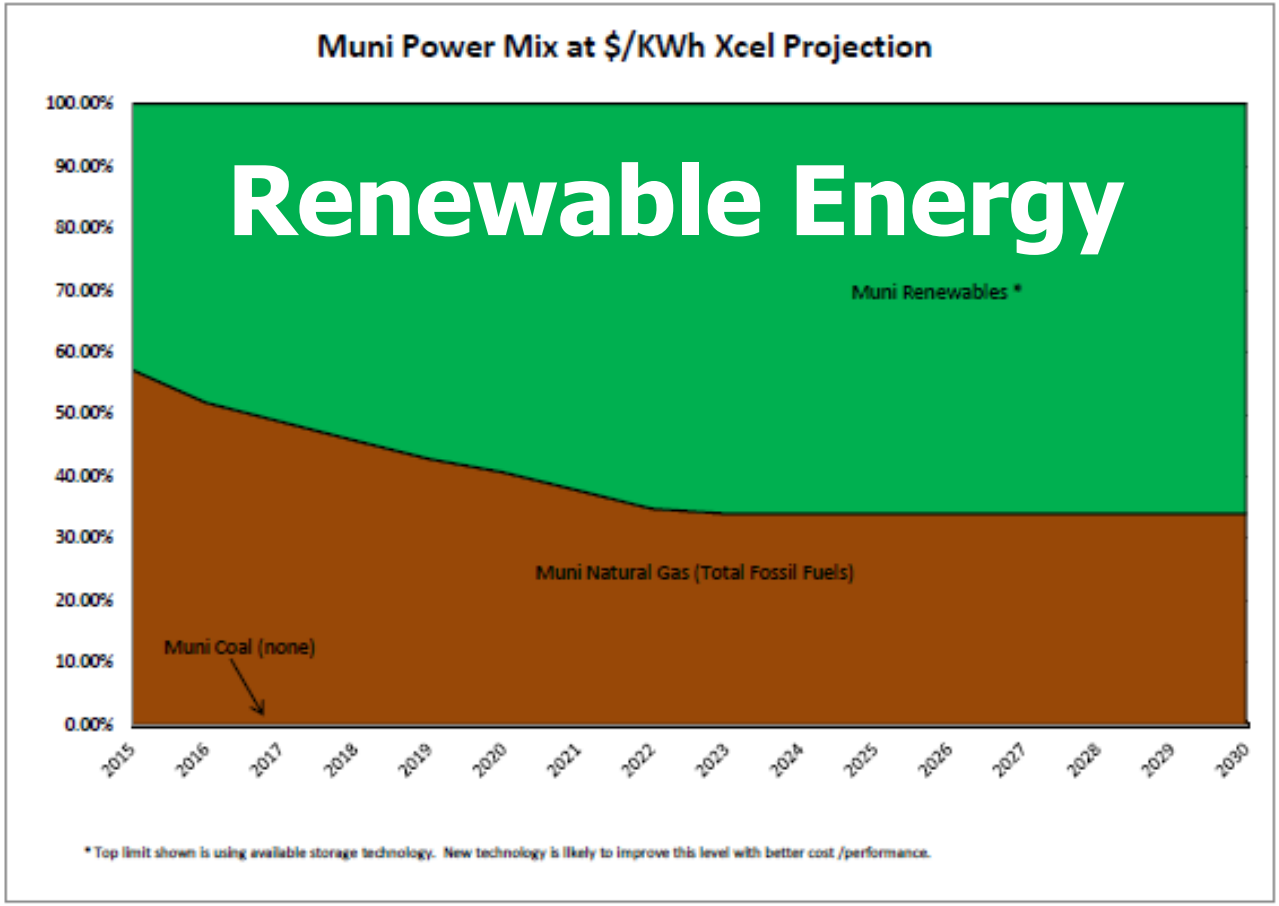
Xcel's Colorado Coal Commitments Extend to 2069



.....2030's.....2041.....2069

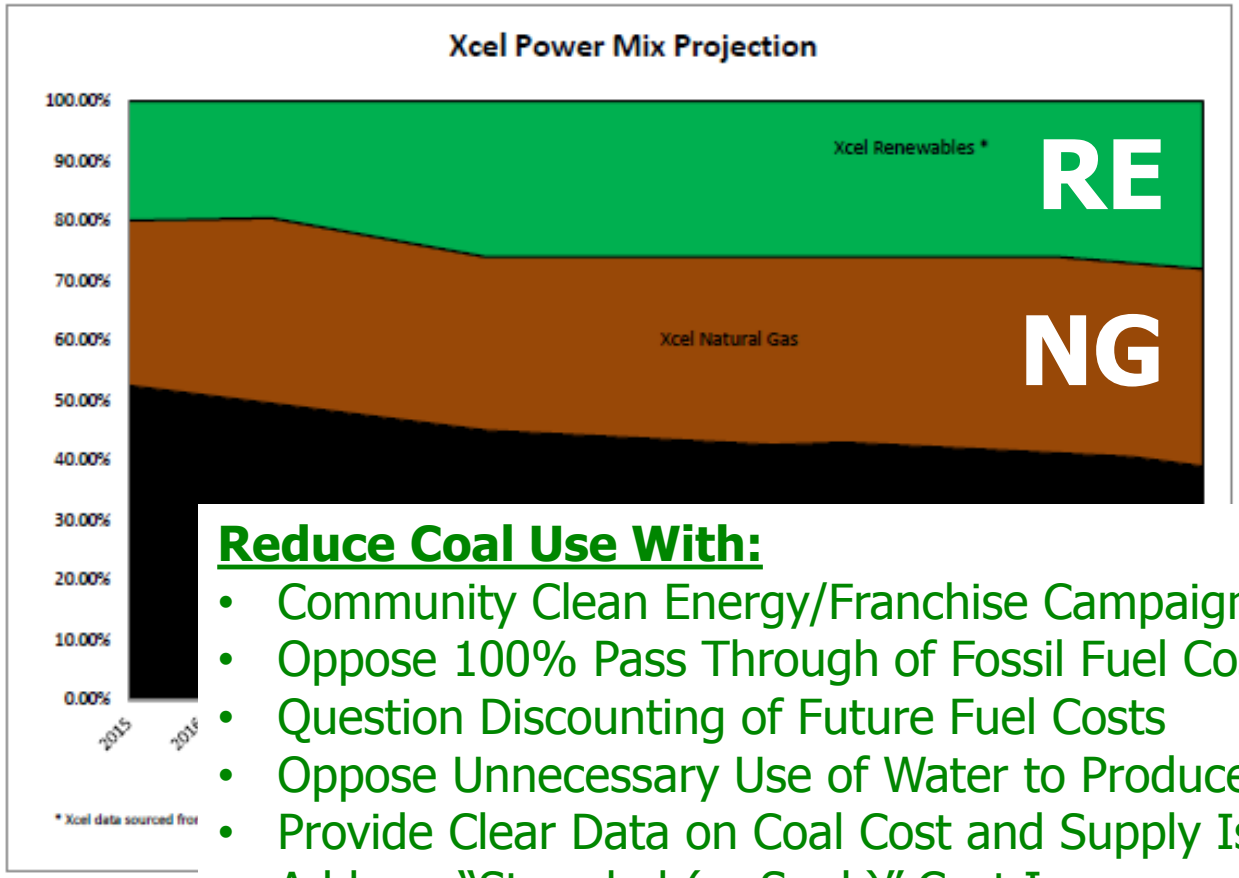
Coal for Another 55 Years????????

Boulder's Projected Fuel Mix Assuming Xcel Maintains 2011 Rates



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

Strategies for Reducing Coal Generation

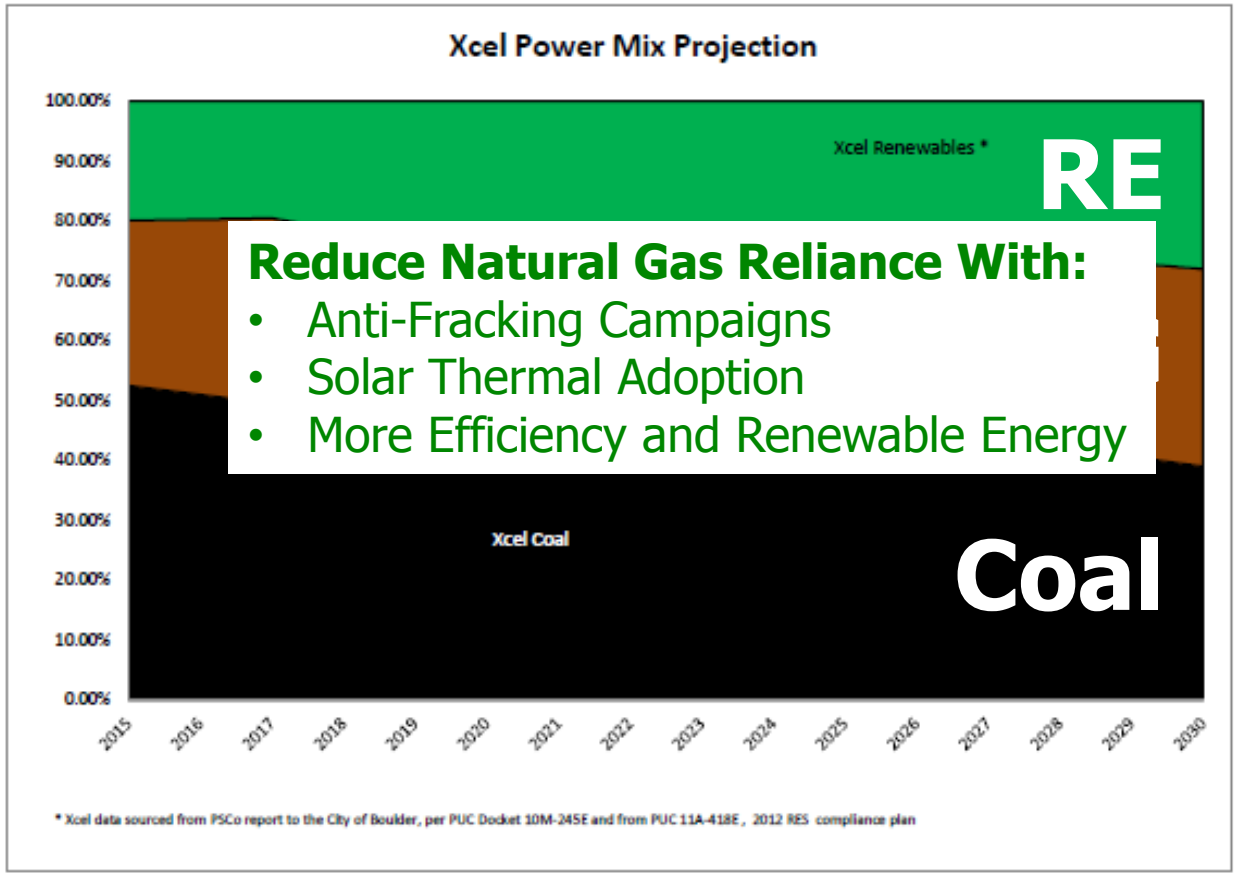


Reduce Coal Use With:

- Community Clean Energy/Franchise Campaigns
- Oppose 100% Pass Through of Fossil Fuel Costs
- Question Discounting of Future Fuel Costs
- Oppose Unnecessary Use of Water to Produce Electricity
- Provide Clear Data on Coal Cost and Supply Issues
- Address "Stranded (or Sunk)" Cost Issue

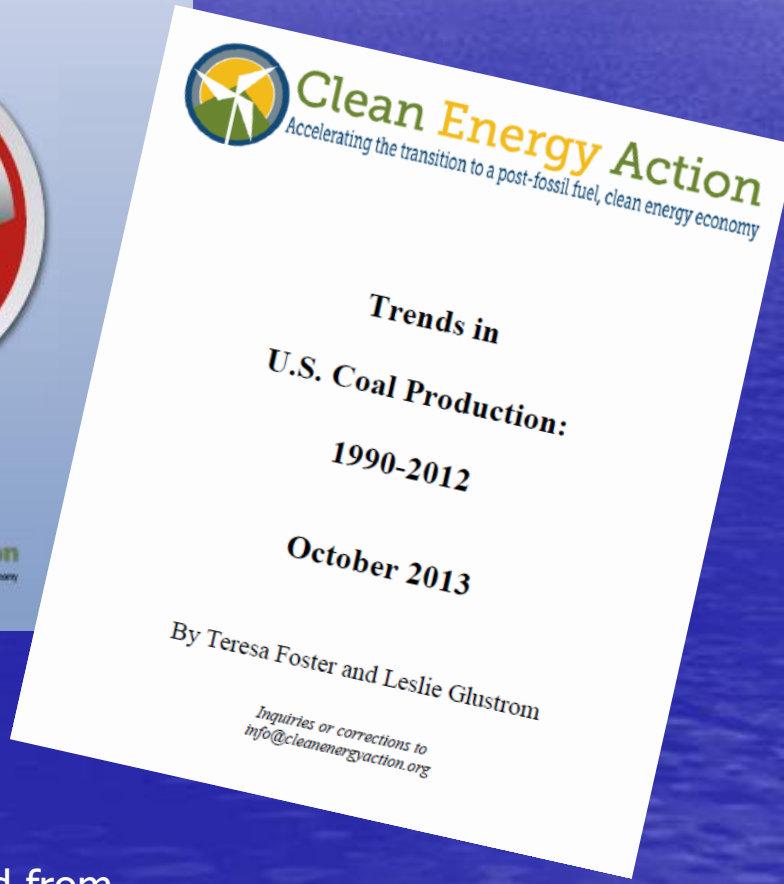
Data provided by Xcel to City of Boulder, December 2010
Graph by Tom Asprey with RenewablesYes.org

Strategies for Reducing Natural Gas Use

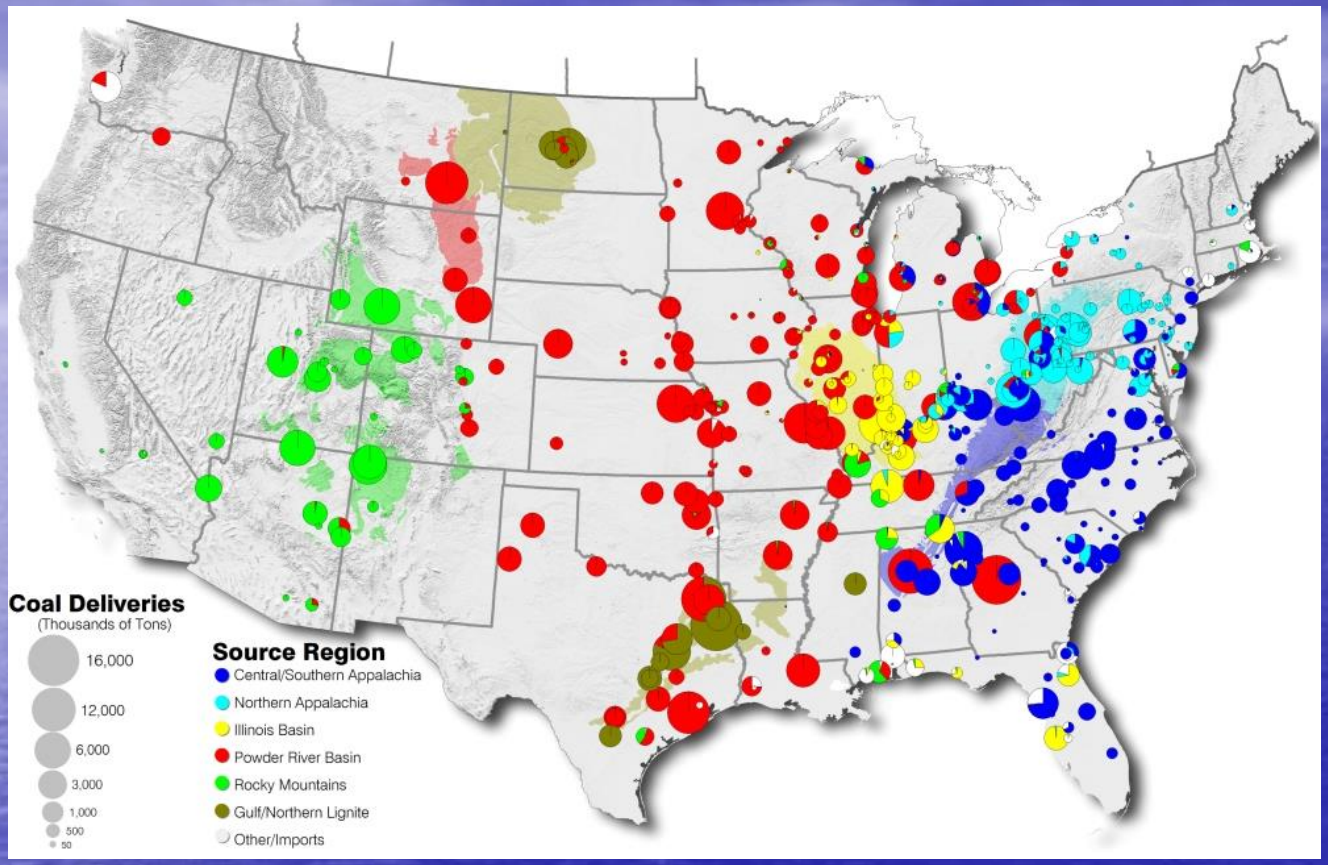


Data provided by Xcel to City of Boulder, December 2010
Graph by Tom Asprey with RenewablesYes.org

Trio of Coal Reports Released October 30, 2013



Available for free download from
http://cleanenergyaction.org/2013/10/30/warning-faulty-reporting-on-us-coal-supplies/



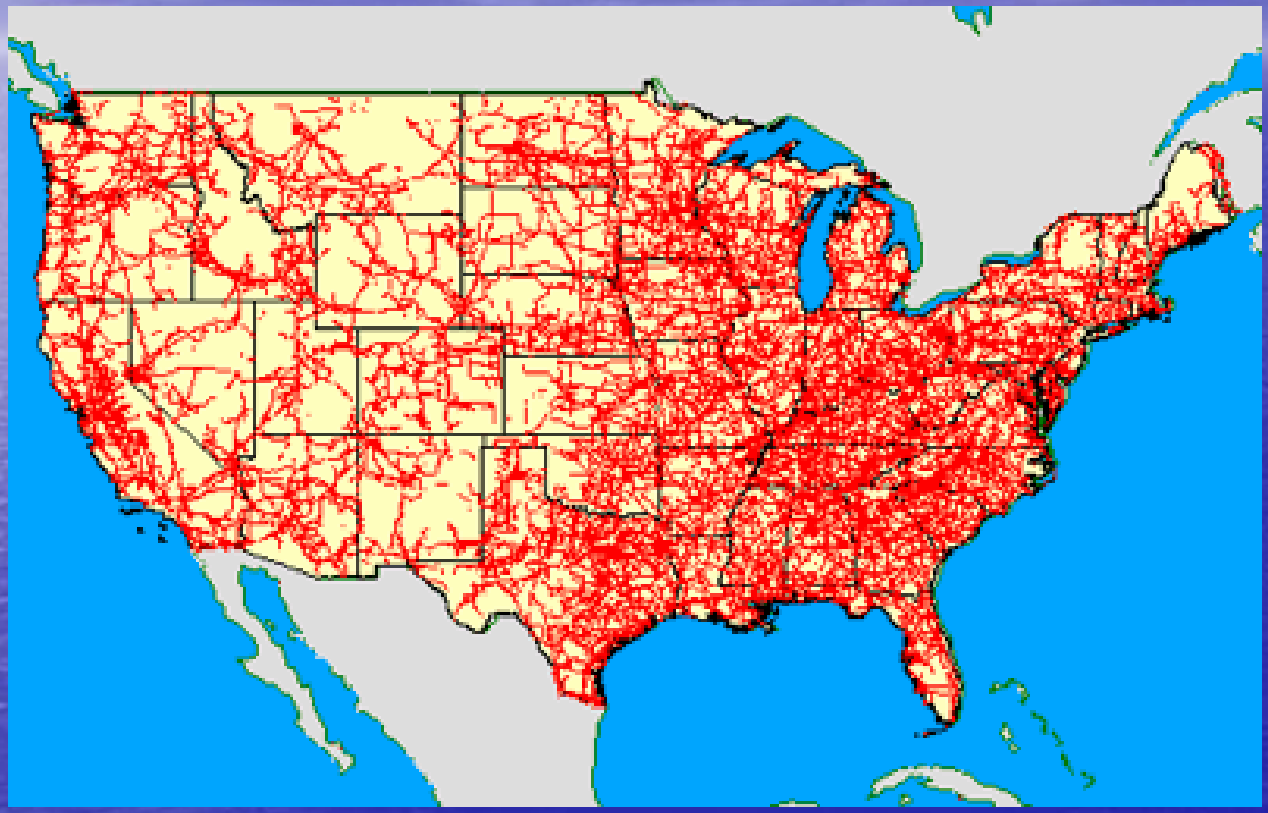
Coal Deliveries to Power Plants by Region—Graphic by Ventyx

Red = Powder River Basin

2005 Data

US Electrical Grid

(Approximate)



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

#1) Oops—
Faulty Reporting of US Coal Reserves…

Report issued Oct-2013 by Clean Energy Action

#2) Repowering the US Electric Grid for the 21st Century Is an

Imperative--

Not a Choice

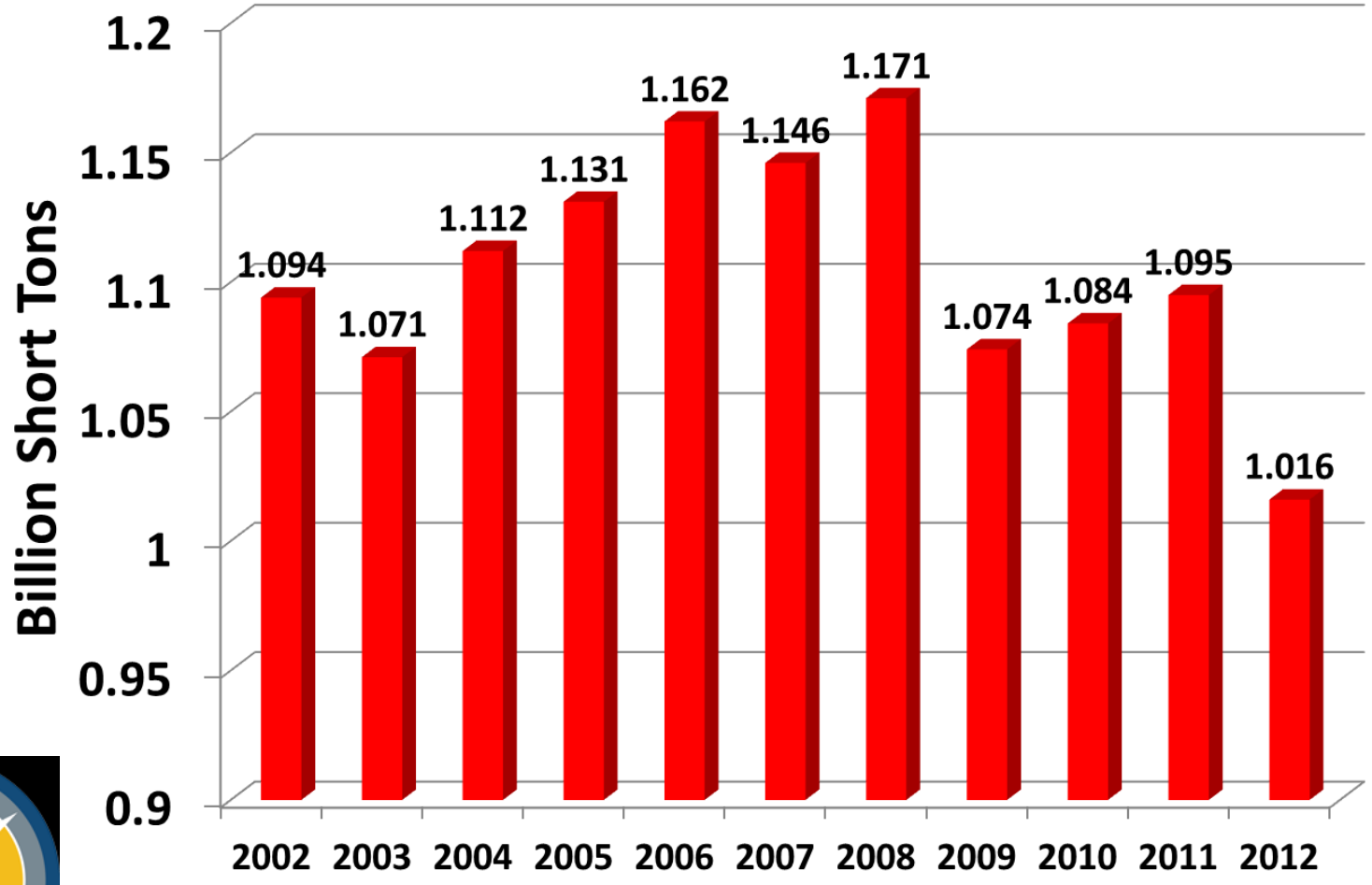
Clean Energy Action
Boulder, Colorado
Began in 2005

#3) Clean Energy Action Will Help Analyze Your Coal Issues

Essentially No Funding from National Foundations

US Coal Production 2002-2012

Data from EIA Annual Coal Reports



http://www.eia.gov/coal/annual/

2012 from 2012 Q4 Quarterly Coal Report http://www.eia.gov/coal/production/quarterly/

UK Coal Industry 1946-1994 Nationalized

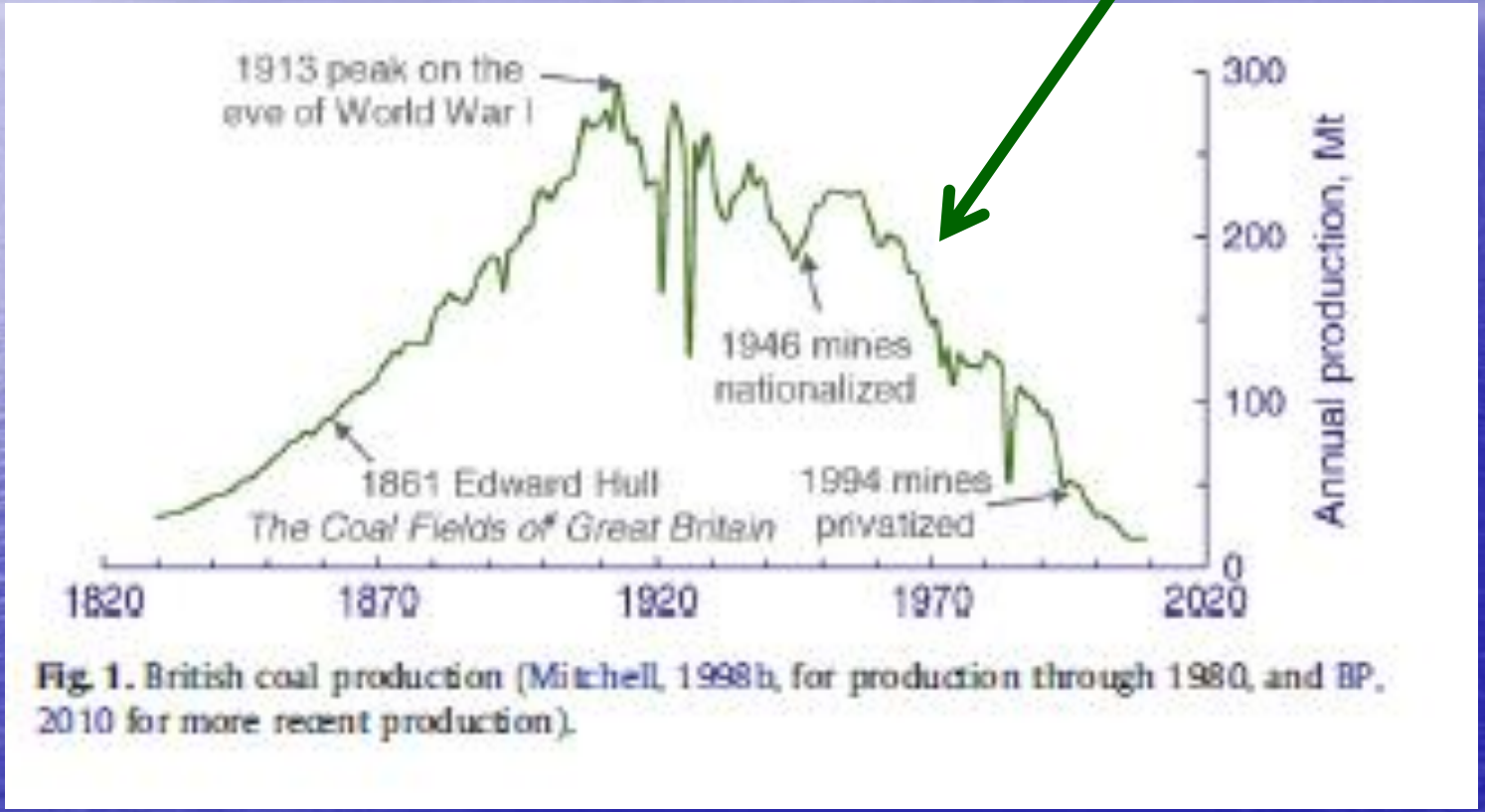


Fig. 1. British coal production (Mitchell, 1988b, for production through 1980, and BP, 2010 for more recent production).

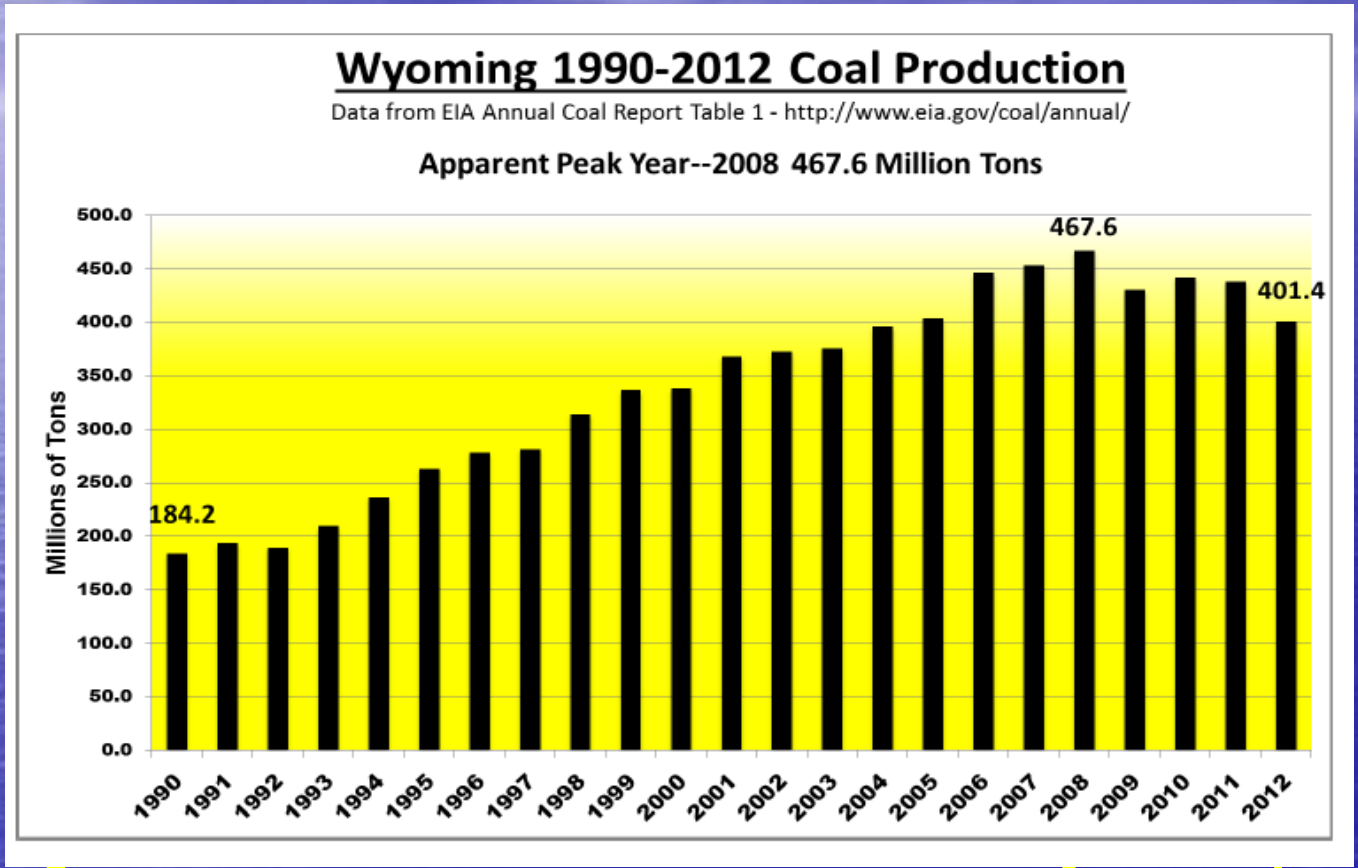
http://www.its.caltech.edu/~rutledge/DavidRutledgeCoalGeology.pdf

US Coal Production by County 2012

Wall Street Journal Jan 7, 2014 John Miller "Despite Gas Boom, Coal Isn't Dead"

Wyoming 1990-2012 Coal Production Peak 2008 (??)

Million Tons

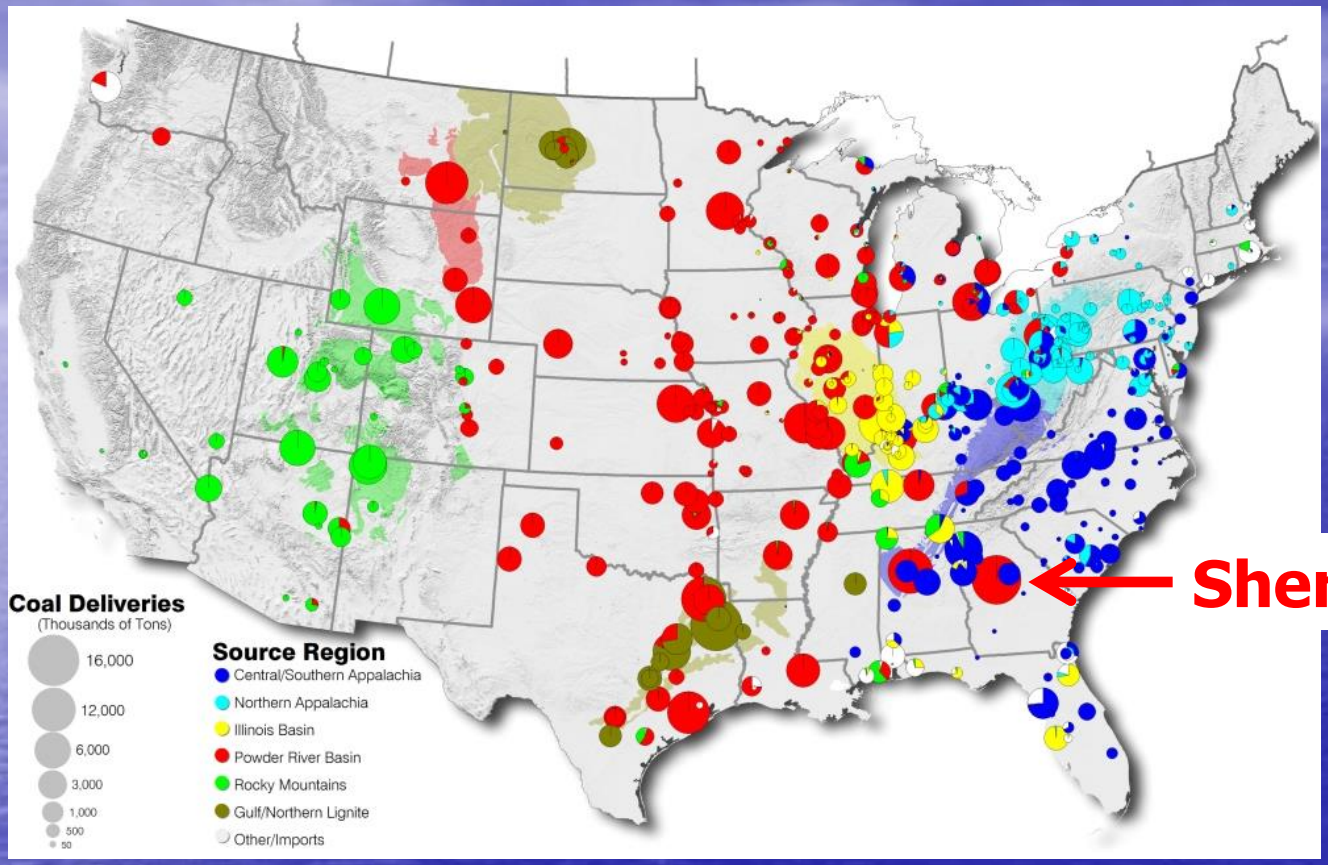


1990
184.2
Million Tons

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

2008
467.6
Million Tons

2012
401.4
Million Tons



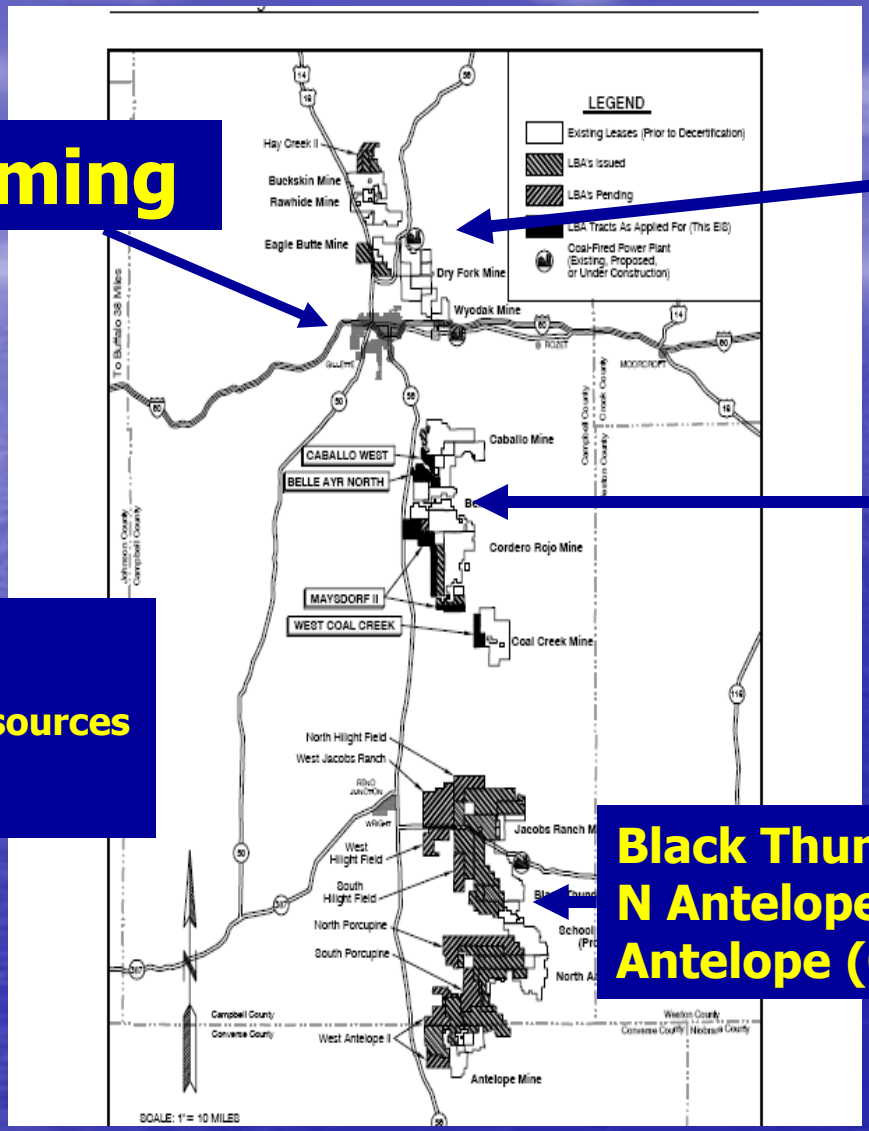
Coal Deliveries to Power Plants by Region—Graphic by Ventyx

Red = Powder River Basin

2005 Data

Twelve Major Coal Mines in the Powder River Basin, Wyoming

Gillette,Wyoming



Bucksin
Rawhide (BTU)
Eagle Butte (ANR)
Dry Fork
Wyodak

Caballo (BTU)
Belle Ayr (ANR)
Cordero Rojo (CLD)
Coal Creek

Black Thunder/Jacobs Ranch (AC
N Antelope/ Rochelle (BTU)
Antelope (CLD)

BTU=Peabody Energy
ACI=Arch Coal Inc.
ANR=Alpha Natural Resources
CLD=Cloud Peak

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

Find Data on

Your State's Coal Supply

from EIA 923 Database

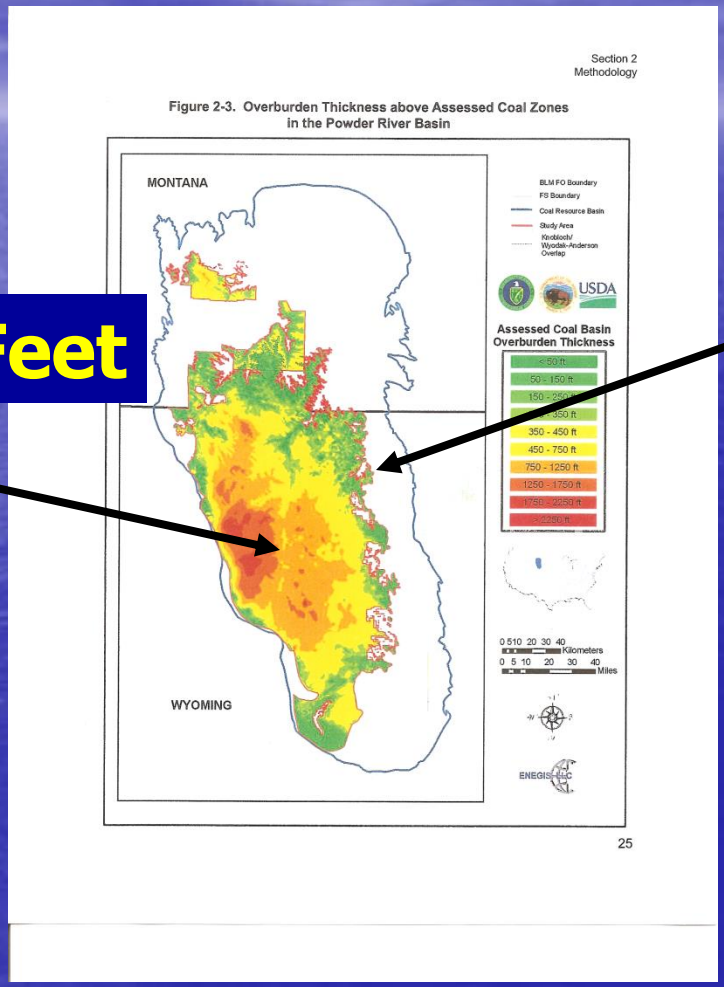
http://www.eia.gov/electricity/data/eia923/

Select Coal Deliveries to Sherer Coal Plant
October 2013
Data from EIA 923 Database

2013	10	6257	Scherer	GA	C	1213	SUB	Coal	S	WY	EAGLE BUTTE MINE	ALPHA COAL	237,544.0	16.658	243.2	REG	Georgia Power Co
2013	10	6257	Scherer	GA	C	1216	SUB	Coal	S	WY	NORTH ANTELOPE ROCHELLE MINE	PEABODY COAL SALES	174,426.0	17.248	250.9	REG	Georgia Power Co
2013	10	6257	Scherer	GA	C	1213	SUB	Coal	S	WY	CORDERO MINE	KENNECOT T ENERGY	95,205.0	16.988	245.1	REG	Georgia Power Co
2013	10	6257	Scherer	GA	C	1013	SUB	Coal	S	WY	BLACK THUNDER	ARCH COAL SALES	95,155.0	17.854	225.3	REG	Georgia Power Co

http://www.eia.gov/electricity/data/eia923/

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

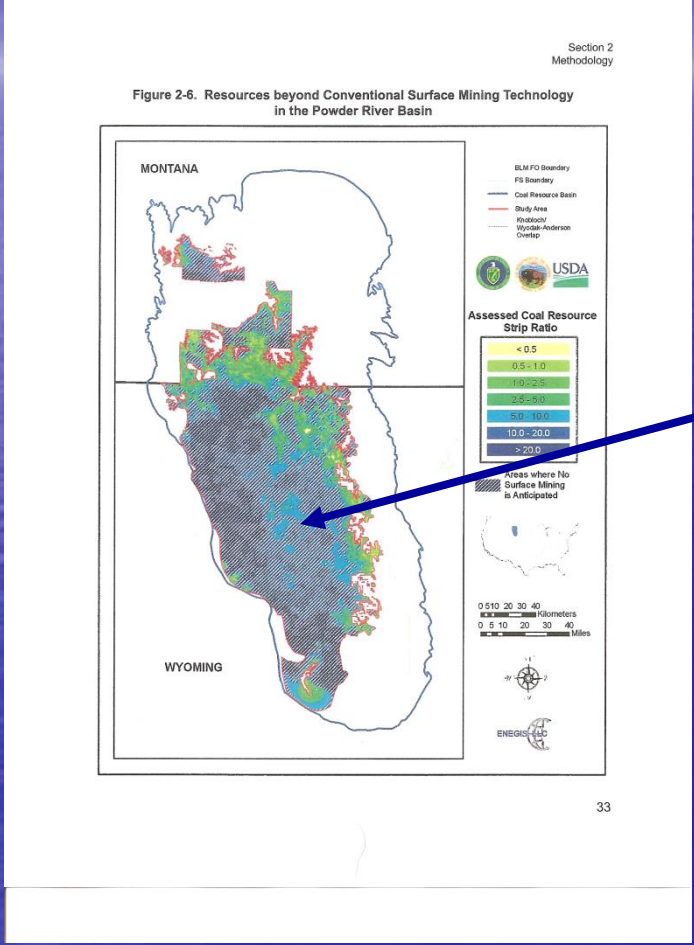


50-200 Feet

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

Powder River Basin Mines Wyoming

Black Thunder Mine

Remaining Life: *About 6 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 and 2013 Arch Coal 10-K Annual Report

Powder River Basin Mines Wyoming

North Antelope/Rochelle Mine

Remaining Life: *20 (??) Years*

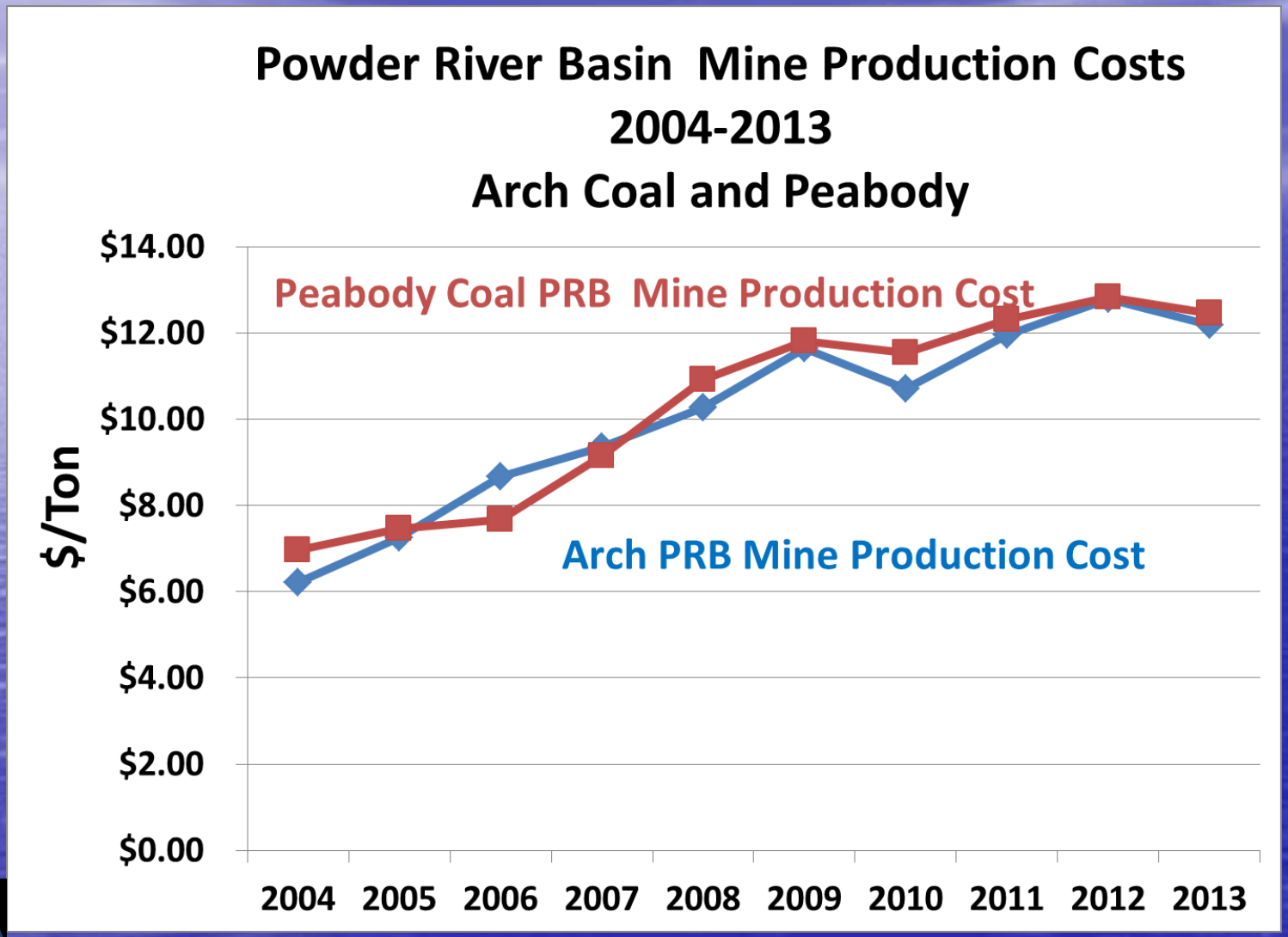
Life Extension: ?? Years

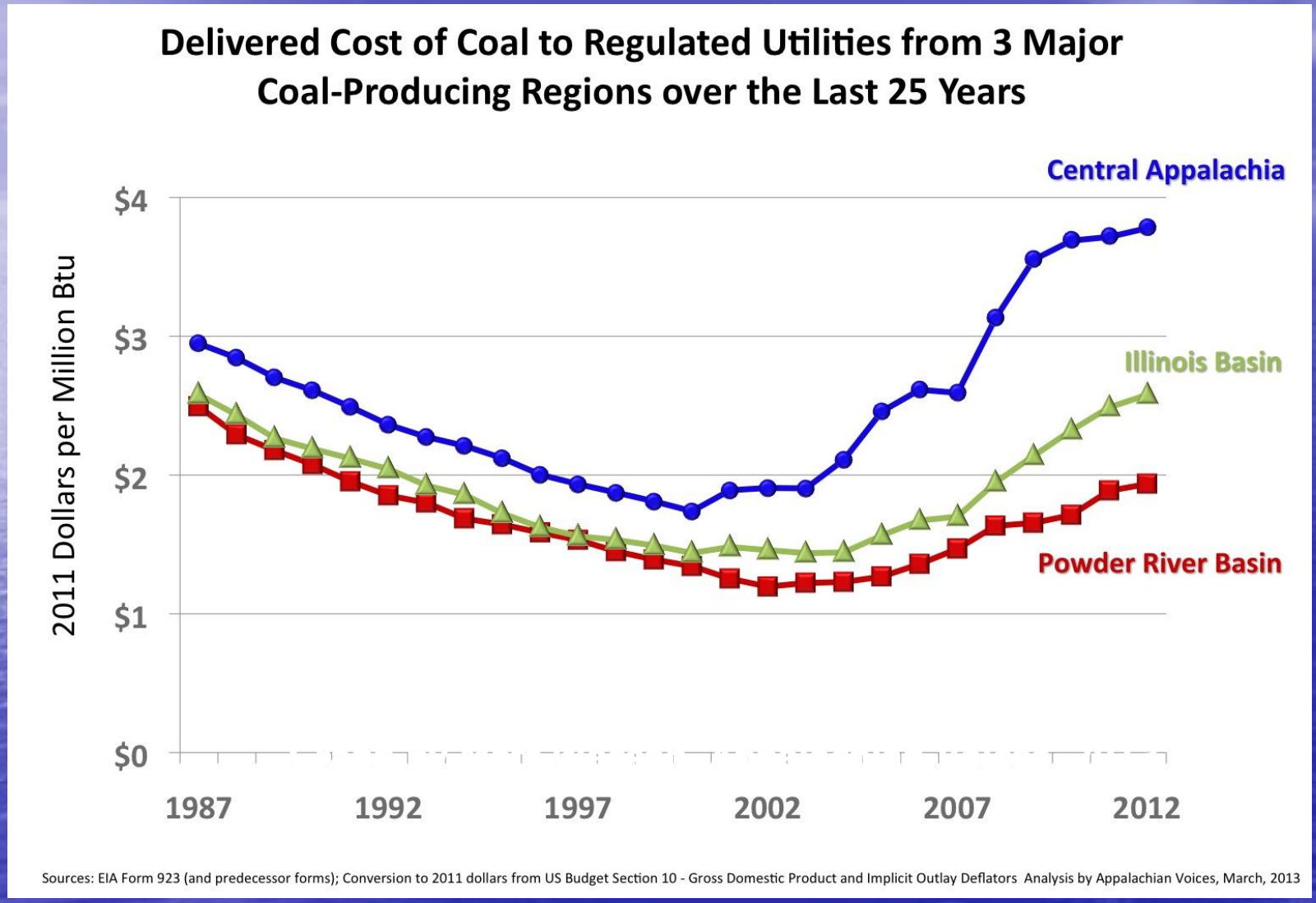
Current Overburden: *211Feet*

Expansion O-burden: *340+ Feet*

Source: Wright Area Environmental Impact Statement PRB Coal Mines
Bureau of Land Management, Casper Wyoming Field Office
and Peabody Annual 10-K Reports

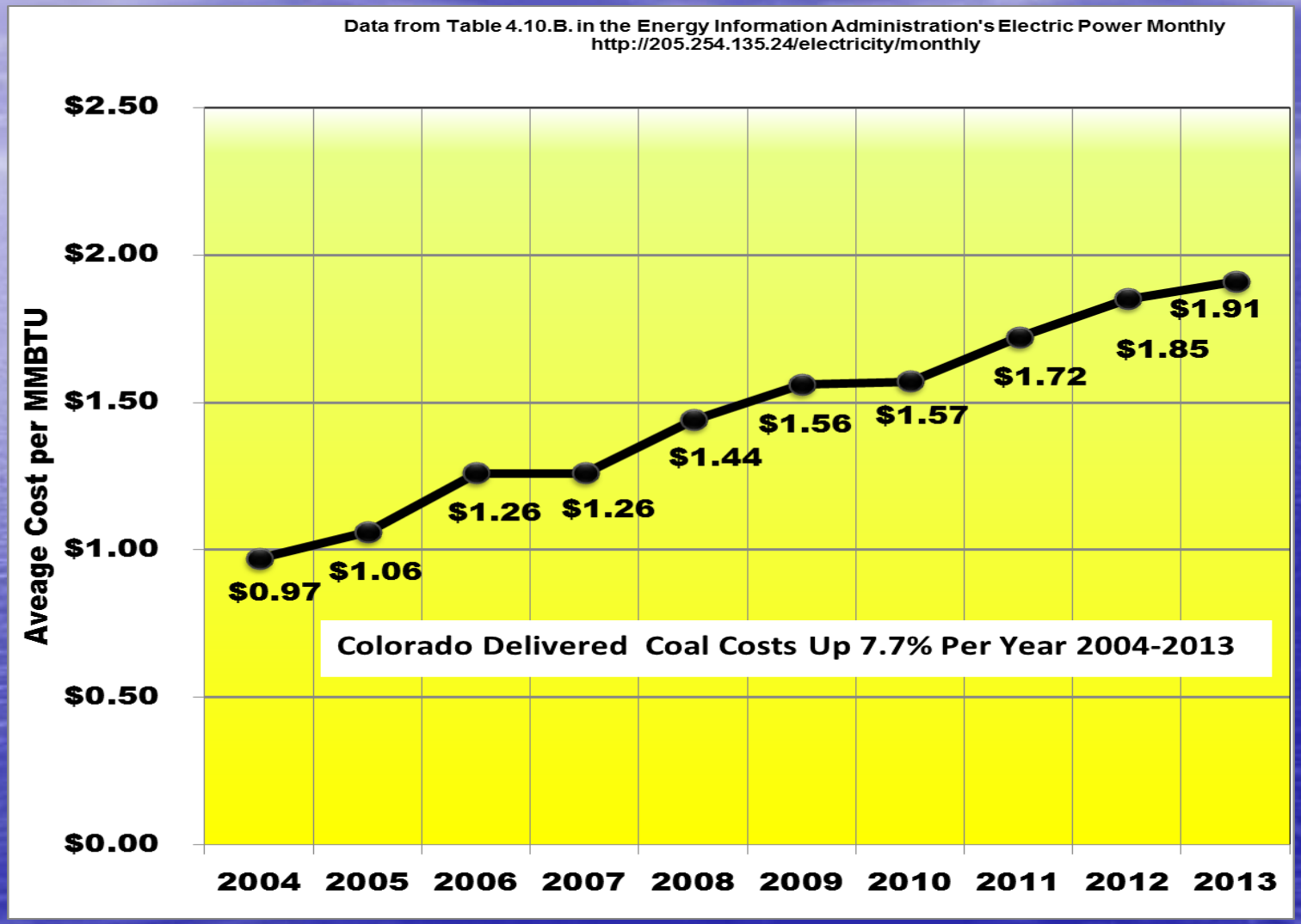
Rising Coal Production Costs in the Powder River Basin





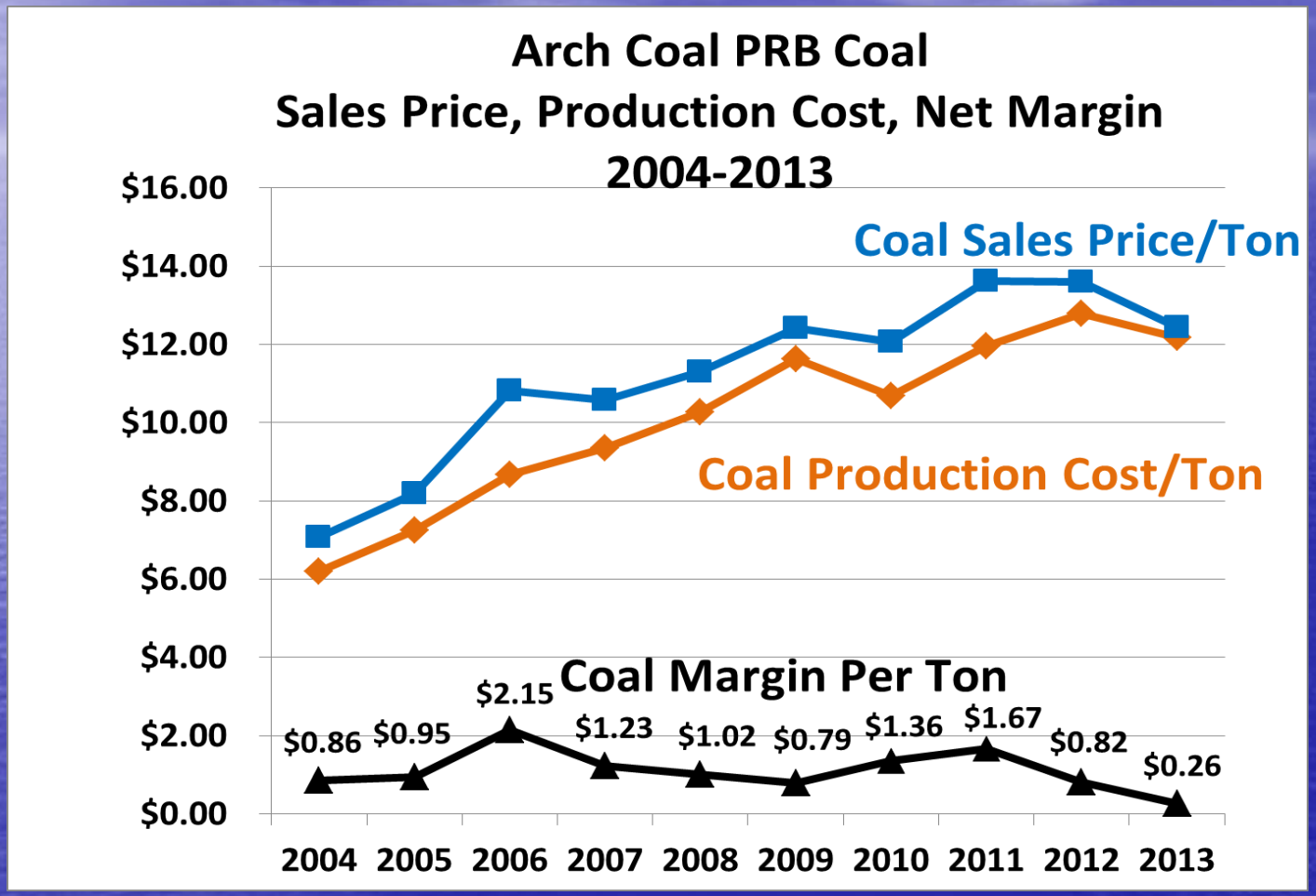
Graph by Matt Wasson, Appalachian Voices

Colorado Delivered Coal Costs 2004-2013



Data from Table 4.10B EIA Electric Power Monthly
http://www.eia.gov/electricity/monthly/

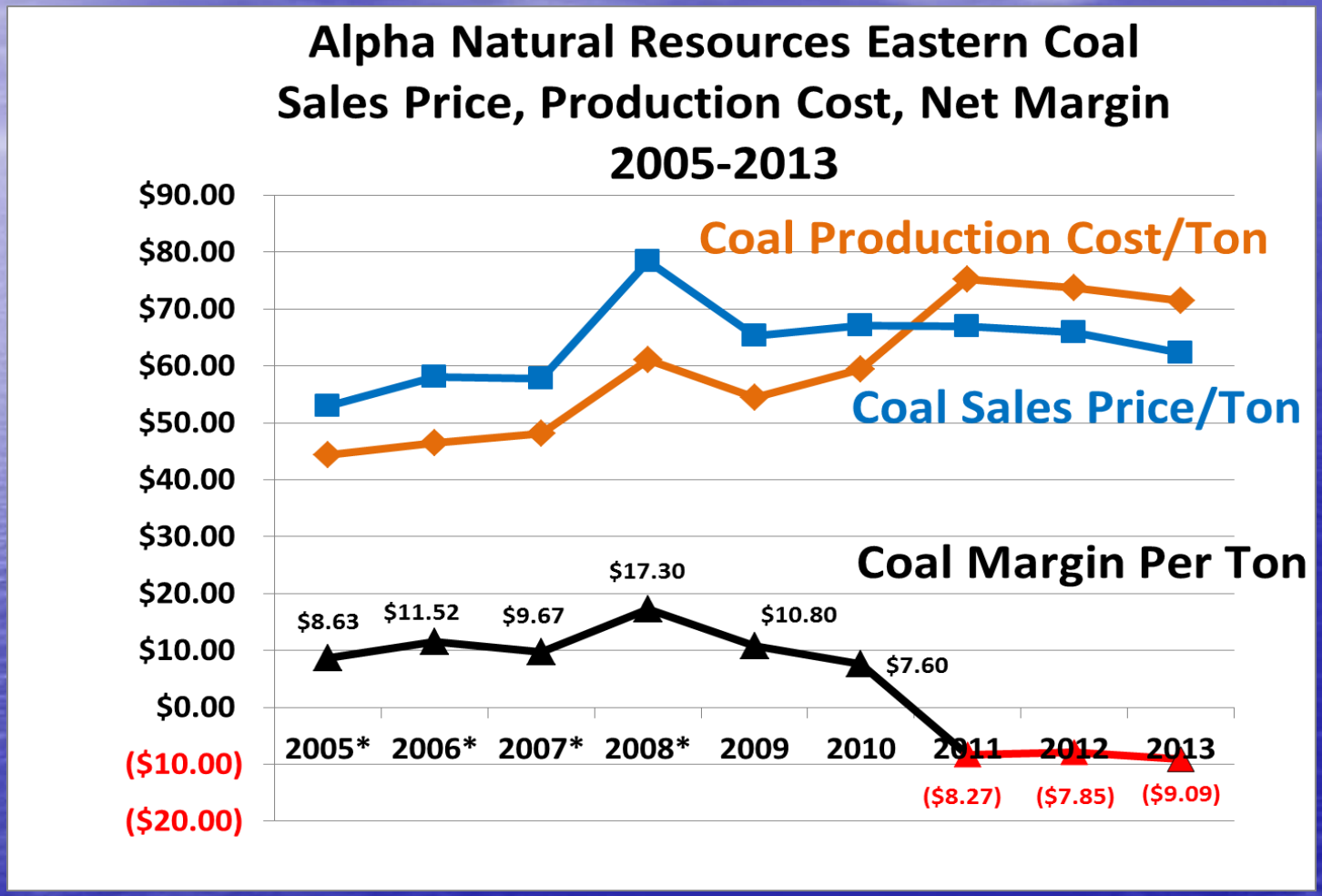
Arch Coal (ACI) Powder River Basin Profit Margins Very Thin



Arch Coal is Owner of Black Thunder Mine, Powder River Basin, WY

Data from Year End Reports Arch Coal Inc.

Alpha Natural Resources (ANR)
Negative Profit Margins from Eastern Mines



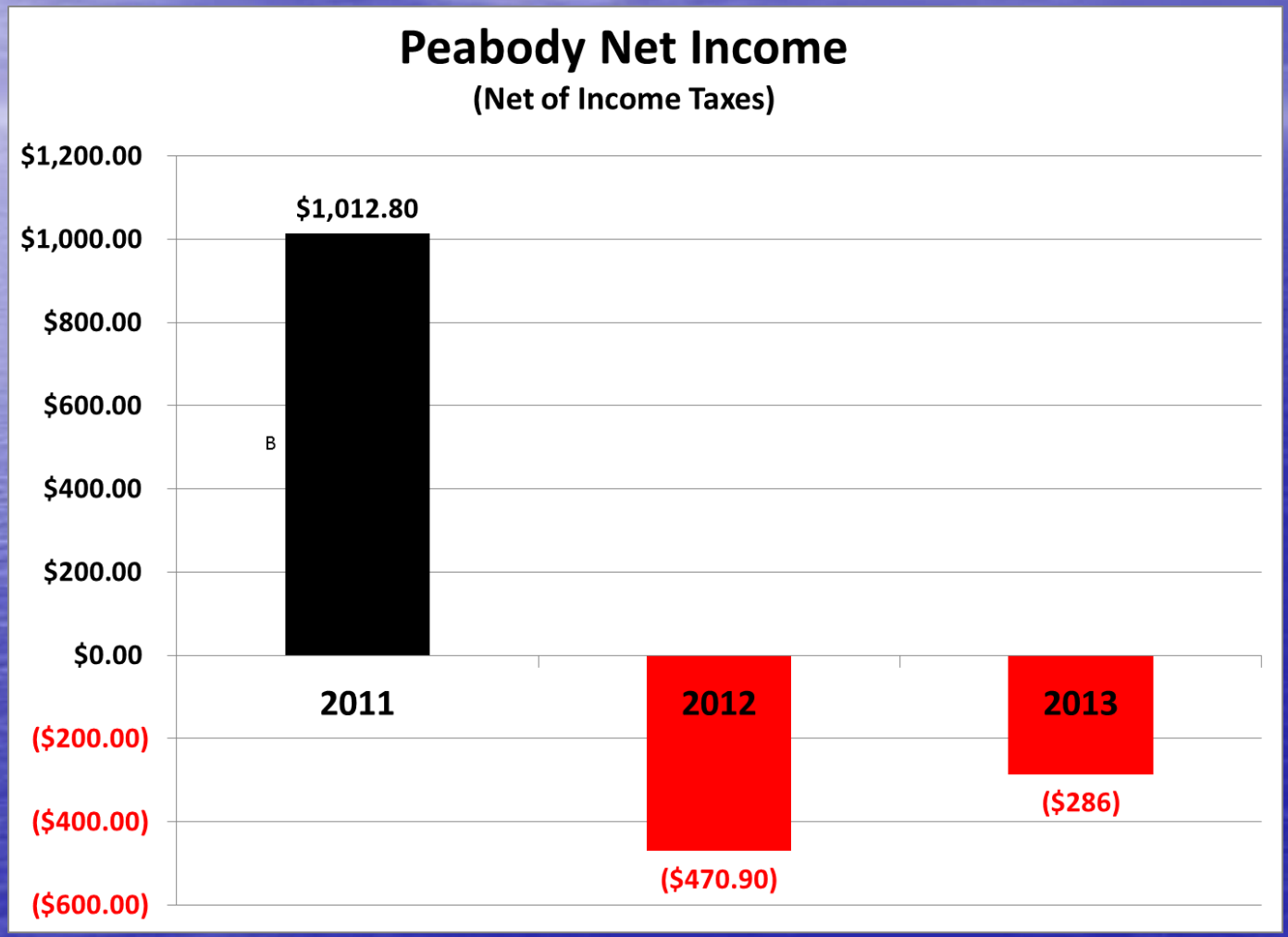
Data from Year End Reports Alpha Natural Resources and Predecessors


STOP the WAR on
COAL
FIRE OBAMA

Gillette Arrest April 29, 2013

Peabody Annual Meeting, Gillette Wyoming April 2013

Peabody Net Income 2011-2013



Peabody 2013 Annual 10-K, page F-5 (p 86 of 188)

Coal Company Debt Coming Due

#1 Peabody ("BTU")

$650 Million due 2016	(7.375%)
$1.52 Billion due 2018	(6%)
$650 Million due 2020	(6.5%)
$ 1.185 Billion (2020)	Term Loan Facility
$1.34 Billion due 2021	(6.25%)
$247 Million due 2026	(7.875%)

Others due later .....

Total over $6 Billion in Debt....

From Peabody 2013 10-K Annual Report, page 64

#1 Peabody CEO, Greg Boyce— 2013 Q3 Earnings Call Transcript

…there has been discussion going around, around what is the – what's the [line] capacity out in the Powder River Basin that can come back in as prices continue to increase. As we have talked before, our view is it's fairly limited.

http://seekingalpha.com/article/1751482-peabody-energys-ceo-discusses-q3-2013-results-earnings-call-transcript?part=single

#1 Peabody—(CEO Greg Boyce 2013 Q3)

”…people are going to have to start spending real cash to repair equipment that’s been parked, replace engines, rear motors and the like. …people have not spent capital to replace equipment that ultimately reached the end of its useful life or spent capital to overcome the annual increase in stripping ratio that naturally occurs in the Powder River Basin.”

http://seekingalpha.com/article/1751482-peabody-energys-ceo-discusses-q3-2013-results-earnings-call-transcript?part=single

How Much Longer For a Financially Healthy US Coal Industry?

A)200 Years—Vanishingly Small

B)20 Years—Not Likely…

C)10 Years--Maybe

D)5 Years--??

E)3 Years--??

Source of the Confusion:

Faulty Reporting of

US Coal Reserves

By the

US Energy Information Administration

2012

EIA US Coal

Estimated Recoverable "Reserves"

258 Billion Tons

Table 15 EIA Annual Coal Report

2012

EIA US[illegible]al

Estimat[illegible]ecoverable [illegible]serves"

258 Billion Tons

Hog Wash!!!!

Table 15 EIA Annual Coal Report

Coal "Reserves" Should Be Economically Accessible: "Resources" are Technically Recoverable If Making a Profit is Not Required.

Reserves

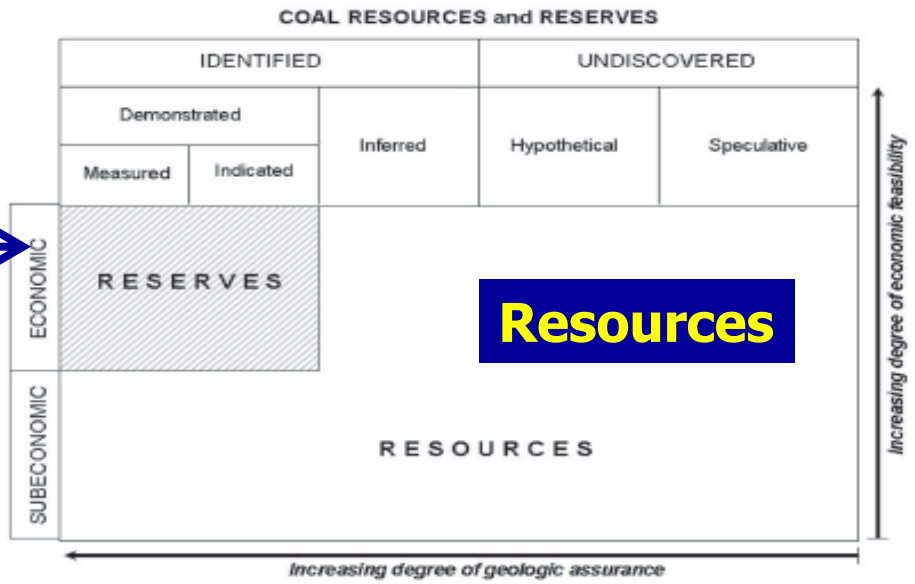


Figure 1. McKelvey-type diagram illustrating the relationship of coal resources and reserves (modified from Falkie and McKelvey, 1976).

Source: Chapter D, National Coal Resource Assessment

Key Source of the Confusion About US Coal Supplies—

EIA Has Been Publishing Reserve Data as Though They

Contain Estimates of Economic Recoverability---

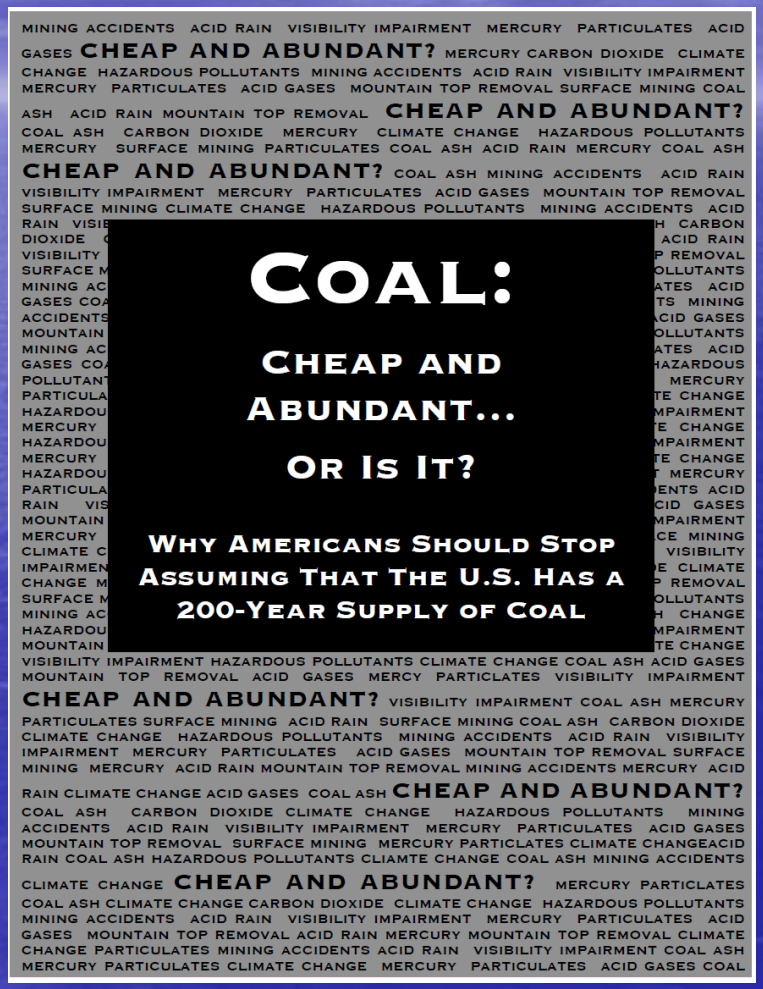
When They Don't

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

First Clean Energy Action Coal Supply Report February 2009



Available for free download from
www.cleanenergyaction.org

Front Page Wall Street Journal June 2009

The Journal Report: The Best Online Tools for Personal Finance

THE WALL STREET JOURNAL.

DOWJONES A News Corporation Company

MONDAY, JUNE 8, 2009 - VOL. CCLIII NO. 132

Last week: DJIA 8763.13 ▲ 262.80 3.1% NASDAQ 1809.42 ▲ 4.2% NIKKEI 9768.01 ▲ 2.6% DJ STOXX 50 2346.35 ▲ 3.0% 10-YR TREASURY ▼ 3 6/32, yield 3.861% OIL $68.41 ▲ $2.13 EURO $1.3965 YEN 98.66

★★★★ $2.00

U.S. Foresees a Thinner Cushion of Coal

BY REBECCA SMITH

Every year, federal employee George Warholic calculates America's vast coal reserves the same way his predecessors have for decades: He looks up the prior year's coal-reserve estimate, subtracts the year's nationwide production and arrives at a new official tally.

Coal provides nearly one-quarter of the total energy consumed in the U.S., and by Mr. Warholic's estimate, the country has enough in the ground to last about 240 years. A belief in this nearly boundless supply has led officials to dub the U.S. the "Saudi Arabia of Coal."

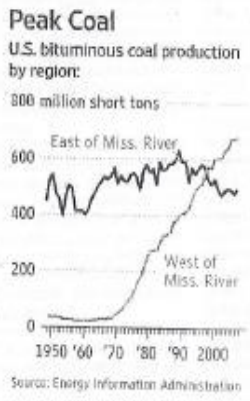
But the estimate, recent findings show, may be wildly overconfident.

While there is almost certainly as much coal in the ground as Mr. Warholic's Energy Information Administration believes, relatively little of it can be profitably extracted. Last year, the U.S. Geological Survey completed an extensive analysis of Wyoming's Gillette coal field, the nation's largest and most productive, and determined that less than 6% of the coal in its biggest beds could be mined profitably, even at prices higher than today's.

"We really can't say we're the Saudi Arabia of coal anymore," says Brenda Pierce, head of the USGS team that conducted the study.

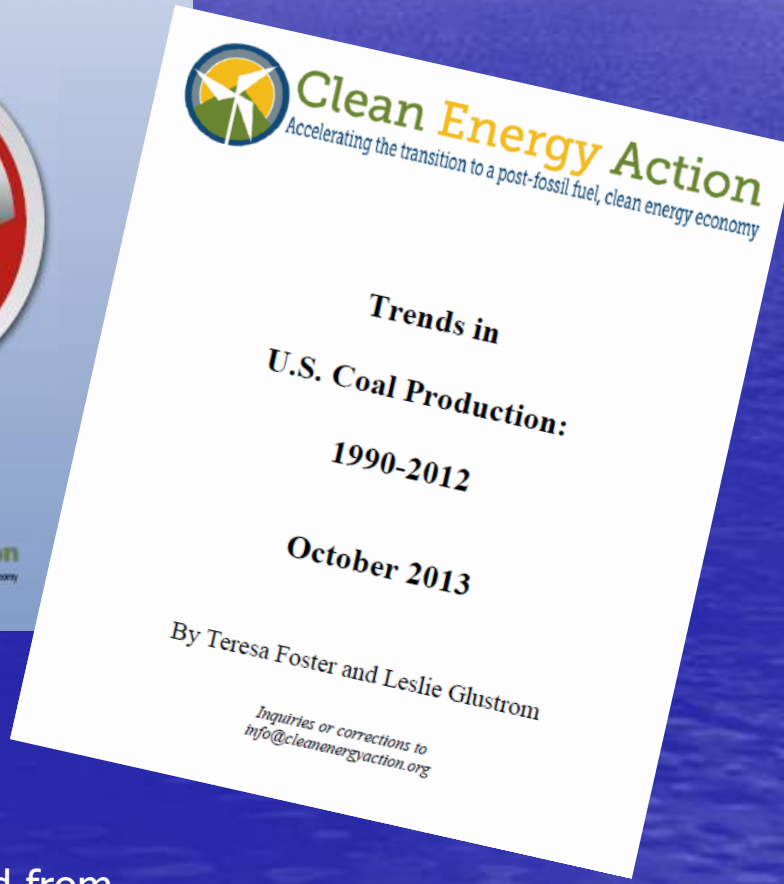
No one says the U.S. is facing a coal shortage. But the emerging ranks of "peak coal" theorists argue that current production levels may be unsustainable and, if anything, create a false sense of security. David Rutledge, an electrical-engineering professor at the California Institute of Technology who has studied global coal production, figures the U.S. has about half as much recoverable reserves as the government says, which would work out to about 120 years' worth.

The Energy Information Ad-
Please turn to the next page



Wall Street Journal 2009-06-08

Trio of Coal Reports Released October 30, 2013



Available for free download from
http://cleanenergyaction.org/2013/10/30/warning-faulty-reporting-on-us-coal-supplies/

December 2013: Energy Information Administration ("EIA") Again Acknowledges US Coal "Reserves" Have Not Been Analyzed for Economic Recoverability

Table 15. Recoverable Coal Reserves at Producing Mines, Estimated Recoverable Reserves, and Demonstrated Reserve by Mining Method, 2012

(million short tons)

Coal-Resource State	Underground - Minable Coal			Surface - Minable Coal			Total		
	Recoverable Reserves at Producing Mines	Estimated Recoverable Reserves	Demonstrated Reserve Base	Recoverable Reserves at Producing Mines	Estimated Recoverable Reserves	Demonstrated Reserve Base	Recoverable Reserves at Producing Mines	Estimated Recoverable Reserves	Demonstrated Reserve Base
Alabama	209	425	844	56	2,230	3,130	265	2,655	3,974
Alaska	-	2,335	5,423	w	487	672	w	2,821	6,094
Arizona	-	-	-	w	-	-	w	-	-
Arkansas	w	127	272	-	101	144	w	228	416
Colorado	w	5,811	11,073	w	3,744	4,759	300	9,555	15,832
Georgia	-	1	2	-	1	2	-	2	4
Idaho	-	2	4	-	-	-	-	2	4
Illinois	w	27,792	87,493	w	10,044	16,502	2,215	37,835	103,995
Indiana	252	3,544	8,556	348	318	544	600	3,862	9,100
Iowa	-	807	1,732	-	320	457	-	1,127	2,189
Kansas	-	-	-	-	680	971	-	680	971
Kentucky Total	**1,071**	**6,947**	**16,130**	**192**	**7,266**	**12,583**	**1,263**	**14,213**	**28,713**
Kentucky (East)	w	360	644	w	5,030	9,008	644	5,390	9,652
Kentucky (West)	w	6,587	15,486	w	2,236	3,574	619	8,823	19,061
Louisiana	-	-	-	w	288	388	w	288	388
Maryland	w	309	564	w	33	48	34	342	612
Michigan	-	55	123	-	3	5	-	58	128
Mississippi	-	-	-	w	-	-	w	-	-
Missouri	-	689	1,479	w	3,155	4,507	w	3,844	5,986
Montana	w	35,906	70,925	w	38,738	47,927	960	74,644	118,851
New Mexico	w	2,763	6,073	w	4,075	5,819	497	6,838	11,892
North Carolina	-	5	11	-	-	-	-	5	11
North Dakota	-	-	-	1,128	6,711	8,797	1,128	6,711	8,797
Ohio	w	7,614	17,306	w	3,717	5,679	235	11,331	22,985
Oklahoma	w	571	1,225	w	221	315	11	791	1,540
Oregon	-	6	15	-	2	3	-	9	17
Pennsylvania Total	**355**	**10,337**	**22,522**	**199**	**985**	**4,155**	**554**	**11,322**	**26,677**
Pennsylvania (Anthracite)	w	340	3,841	w	418	3,341	131	758	7,183
Pennsylvania (Bituminous)	w	9,997	18,681	w	567	814	423	10,564	19,495
South Dakota	-	-	-	-	277	366	-	277	366
Tennessee	w	274	500	w	171	253	4	445	753
Texas	-	-	-	751	9,252	12,019	751	9,252	12,019
Utah	w	2,365	4,825	w	211	267	199	2,576	5,091
Virginia	234	517	920	49	312	488	283	829	1,408
Washington	-	674	1,332	-	6	8	-	681	1,340
West Virginia Total	**1,337**	**14,949**	**28,010**	**505**	**2,064**	**3,271**	**1,842**	**17,013**	**31,281**
West Virginia (Northern)	w	NA	NA	w	NA	NA	480	NA	NA
West Virginia (Southern)	w	NA	NA	w	NA	NA	1,362	NA	NA
Wyoming	w	22,926	42,456	w	14,487	17,495	6,932	37,413	59,951
U.S. Total	**6,656**	**147,750**	**329,814**	**12,008**	**109,898**	**151,571**	**18,664**	**257,648**	**481,385**

- = No data reported.

w = Data withheld to avoid disclosure.

NA = Not Available.

Notes: Recoverable coal reserves at producing mines represent the quantity of coal that can be recovered (i.e. mined) from existing coal reserves at reporting mines. EIA's estimated recoverable reserves include the coal in the demonstrated reserve base considered recoverable after excluding coal estimated to be unavailable due to land use restrictions, and after applying assumed mining recovery rates. This estimate does not include any specific economic feasibility criteria. The effective date for the demonstrated reserve base, as customarily worded, is 'Remaining as of January 1, 2013.' These data are contemporaneous with the Recoverable Reserves at Producing Mines, customarily presented as of the end of the reporting year's mining, that is in this case, December 31, 2012. The demonstrated reserve base includes publicly available data on coal mapped to measured and indicated degrees of accuracy and found at depths and in coalbed thicknesses considered technologically minable at the time of determinations; see Glossary for criteria. All reserve expressions exclude silt, culm, refuse bank, slurry dam, and dredge operations. Reserves at Producing Mines exclude mines producing less than 25,000 short tons, which are not required to provide reserves data.

Source: U.S. Energy Information Administration Form EIA-7A, 'Coal Production and Preparation Report,' and U.S. Department of Labor, Mine Safety and Health Administration Form 7000-2, 'Quarterly Mine Employment and Coal Production Report.'

The BIG Acknowledgement

Table 15, EIA Annual Coal Report

December 2013: Energy Information Administration ("EIA") Again Acknowledges US Coal "Reserves" Have Not Been Analyzed for Economic Recoverability

Table 15. Recoverable Coal Reserves at Producing Mines, Estimated Recoverable Reserves, and Demonstrated Reserve by Mining Method, 2012

(million short tons)

	Underground - Minable Coal			Surface - Minable Coal			Total		
Coal-Resource State	Recoverable Reserves at Producing Mines	Estimated Recoverable Reserves	Demonstrated Reserve Base	Recoverable Reserves at Producing Mines	Estimated Recoverable Reserves	Demonstrated Reserve Base	Recoverable Reserves at Producing Mines	Estimated Recoverable Reserves	Demonstrated Reserve Base
Alabama	209	425	844	56	2,230	3,130	265		
Alaska	-	2,335	5,423	w	487	672	w		
Arizona	-	-	-	w	-	-	w		
Arkansas	w	127	272	-	101	144	w		
Colorado	w	5,811	11,073	w	3,744	4,759	300		
Georgia	-	1	2	-	1	2	-		
Idaho	-	2	4	-	-	-	-		
Illinois	w	27,792	87,493	w	10,044	16,502	2,215		
Indiana	252	3,544	8,556	348	318	544	600		
Iowa	-	807	1,732	-	320	457	-		
Kansas	-	-	-	-	680	971	-		
Kentucky Total	**1,071**	**6,947**	**16,130**	**192**	**7,266**	**12,583**	**1,263**		
Kentucky (East)	w	360	644	w	5,030	9,008	644		
Kentucky (West)	w	6,587	15,486	w	2,236	3,574	619		
Louisiana	-	-	-	w	288	388	w		
Maryland	w	309	564	w	33	48	34		
Michigan	-	55	123	-	3	5	-		
Mississippi	-	-	-	w	-	-	w		
Missouri	-	689	1,479	w	3,155	4,507	w		
Montana	w	35,906	70,925	w	38,738	47,927	960		
New Mexico	w	2,763	6,073	w	4,075	5,819	497		
North Carolina	-	5	11	-	-	-	-		
North Dakota	-	-	-	1,128	6,711	8,797	1,128		
Ohio	w	7,614	17,306	w	3,717	5,679	235		
Oklahoma	w	571	1,225	w	221	315	11		
Oregon	-	6	15	-	2	3	-		
Pennsylvania Total	**355**	**10,337**	**22,522**	**199**	**985**	**4,155**	**554**		
Pennsylvania (Anthracite)	w	340	3,841	w	418	3,341	131		
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Wyoming	w	22,926	42,456	w	14,487	17,495	6,932	37,413	59,951
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Notes: Recoverable coal reserves at producing mines represent the quantity of coal that can be recovered (i.e. mined) from existing coal reserves at reporting mines. EIA's estimated recoverable reserves include the coal in the demonstrated reserve base considered recoverable after excluding coal estimated to be unavailable due to land use restrictions, and after applying assumed mining recovery rates. This estimate does not include any specific economic feasibility criteria. The effective date for the demonstrated reserve base, as customarily worded, is 'Remaining as of January 1, 2013.' These data are contemporaneous with the Recoverable Reserves at Producing Mines, customarily presented as of the end of the reporting year's mining, that is in this case, December 31, 2012. The demonstrated reserve base includes publicly available data on coal mapped to measured and indicated degrees of accuracy and found at depths and in coalbed thicknesses considered technologically minable at the time of determinations; see Glossary for criteria. All reserve expressions exclude silt, culm, refuse bank, slurry dam, and dredge operations. Reserves at Producing Mines exclude mines producing less than 25,000 short tons, which are not required to provide reserves data.

Source: U.S. Energy Information Administration Form EIA-7A, 'Coal Production and Preparation Report,' and U.S. Department of Labor, Mine Safety and Health Administration Form 7000-2, 'Quarterly Mine Employment and Coal Production Report.'

Table 15 ,EIA Annual Coal Report

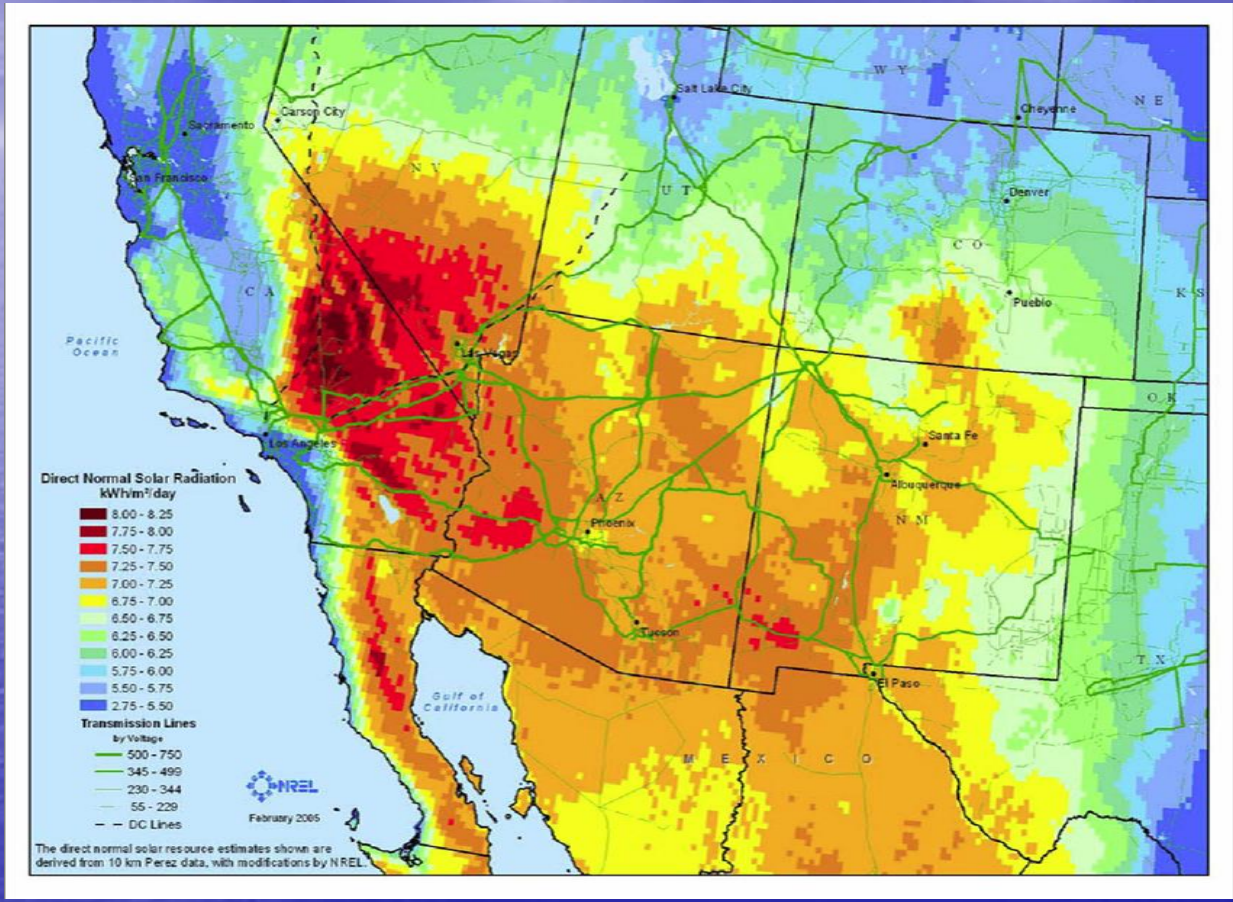
EIA's Estimated Recoverable Reserves Do "Not Include Any Specific Economic Feasibilty Criteria"

i.e. US Coal "Reserves" ARE NOT Reserves….

Oops—
Faulty Reporting of US Coal Reserves…

Report issued Oct 2013 by Clean Energy Action

Thank You

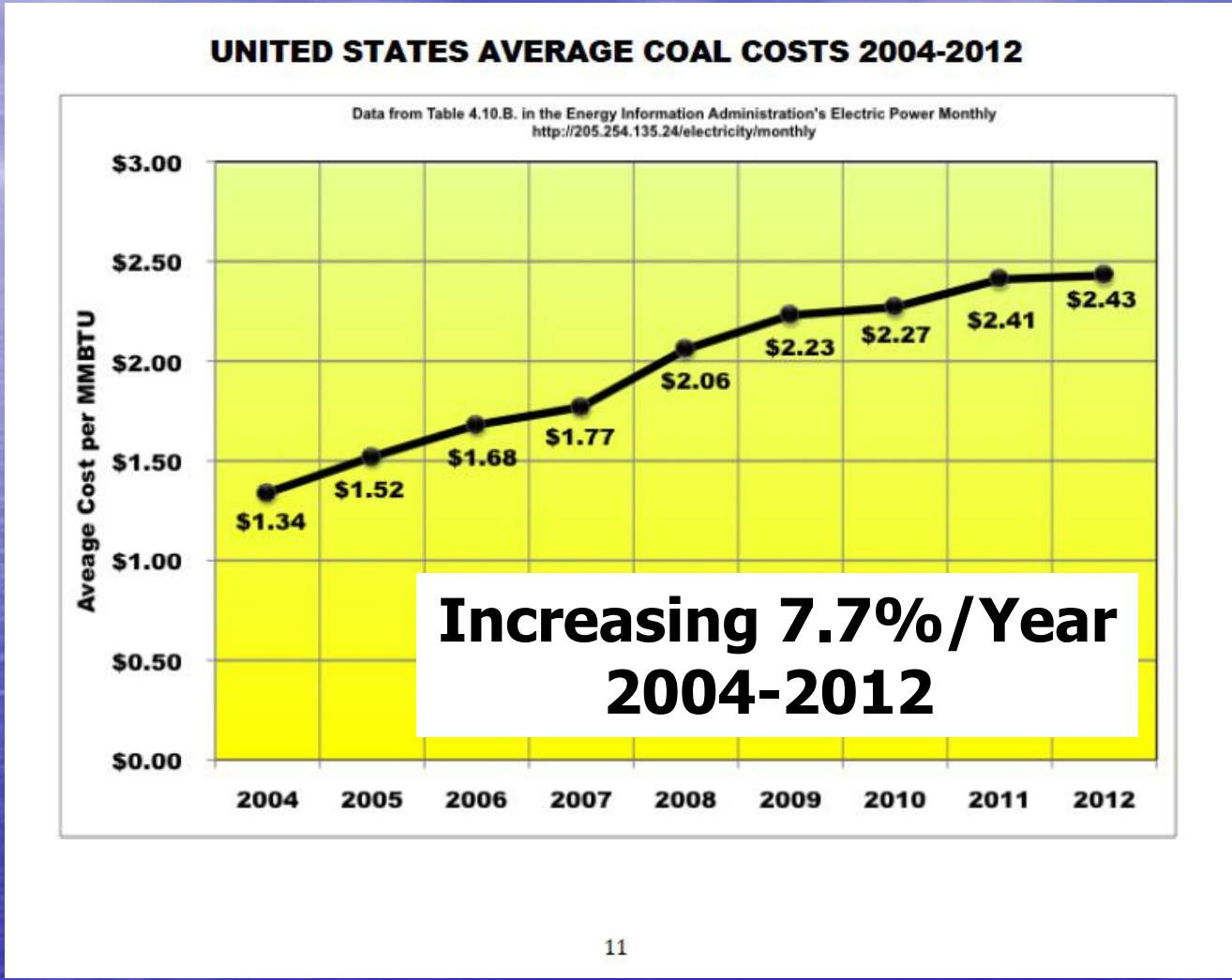


Leslie Glustrom lglustrom(at)gmail.com 303-245-8637

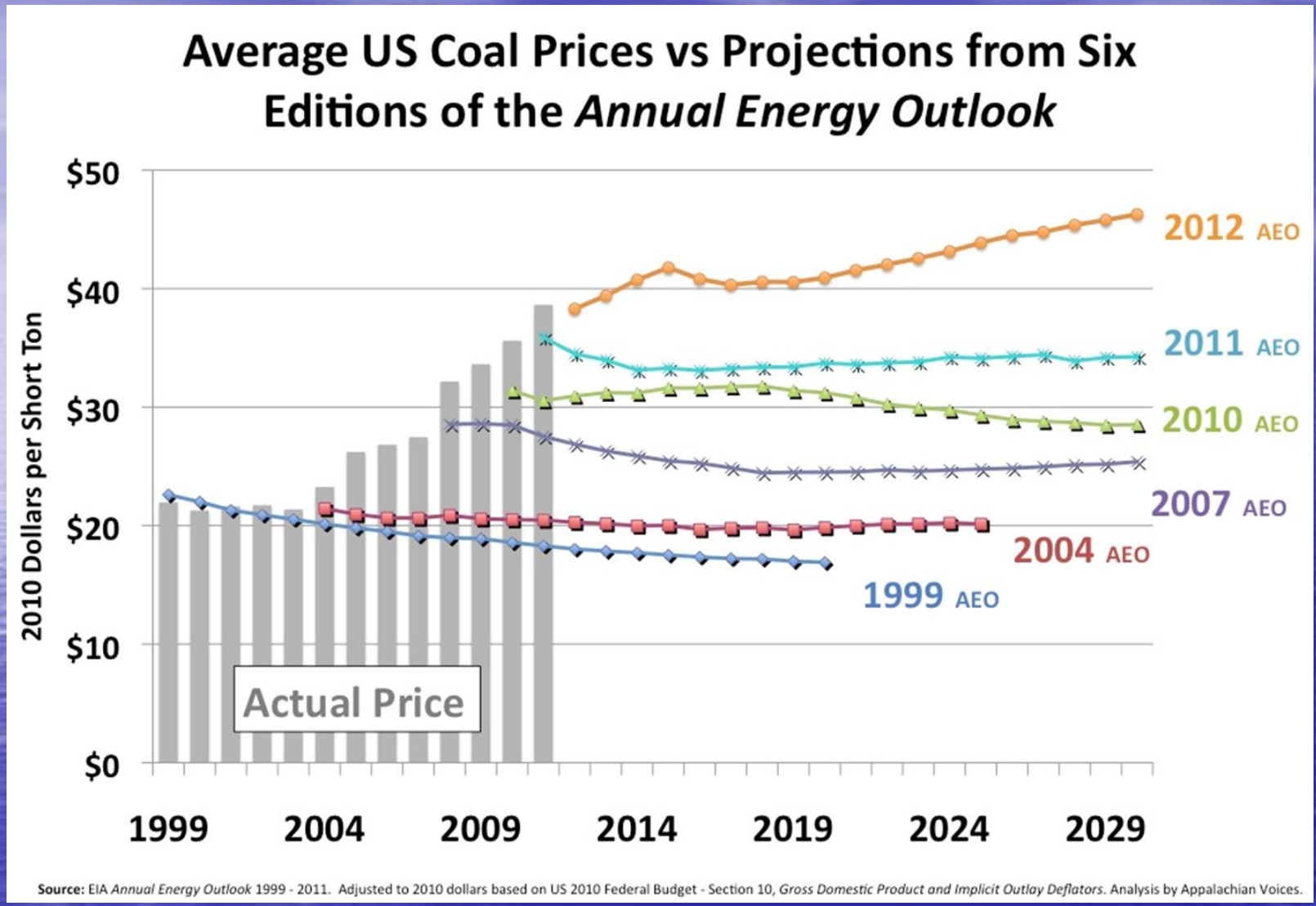
www.cleanenergyaction.org

Extra Slides

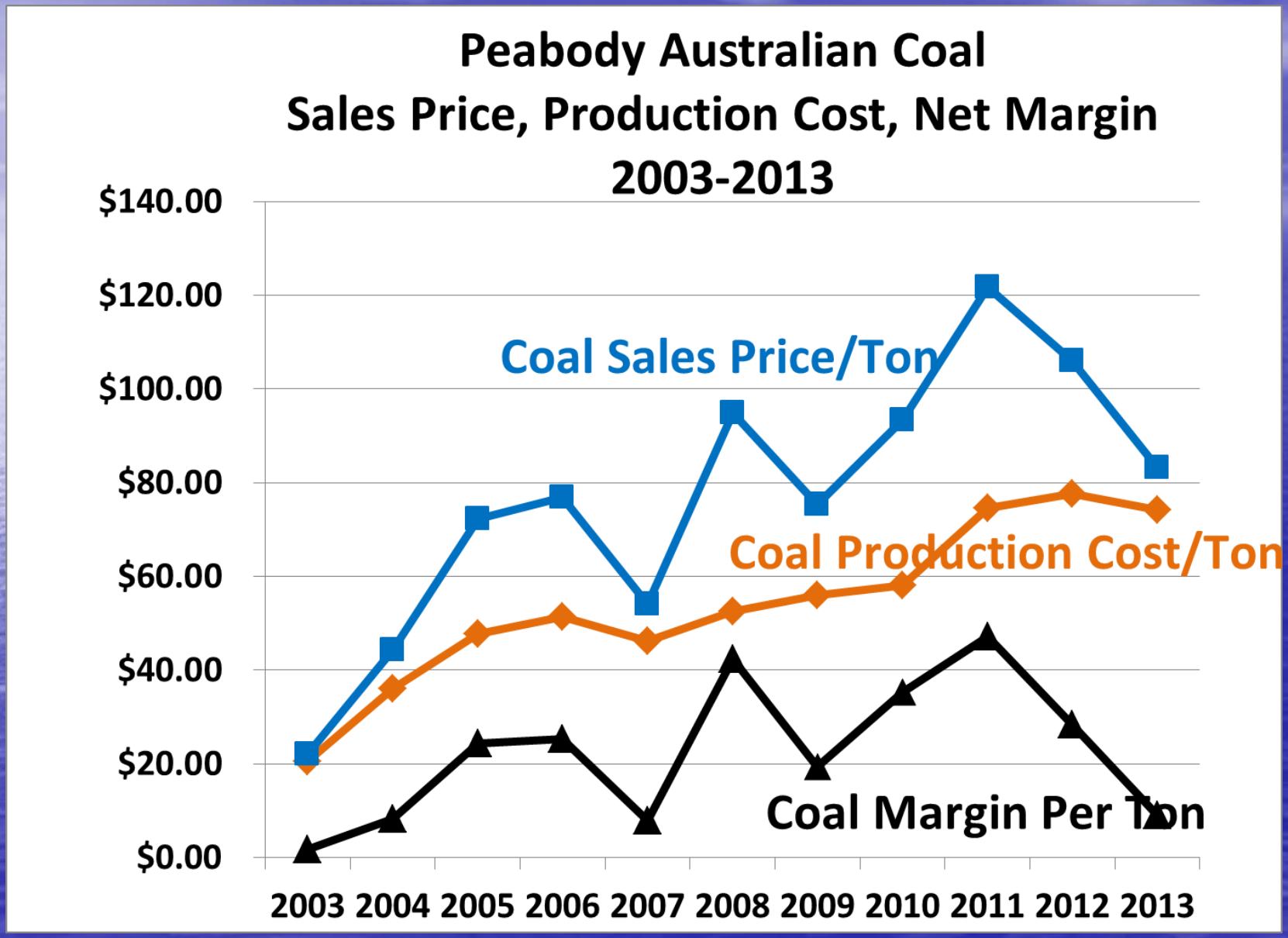
U.S. Coal Costs 2004-2012



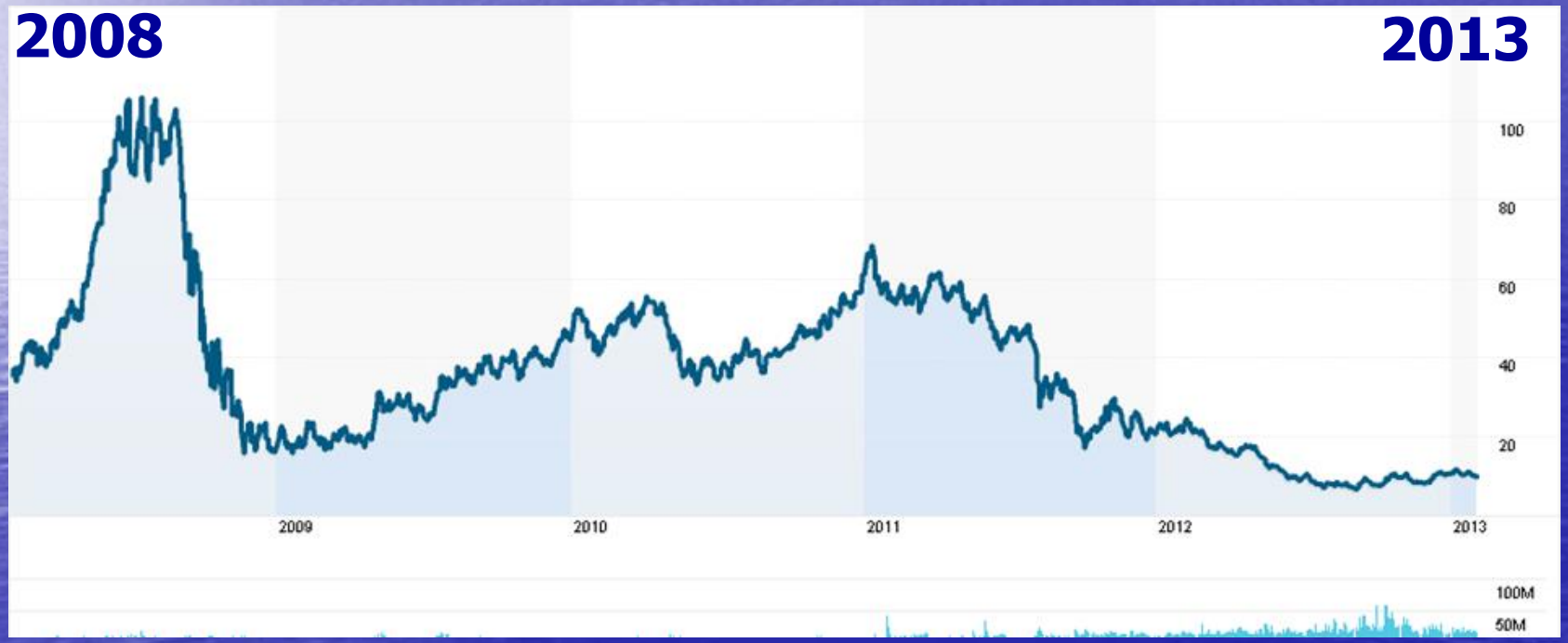
Data from Table 4.10B EIA Electric Power Monthly
http://205.254.135.24/electricity/monthly/



From Matt Wasson, Appalachian Voices


Peabody Australian Coal
Sales Price, Production Cost, Net Margin
2003-2013
$140.00
$120.00
$100.00
$80.00
$60.00
$40.00
$20.00
$0.00
Coal Sales Price/Ton
Coal Production Cost/Ton
Coal Margin Per Ton
2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013

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

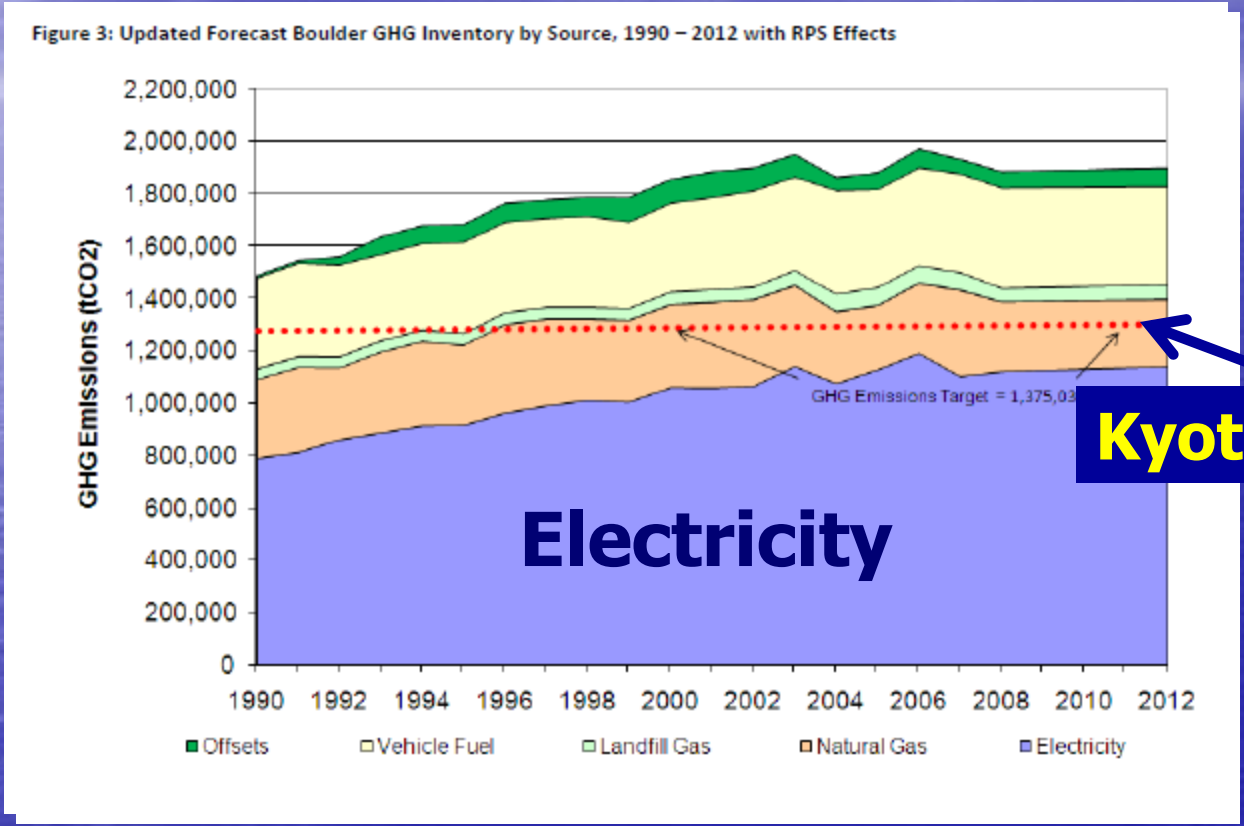


http://www.reuters.com/finance/stocks/overview?symbol=ANR

Loss in Share Price—US Coal Companies 2011-2013

http://www.vancouverobserver.com/blogs/climatesnapshot/collapsing-share-prices-us-coal-hold-warning-bc-and-alberta-carbon-bubbles

Boulder's Greenhouse Gas Inventory

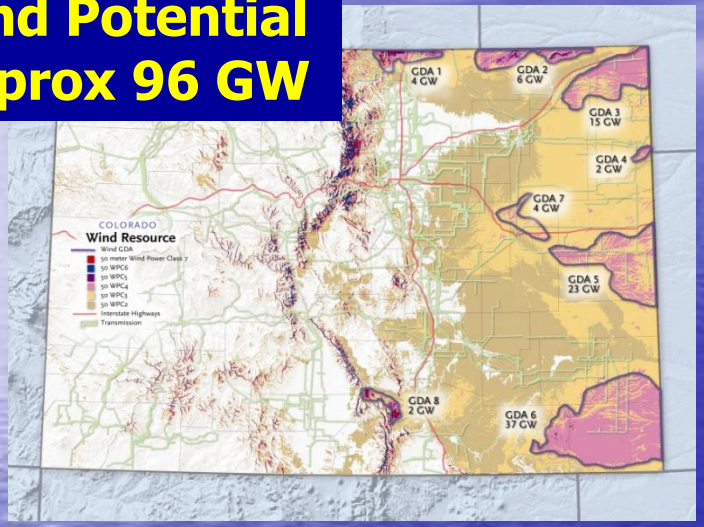


Kyoto Target

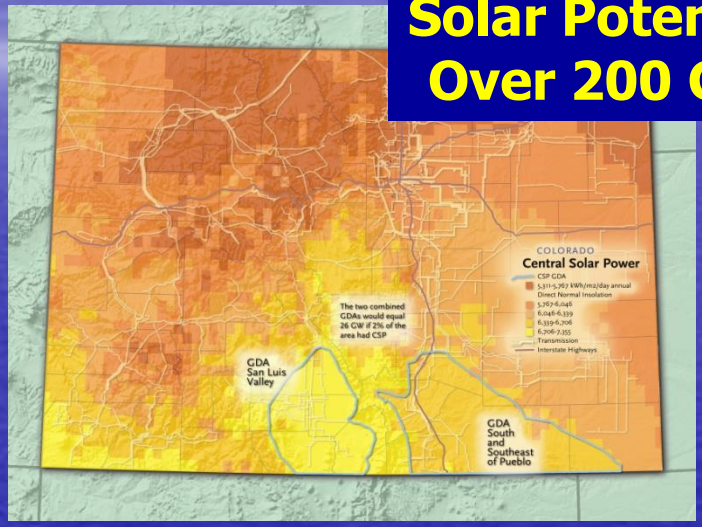
Source: City of Boulder Climate Action Plan Assessment July 2009
http://www.bouldercolorado.gov/files/Environmental%20Affairs/climate%20and%20energy/City_of_Boulder_ALL_SECTIONS_FINAL_072809_v9.pdf

Repowering and Decarbonizing Colorado

Colorado's Wind Potential Approx 96 GW



Colorado's Solar Potential Over 200 GW



To Meet Peak Demand, Colorado Needs About 12 GW (12,000 MW)

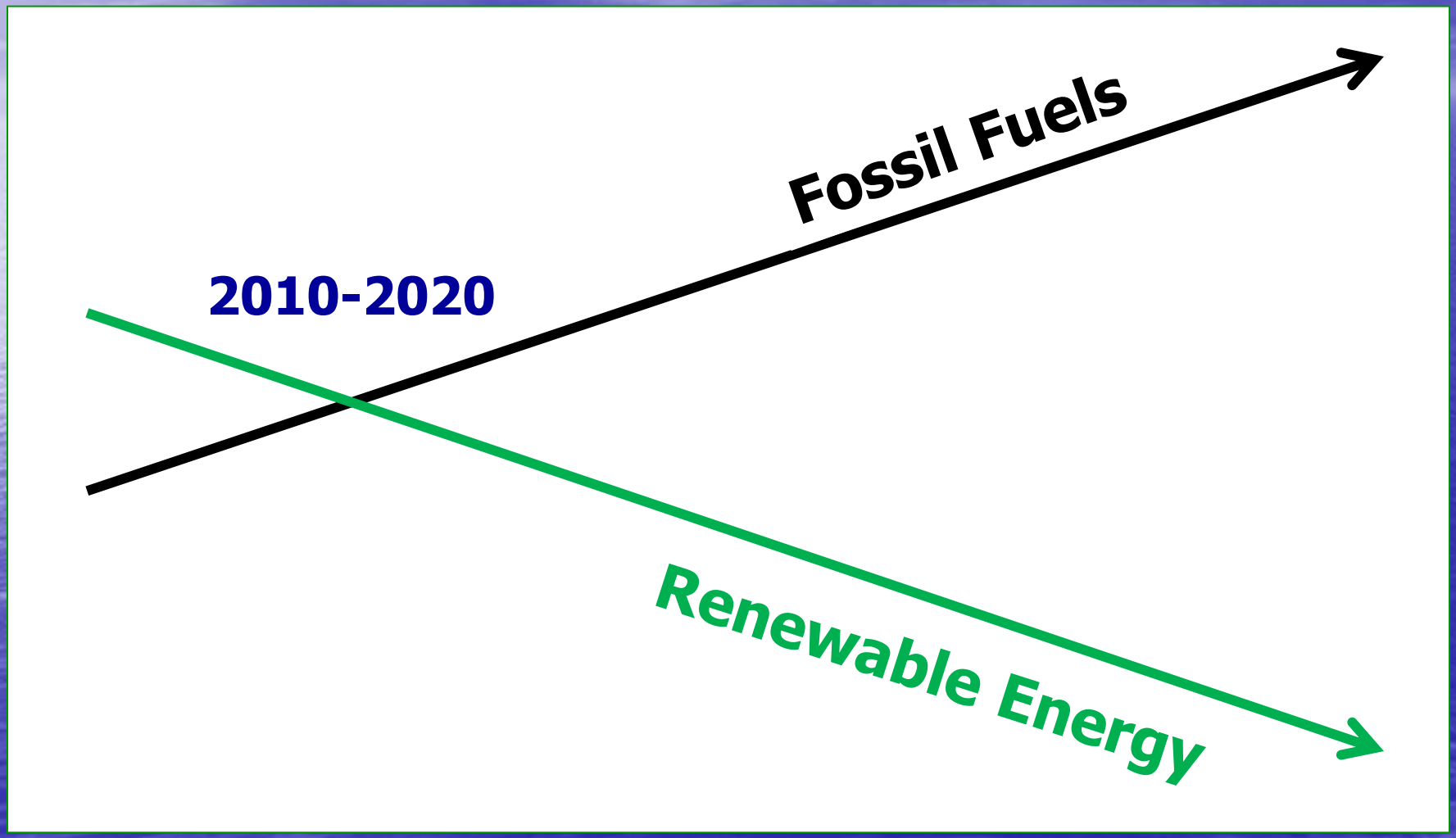
Colorado has the Potential for Over 300 GW of Wind and Solar….

And Many Companies Ready to Build Projects.

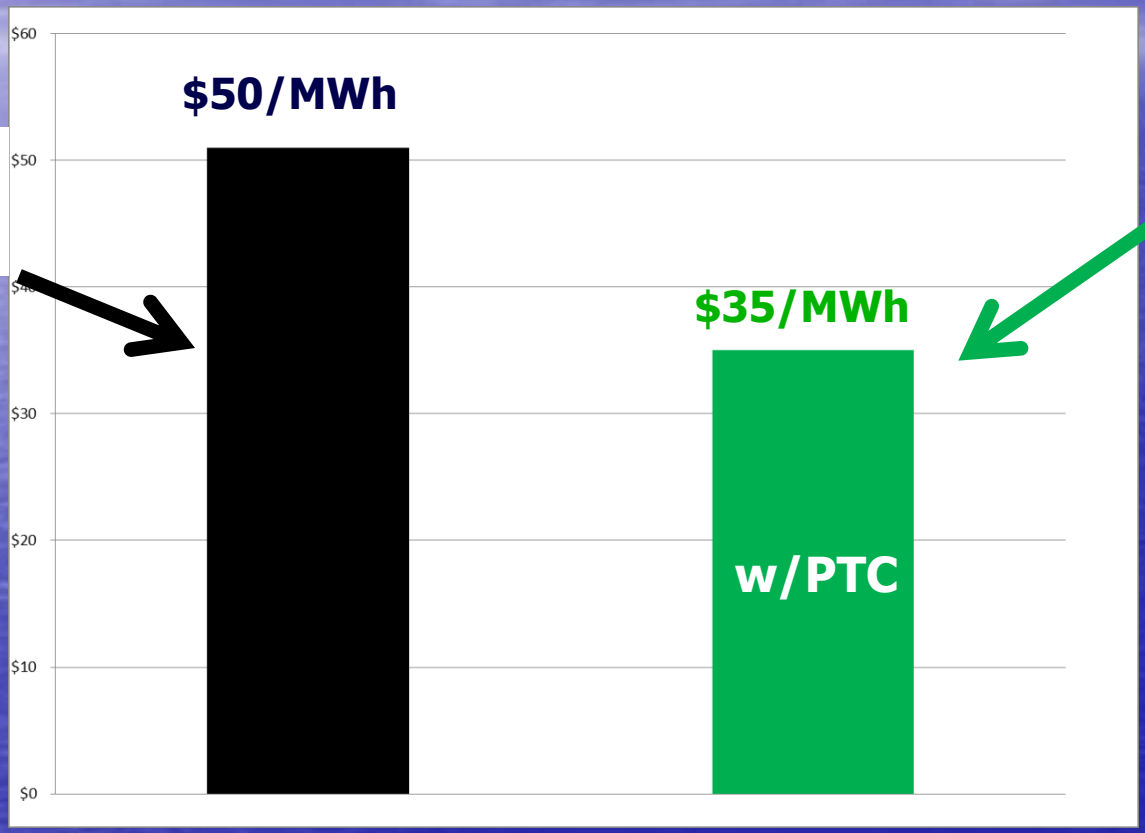
Clearly, we can largely decarbonize our electricity--IF we decide to do it!

Maps and Resource Potential from Colorado Governor's Energy Office based on NREL Data
Information on Wind and Solar Bids from Xcel Energy

Costs Going Forward



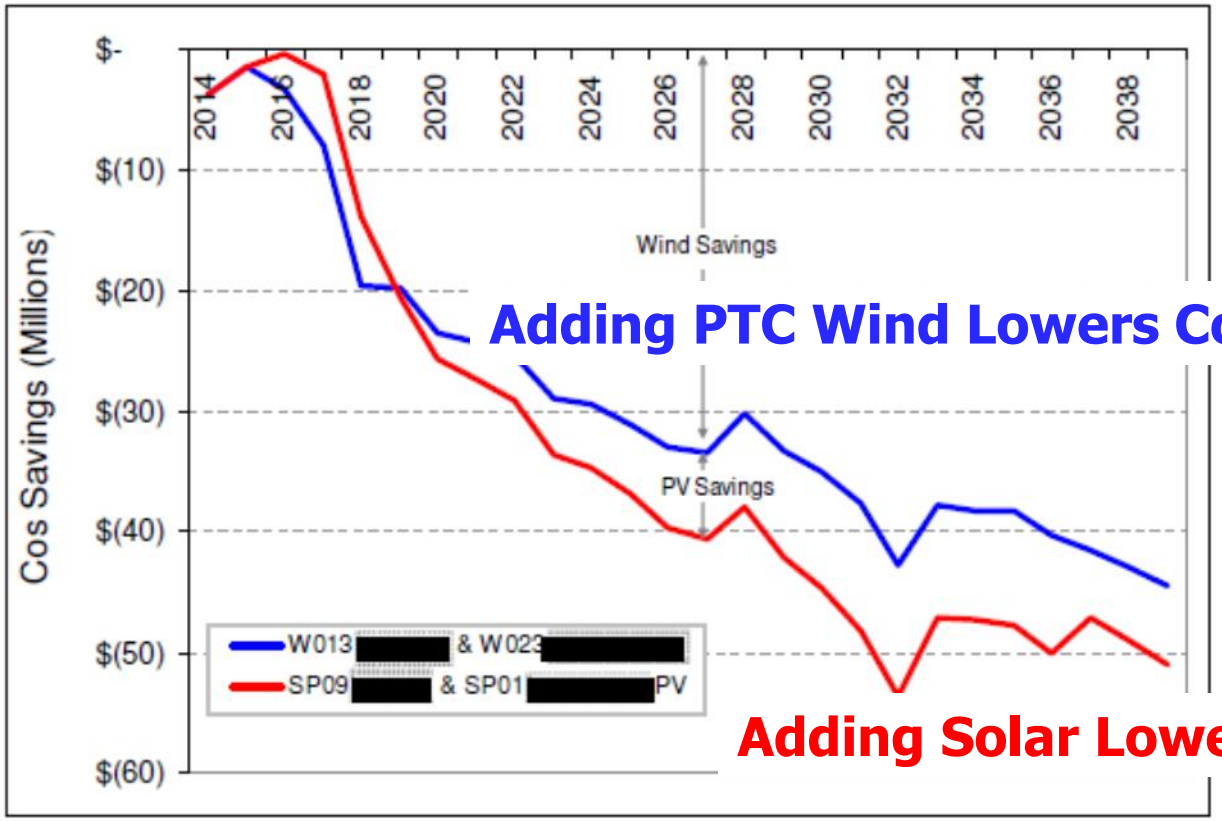
Xcel's Recent Cost Data
(February 2012)



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….

Example of Xcel Modeling Results September 9, 2013

Figure 22 - Annual Cost Savings of 450 MW Wind and 170 MW PV



Adding PTC Wind Lowers Costs!!

Adding Solar Lowers Costs!!

Xcel's 120 Day Report, Docket 11A-869E Colorado PUC , Page 70

US Wind Resource

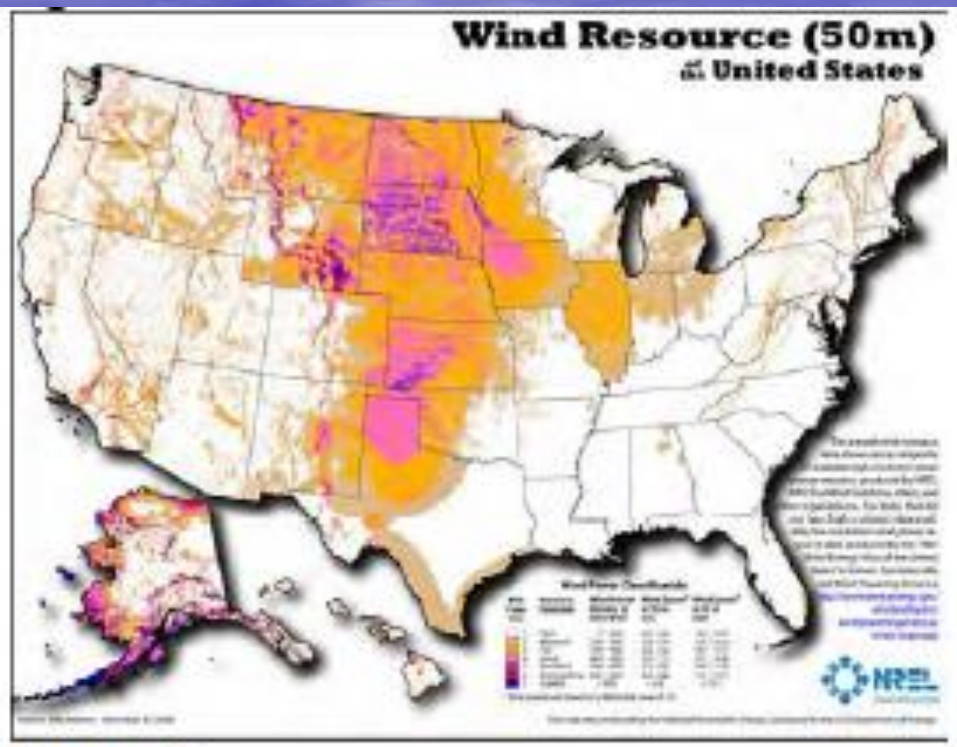


Figure 13

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

US Solar Resource

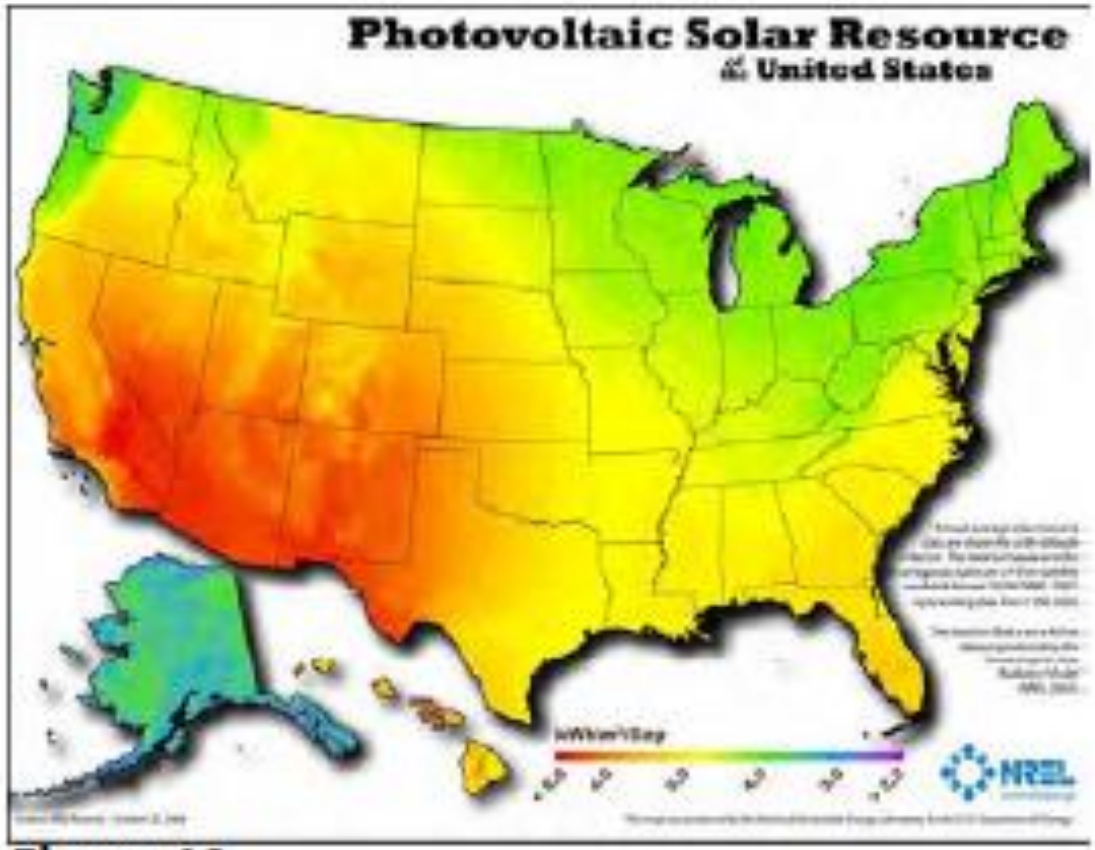
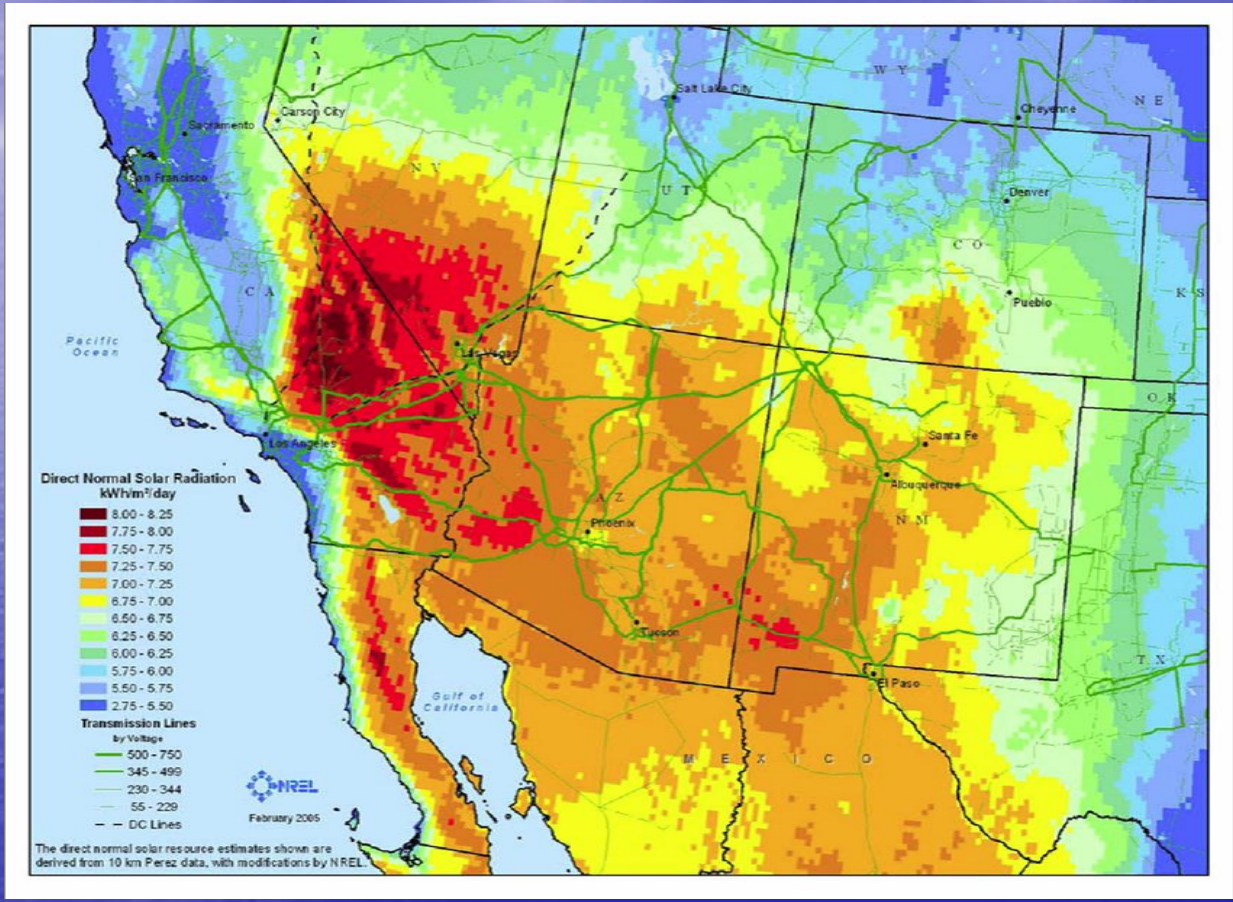


Figure 12

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

Thank You



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