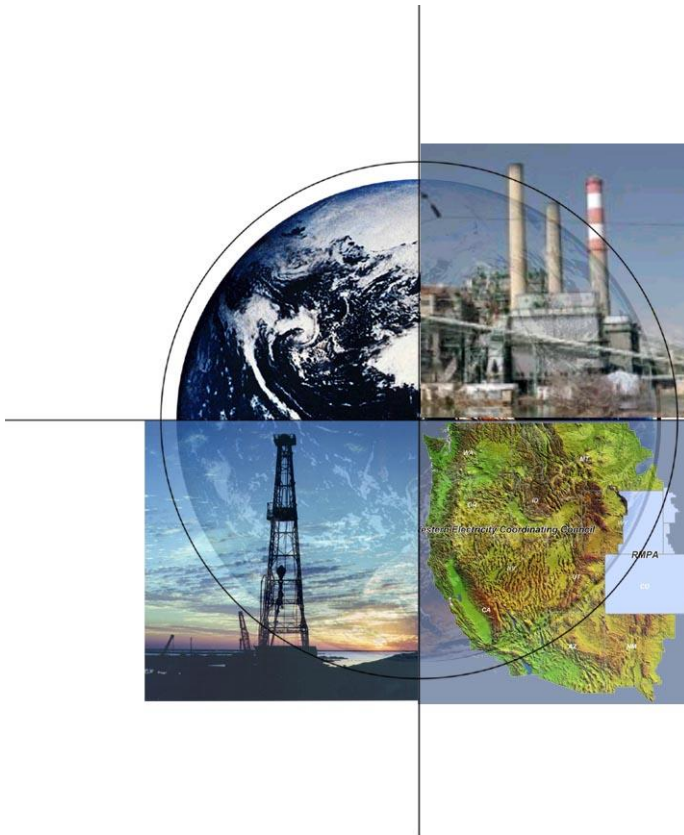


Coping With Competing Energy Strategy Directions



**CEIC (Carnegie Mellon
Electricity Industry Center)
Luncheon Seminar**

April 23, 2008

Ken Kern

National Energy Technology Laboratory



Office of Fossil Energy



National Energy Technology Laboratory

- **Only DOE national lab dedicated to fossil energy**
 - Fossil fuels provide 85% of U.S. energy supply
- **One lab, five locations, one management structure**
- **~1,200 Federal and support-contractor employees**
- **Research spans fundamental science to technology demonstrations**



Alaska



Oklahoma



Oregon



Pennsylvania



West Virginia



Where is NETL (Pittsburgh)?



Carnegie-Mellon Kayoes Panthers

By ROY McHUGH

It was a dark day for Pitt, but the Panthers went down fighting.

After a pitched battle near the end of the first half, followed by a five-minute cooling-off period, Pitt lost to Carnegie-Mellon at Skibo Gym yesterday, 68-64, and thereby ended the basketball season with its worst record in 63 years.

Moreover, no CMU team had beaten a Pitt team since December of 1954, when CMU was Carnegie Tech. To celebrate the end of the 27-game losing streak, CMU students who weren't even in kindergarten in 1954 carried the Tartan players and Coach Moe Fassinger triumphantly off the floor.

Yesterday afternoon, CMU led all the way. There was excitement at the finish, when Pitt got as close as three points, but the big blow-up came with 54 seconds left in the half.

CMU's Mark Lang and two Pitt players dove for a loose ball. Ordinarily, Pitt and CMU are the best-behaved of basketball teams, but the game had been full of contact and tension was building up.

Somebody threw a punch, somebody else retaliated and in an instant there was fighting all over the floor. Both benches emptied, the student managers started slugging one another, and spectators poured out of the stands, fists pumping.

One of them was CMU's junior-varsity coach, Ray Burdett. The free-for-all lasted a full minute, at least, before a campus policeman came out on the floor and the last round-house right found its mark. Pitt, out-numbered, suffered the only identifiable casualty, Freshman Coach Tim Grgurich.

Hit from in front and behind, Grgurich went to the locker room with a bloody nose and a bump on the back of his head.

He did not join the team on the bench in the second half, but watched from an area way.

On the small CMU court, Pitt could not get the ball to its

big men and for an offense the Panthers had to rely on their only outside shooter, Mike Caldwell, who scored 22 points.

CMU, meanwhile, was having no trouble with Pitt's press, Freshman Bob Brown driving past it with ease.

Brown made his first five shots, but went to the bench with three fouls after CMU stretched its lead to 31-18. Pitt then scored seven straight points and Brown returned at the start of the second half only to draw his fourth foul as he scored on another drive.

With almost 17 minutes left, Fassinger benched him again, but Bill Weborg, a sub, started hitting from the corner and so did Lang.

At the end Lang had 20 points, tying Bill Sofia's career CMU field-goal record with his seventh of the game.

He lost the record-breaking field goal when the ball hit a guy wire over the basket before going in, but CMU plays one more game, against Washington and Jefferson at home Friday night.

Late in the second half, CMU was ahead by as much as 12 points. However, Pitt's strength under the boards began to have an effect and Caldwell's drive with 1:27 remaining cut the CMU lead to 64-61.

Then on a one-and-one free-throw try, Lang made both shots and CMU had some breathing room.

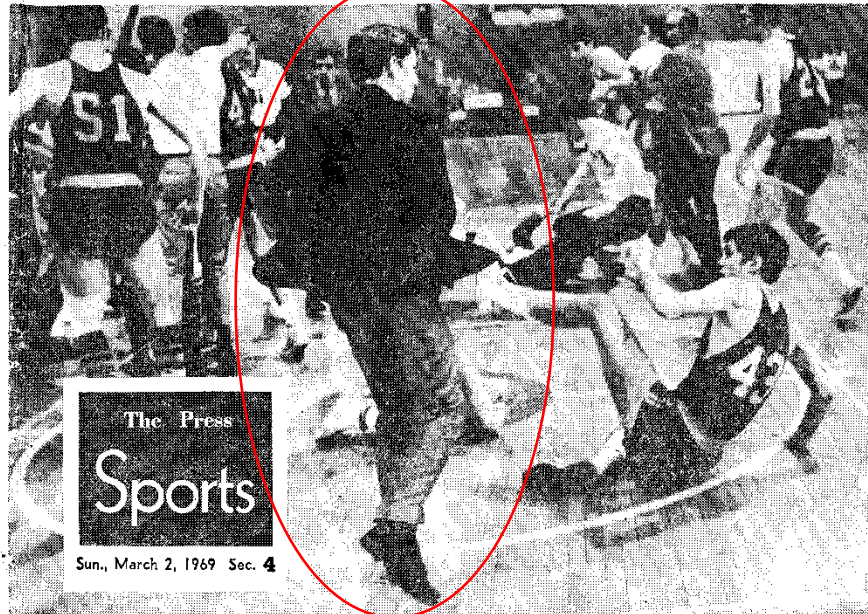
Tightening up after the fight, the officials called 33 fouls in the second half.

The defeat left Pitt with a 4-20 record in Buzz Ridd's first season as coach. Until yesterday, the 1965-66 team, with its 2-9 record, had the distinction of being Pitt's least successful.

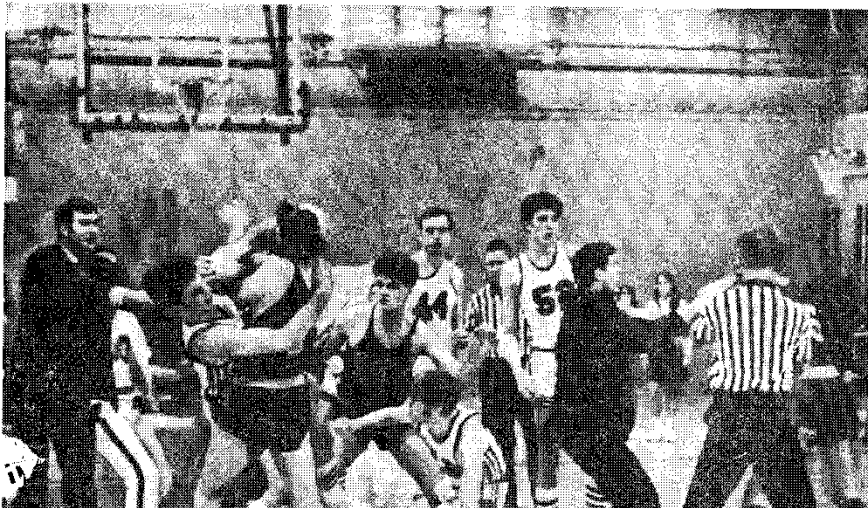
That was the first year of basketball at Pitt.

The present season started hopefully, with a prediction in the press guide to the effect that Pitt's basketball stock was

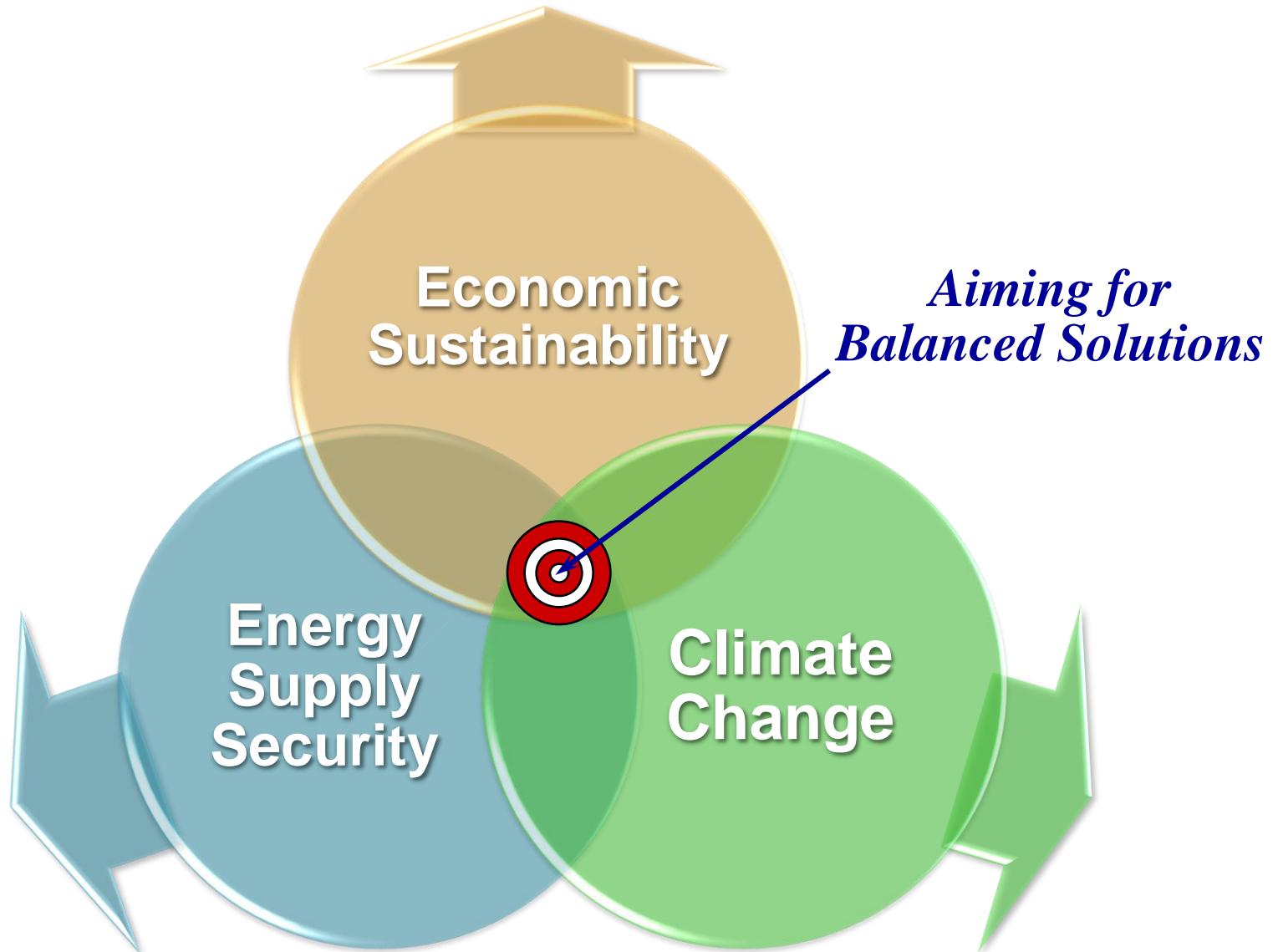
(Continued on Page 7)



The first knockdown punch: Pitt's Tom Withers hits the deck.



Energy Strategy Complexity





David Crigger / Bristol (Va.) Herald Courier

OPPOSITION: Demonstrators march through Abington , Va., last month to protest a proposed coal-fired power plant. Legal clashes over coal are rivaling those over nuclear power decades ago.

“We hope to clog up the system”

David Bookbinder, Sierra Club Chief Climate Counsel

Sunday April 20th 2008

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Electricity in South Africa

The dark ages

Jan 31st 2008 | JOHANNESBURG

From *The Economist* print edition

South Africa's power crisis is having wider repercussions

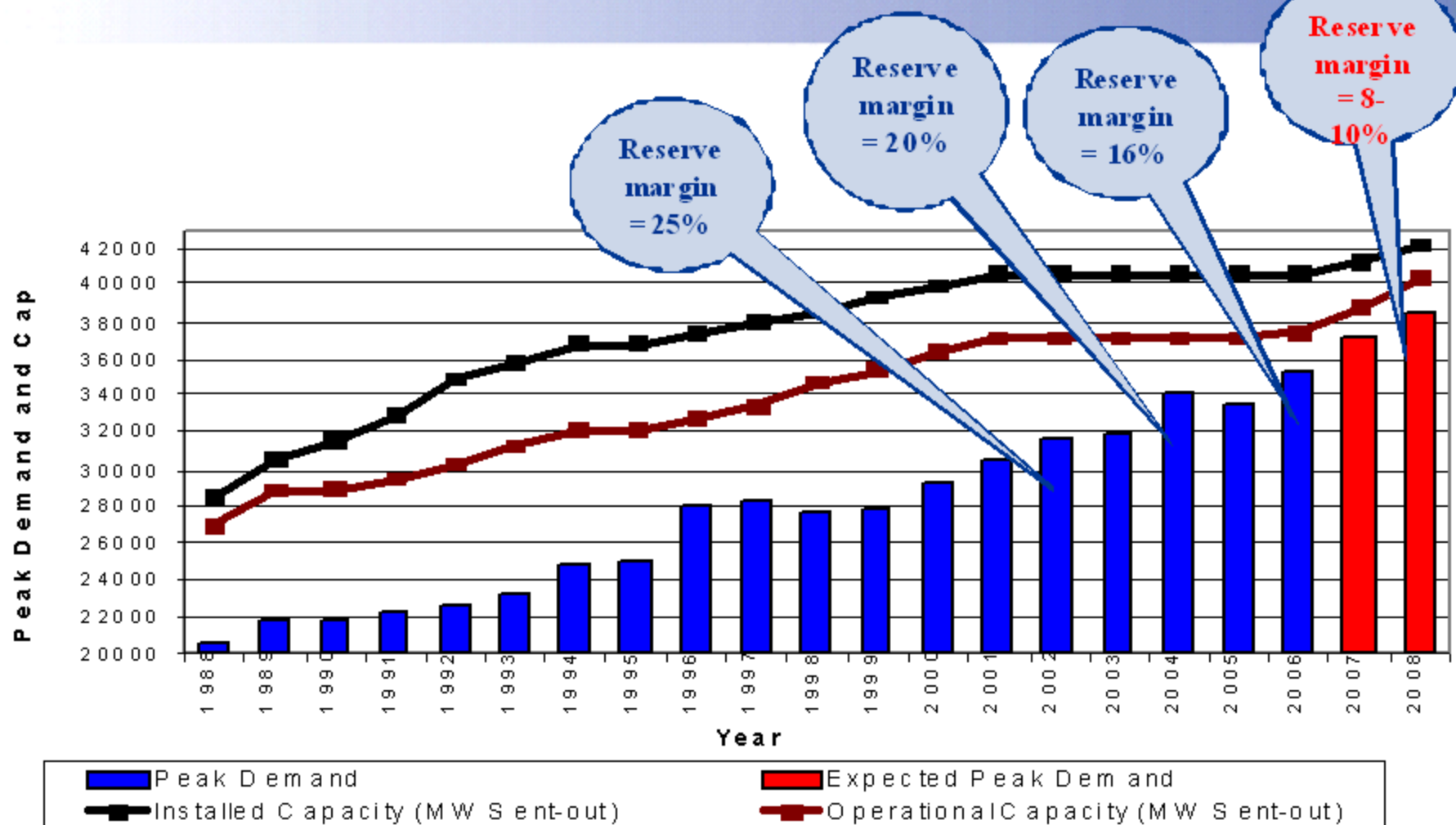


So much for power to the people

AFP

AT THE big Sandton mall in northern Johannesburg, idle shoppers stroll in darkness. They have been caught in one of the many blackouts that have plagued South Africa for three weeks. Shops are closed, unable to open their tills or process credit cards. Ice-cream shops watch their merchandise dissolve; food stalls are unable to offer coffee or anything hot to eat. In Cape Town a power cut trapped tourists in the cable car that goes up Table Mountain, and in Pretoria angry commuters whose trains stopped running set them on fire. In

Historical demand overview



Reserve margin aspiration = 15%

NERC

NORTH AMERICAN ELECTRIC
RELIABILITY CORPORATION

2007 Long-Term Reliability Assessment

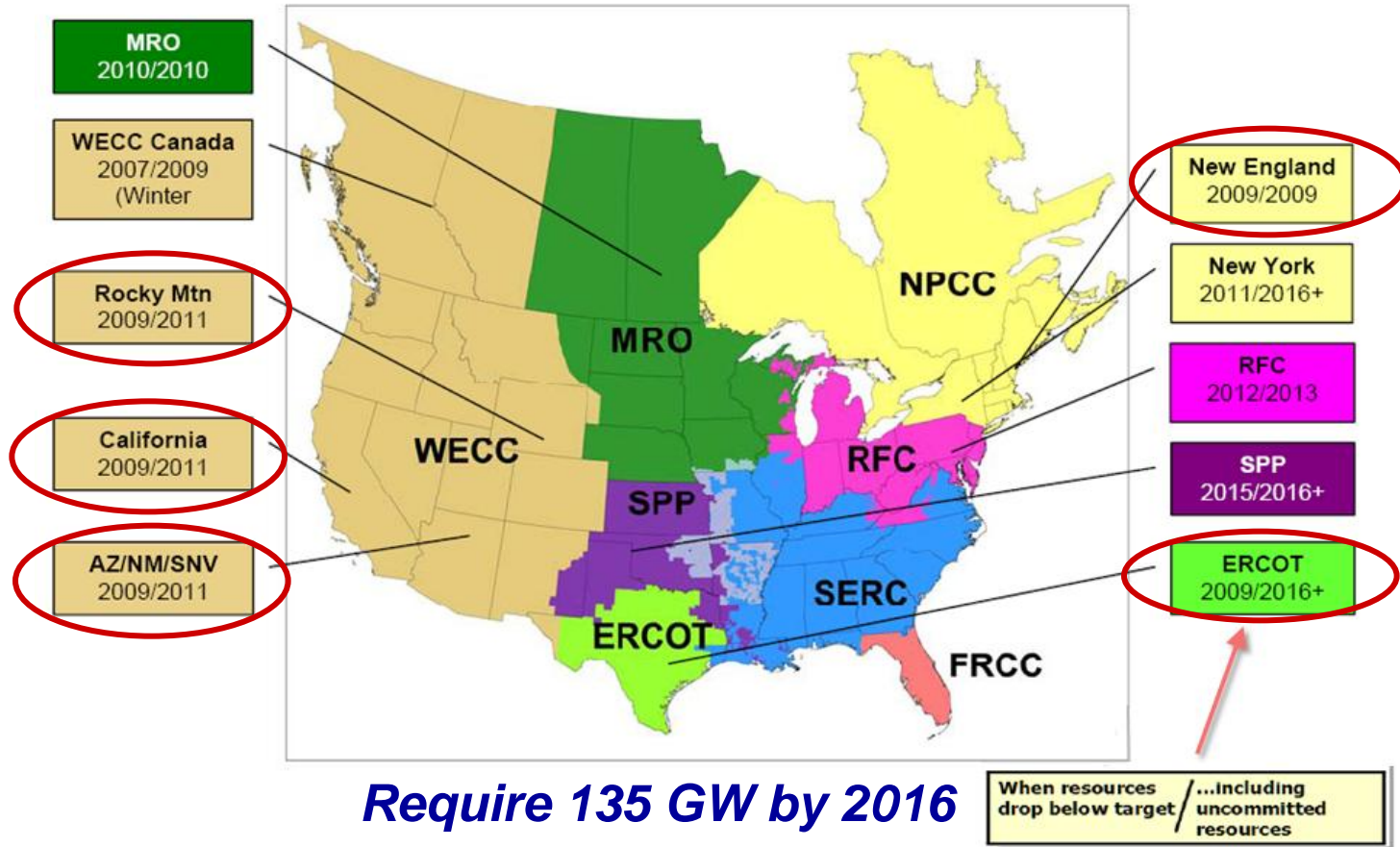
2007-2016

to ensure
the reliability of the
bulk power system

October 2007

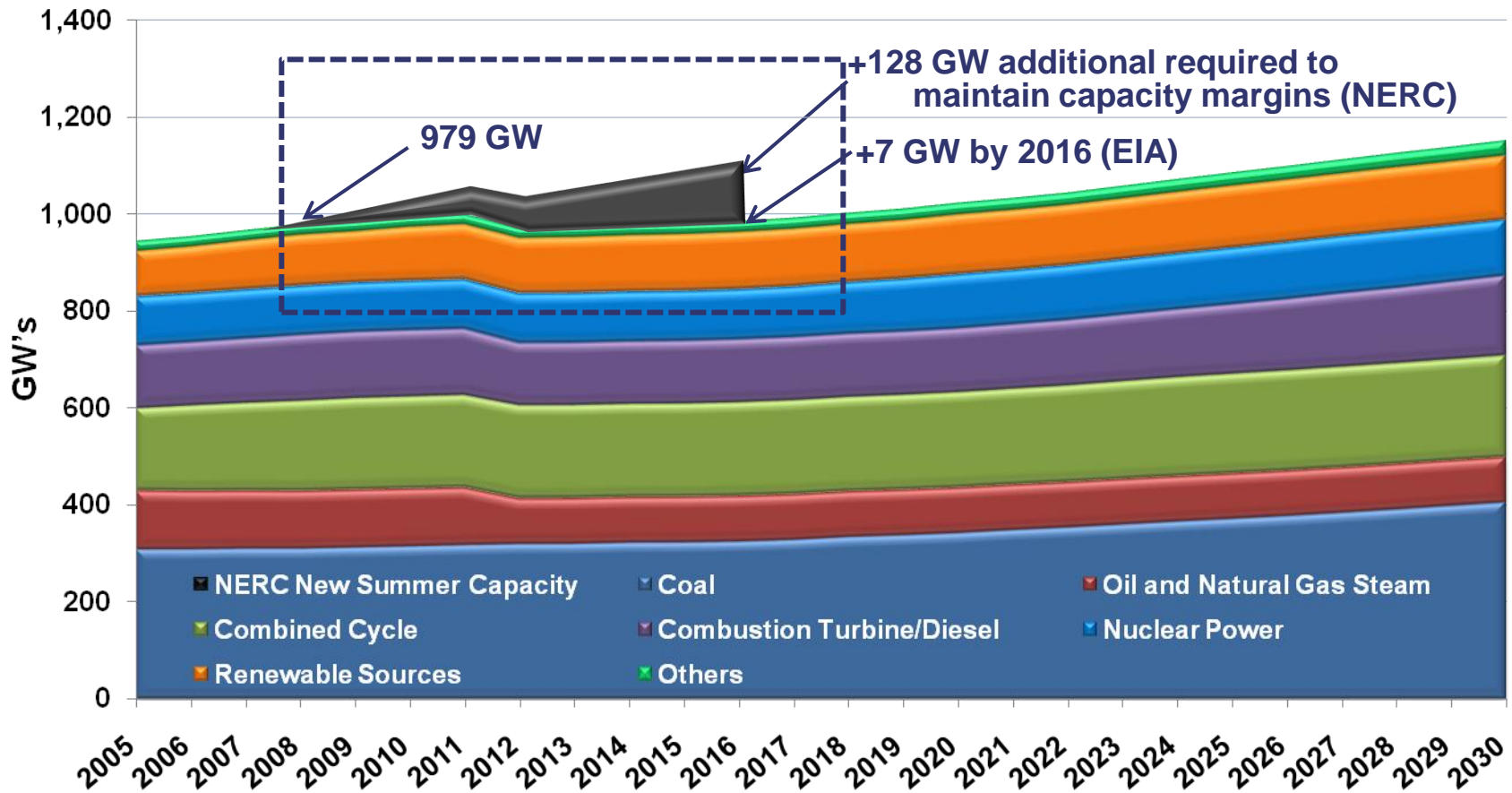
116-390 Village Blvd., Princeton, NJ 08540
609.452.8060 | 609.452.9550 fax
www.nerc.com

NERC Long Term Reliability Assessment 2007



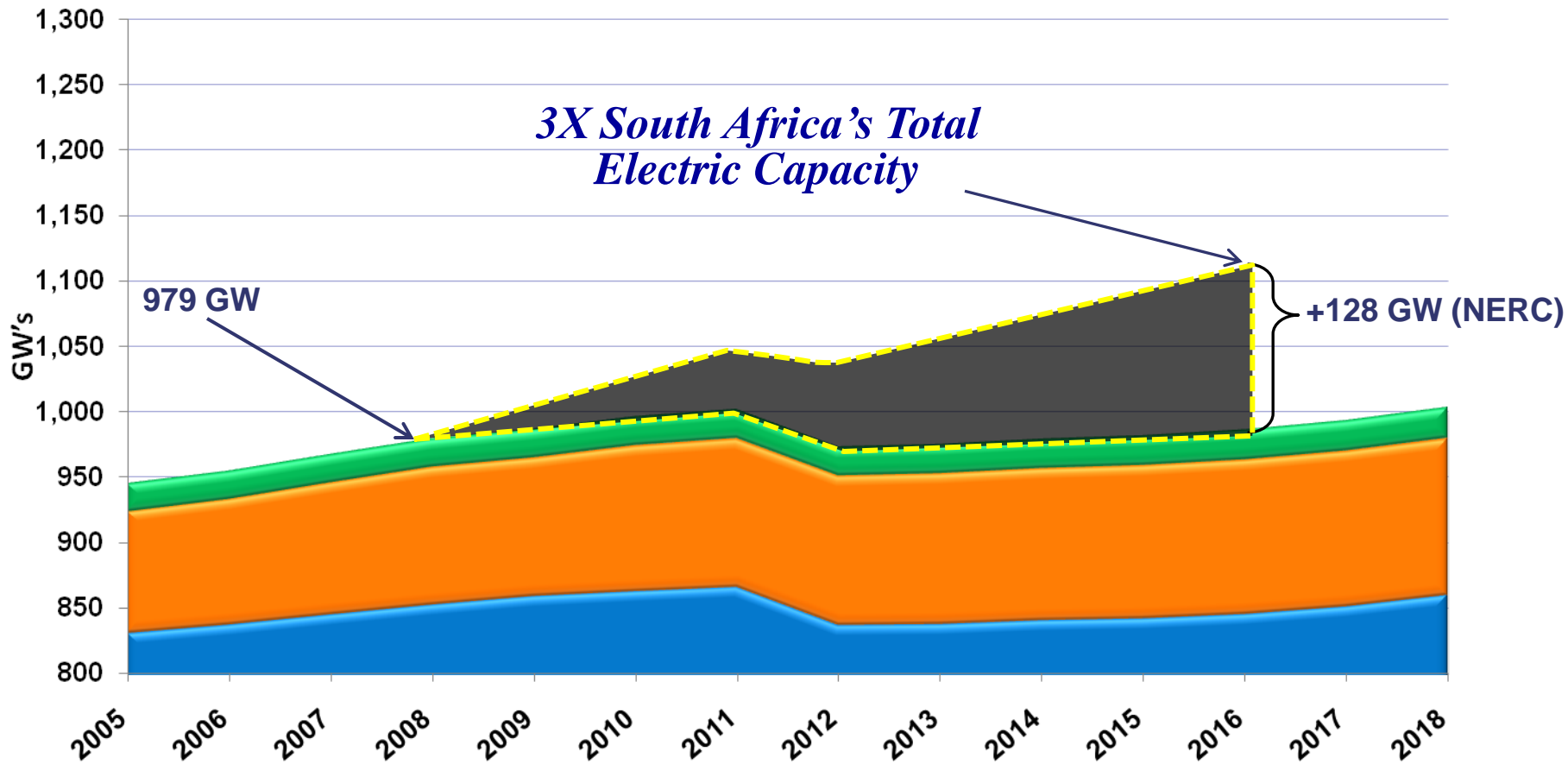
“Areas of the most concern include WECC-Canada, California, Rocky Mountain States, New England, Texas, Southwest and the Midwest. The outlook improves somewhat when uncommitted resources — those resources still too early in the planning process to commit to providing energy — are included. Even with these uncommitted resources included, some areas remain a concern.”

U.S. Peak Summer Generation Capacity: NERC and AEO'08 Capacity Outlook



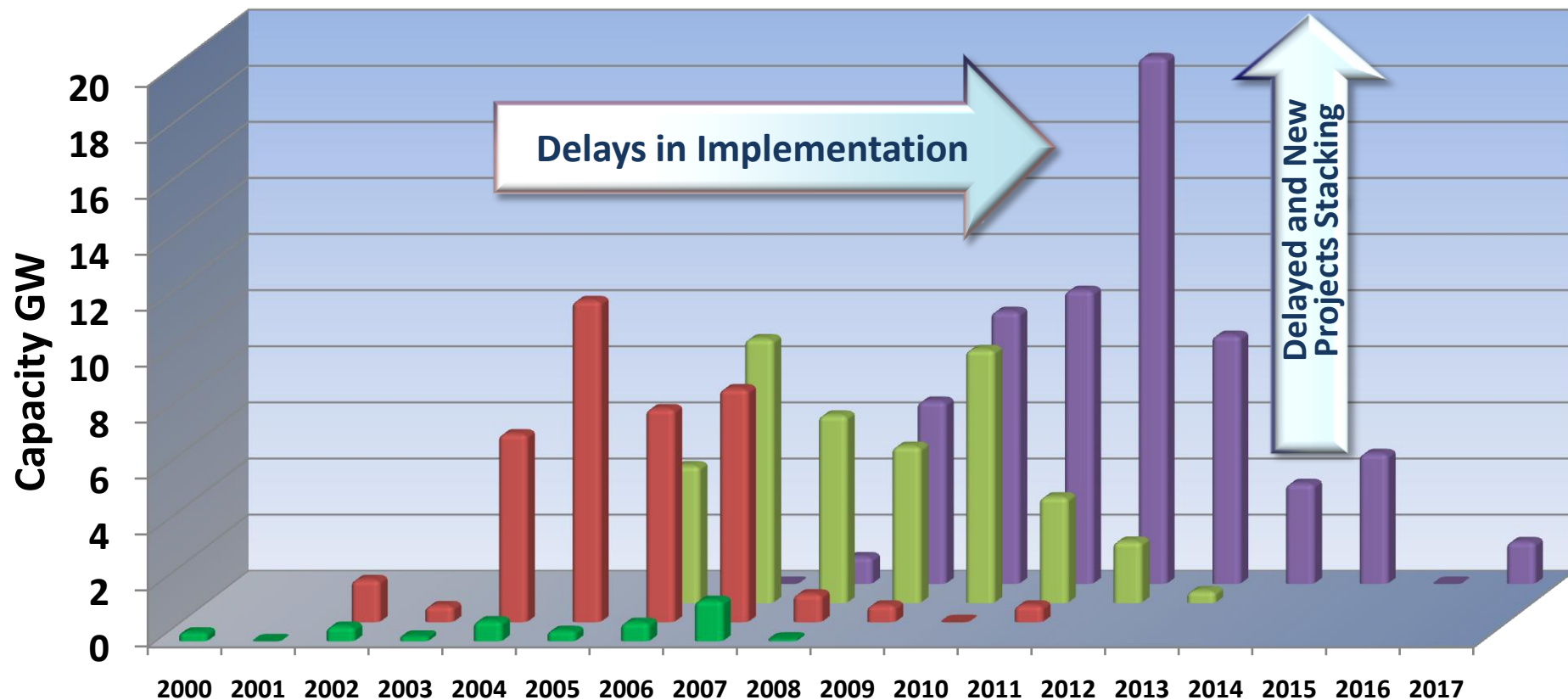
Capacity Growth Forecasts Vary Substantially Due to Assumptions for Annual Electricity Demand Growth Rates, GDP Growth, and Oil Price

U.S. Peak Summer Generation Capacity: NERC and AEO'08 Capacity Outlook



*Deficiency Equals Double All Coal-fired Plants in Development
Five Times Coal-fired Plants "Progressing"*

Past Capacity Coal-Fired Announcements vs. Actual



Historically, actual capacity has been seen to be significantly less than proposed capacity. For example, the 2002 report listed 36,161 MW of proposed capacity by the year 2007 when actually only 4,478 MW (12%) were constructed.

■ Actual

■ 2002 Report

■ 2005 Report

■ April 2008

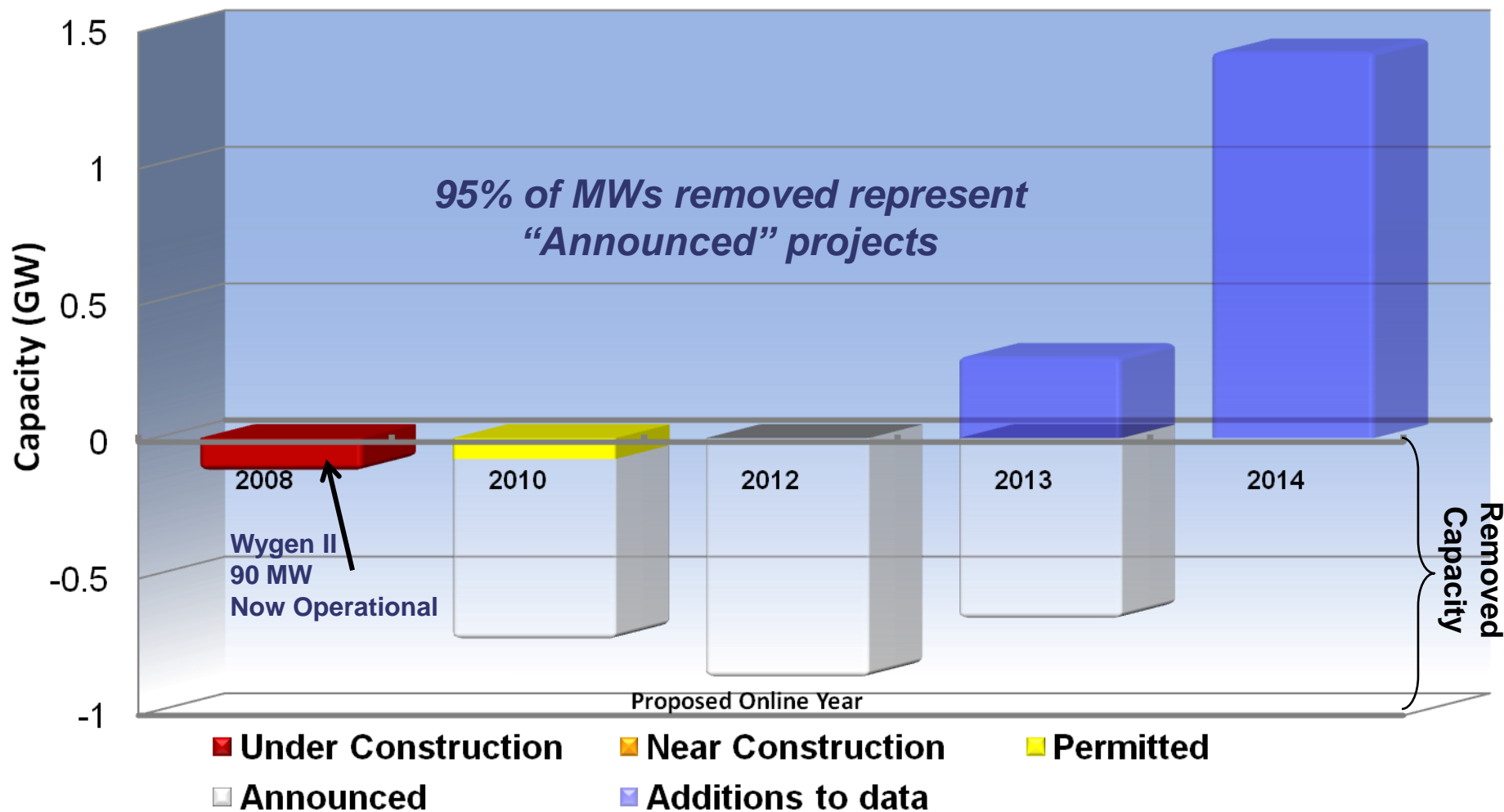
Current Coal-Fired Capacity Projects *(quarterly change)*

		<i>Number of Plants</i>			<i>Capacity (MW)</i>		
<i>General Status</i>		December 2007 Report	Current Report	<i>Net Change</i>	December 2007 Report	Current Report	<i>Net Change</i>
Progressing Projects	<i>Under Construction</i>	28	30	+2	14,885	16,984	+2,099
	<i>Near Construction</i>	6	5	-1	1,859	1,437	-422
	<i>Permitted</i>	13	12	-1	6,422	6,162	-260
	SUB TOTAL	47	47	0	23,166	24,583	+1,417 (+6%)
Uncertain Potential and Timing	<i>Announced (early stages of development)</i>	67	63	-4	42,394	40,363	-2,031 (-5%)
	TOTAL	114	110	-4	65,560	64,946	-614 (-0.9%)

<i>Status Listing</i>	<i>Description</i>
<i>Under Construction</i>	Project is under construction.
<i>Near Construction</i>	Project has been approved; majority or all permits are obtained. Sponsor is contracting vendors and Engineering, Procurement and Construction (EPC) contractors. Site preparation has begun.
<i>Permitted</i>	In the permitting phase. Two or more permits approved or fuel or power contracts have been negotiated.
<i>Announced</i>	Early stages of development to filing for permits. May include a feasibility study.

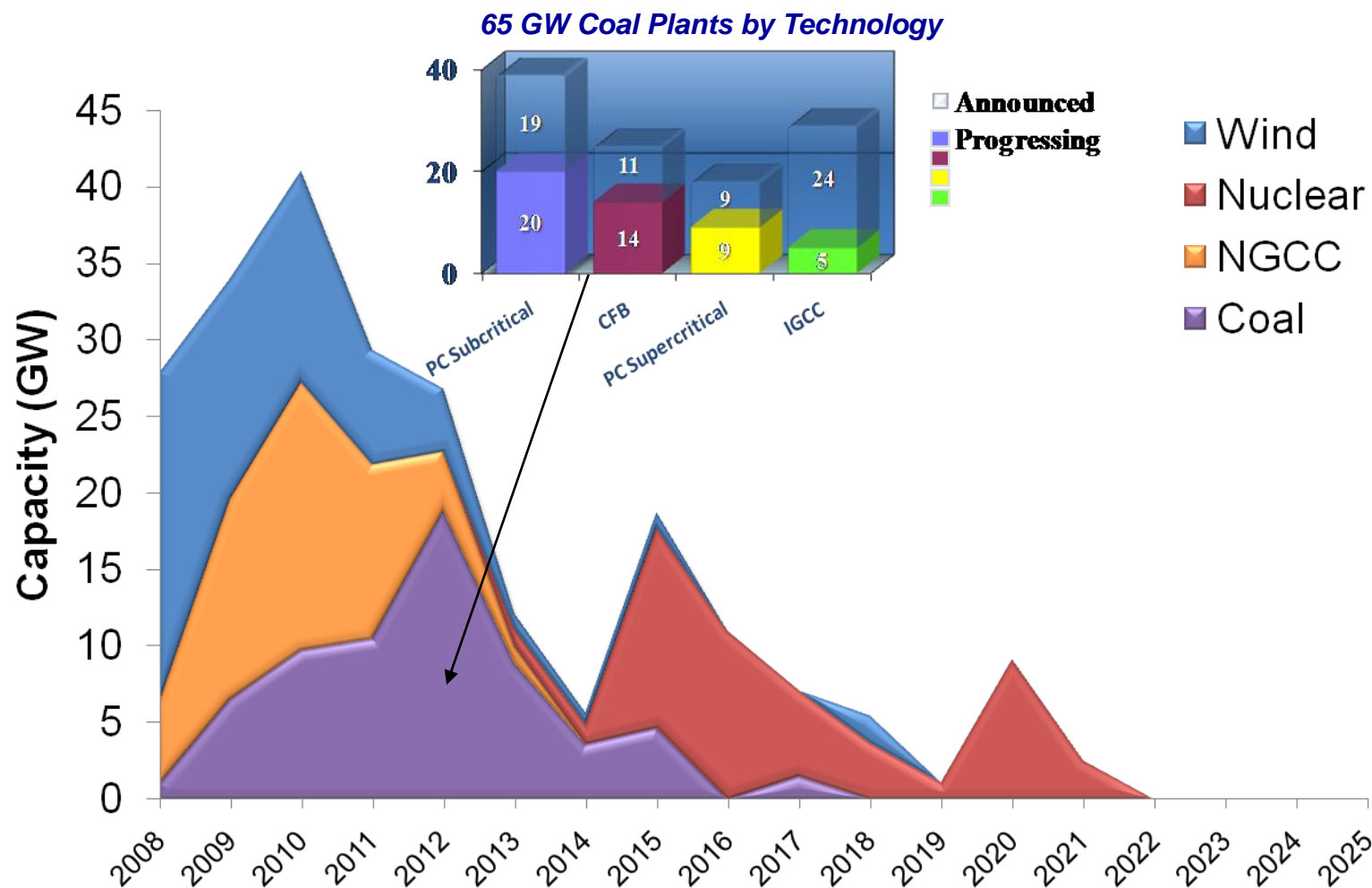
Net Capacity Changes (Removed or Added Opportunities)

1st Quarter 2008

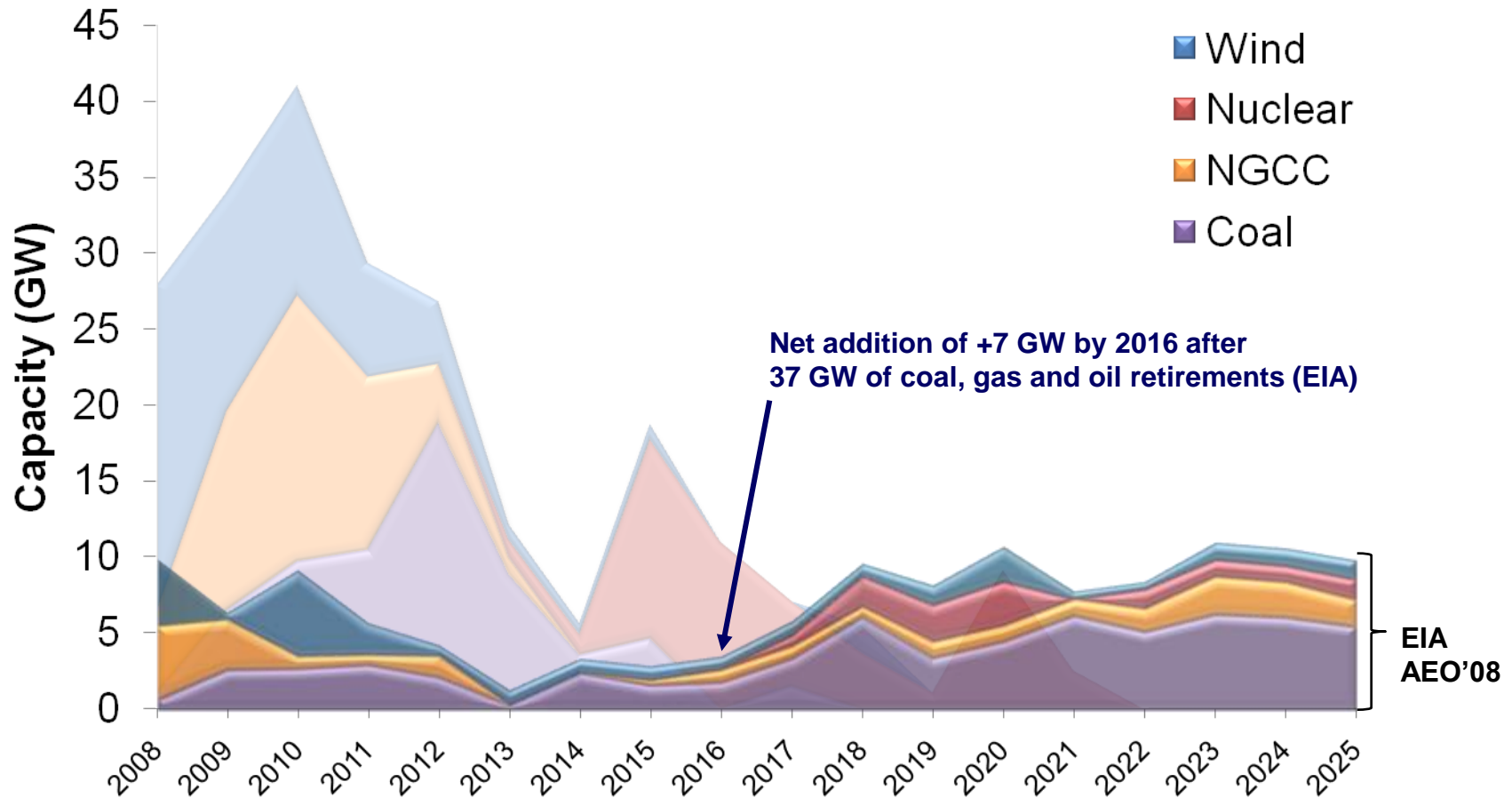


Total Net Reductions 614 MW (-0.9%) for 1th Quarter 2008

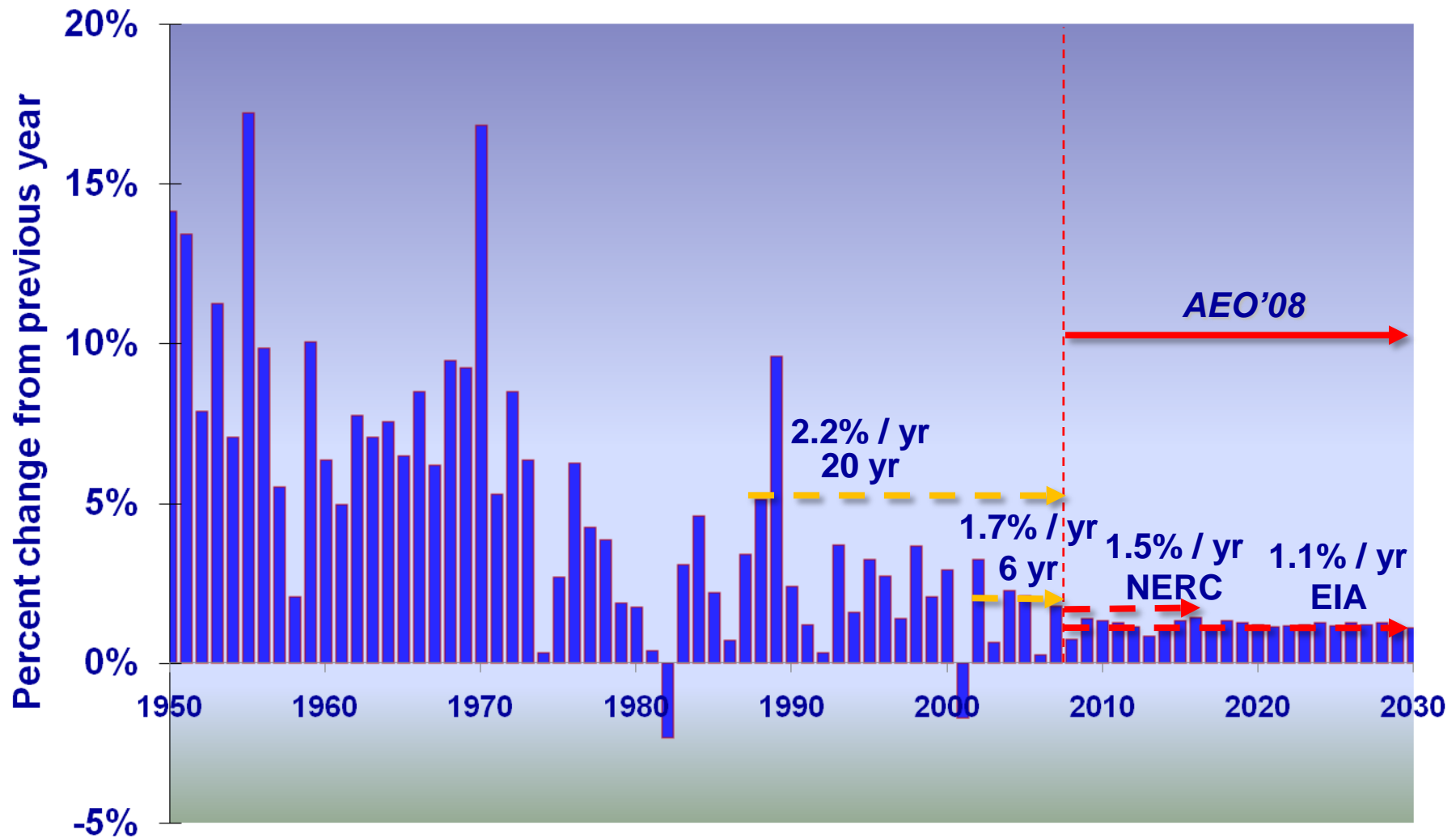
All Currently Proposed Generation



All Currently Proposed Generation *Compared with EIA AEO'08 revised*

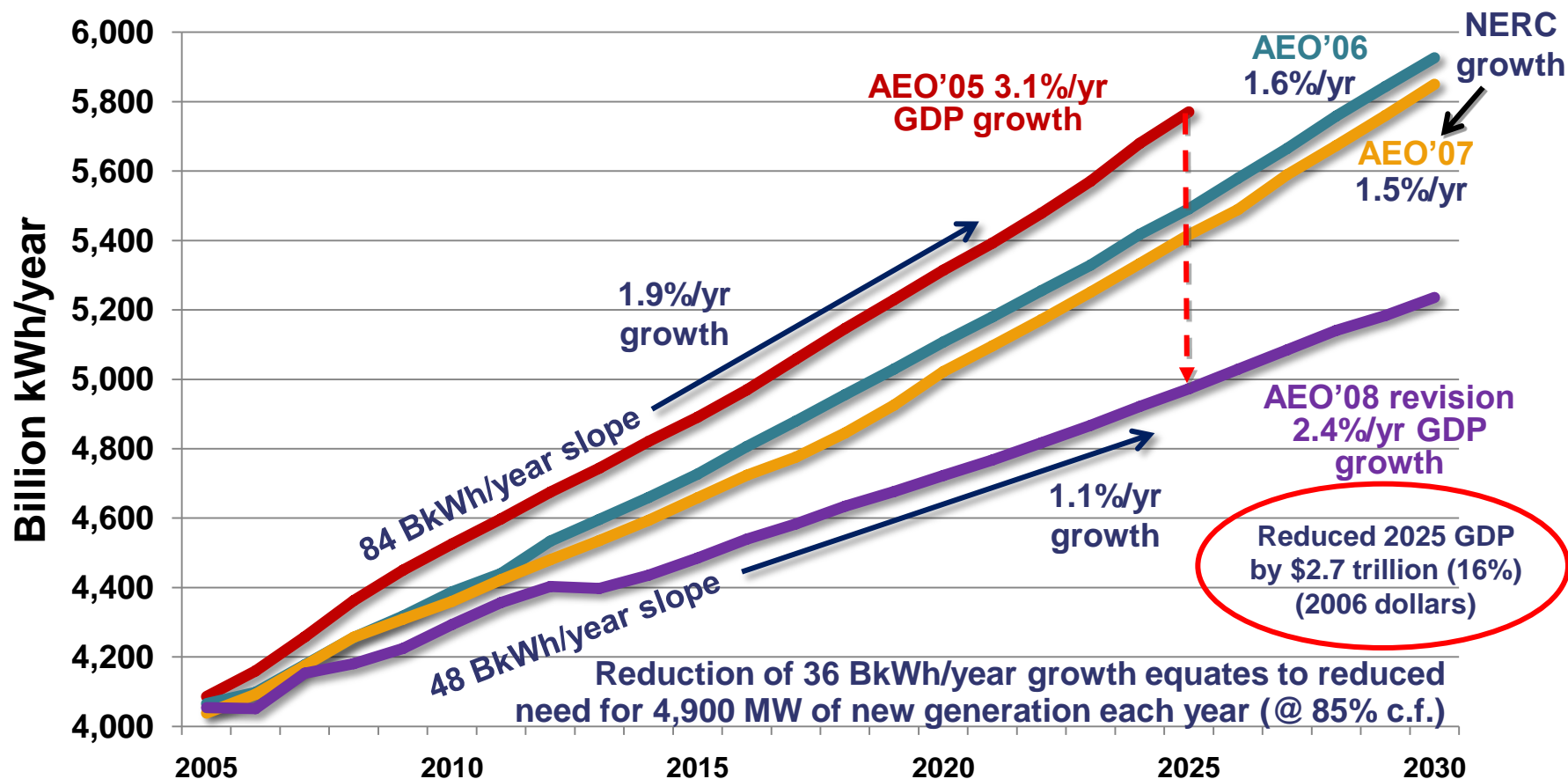


Total Electricity Generation Growth Rates



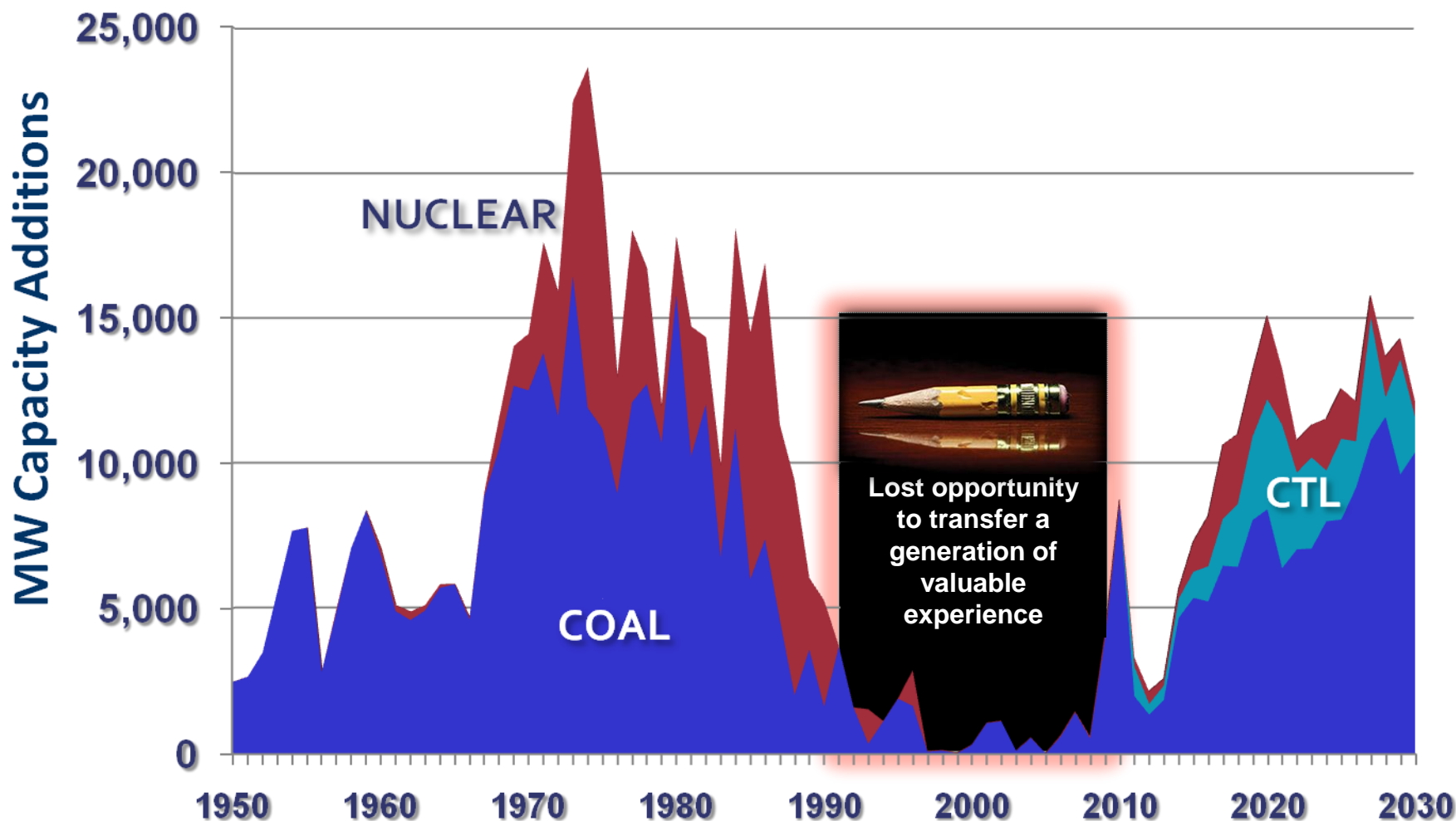
Forecast for Electricity Generation Growth Well Below Recent Averages

Declining Total Electricity Generation Growth Rate Assumptions



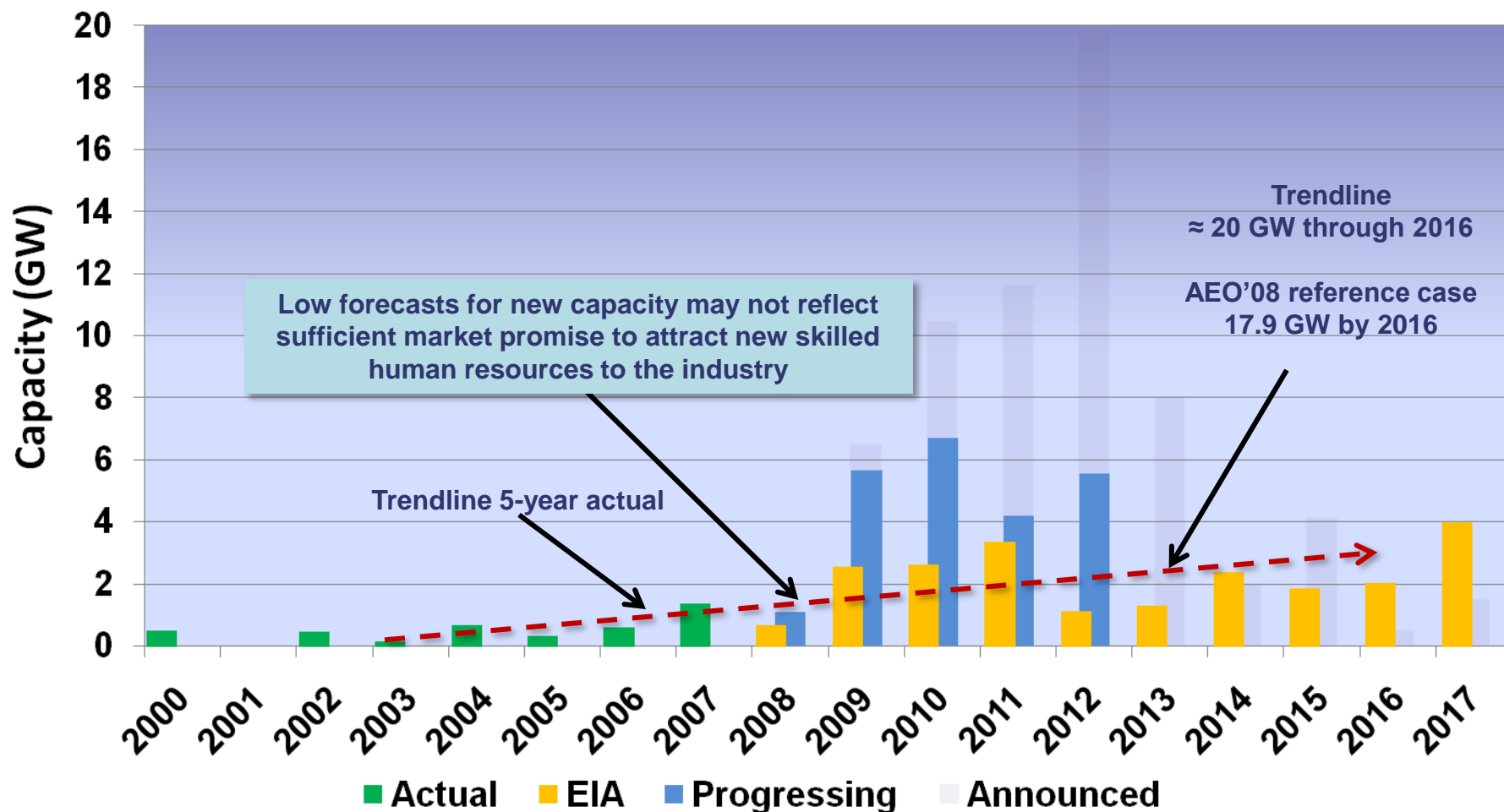
*Declining Growth in Long-Term Electricity Demand and U.S. GDP;
NERC Estimates Tied to Higher Growth Rate*

Our Workforce and Skills Challenge



A Two-Decade Gap for Coal; Three Decades for Nuclear

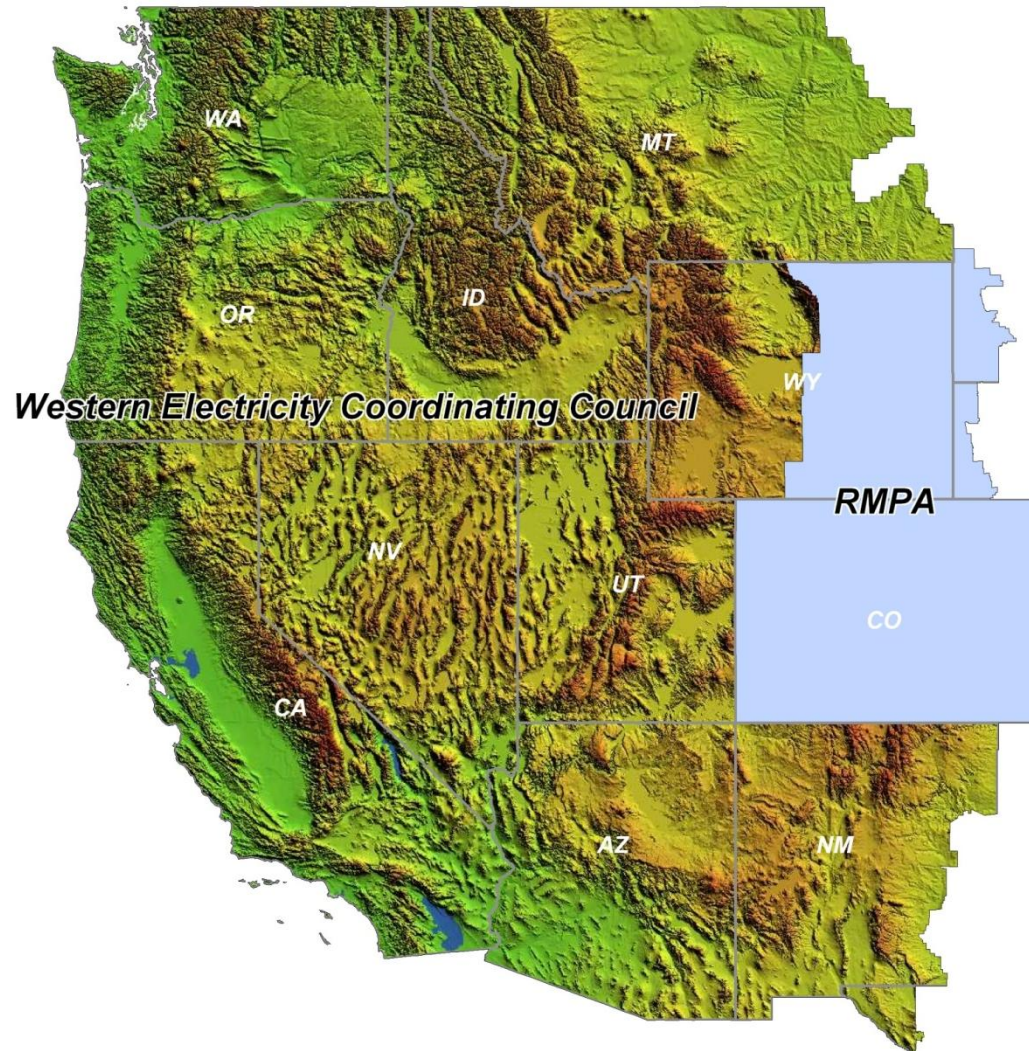
Coal-Fired Development Activity vs. EIA AEO'08



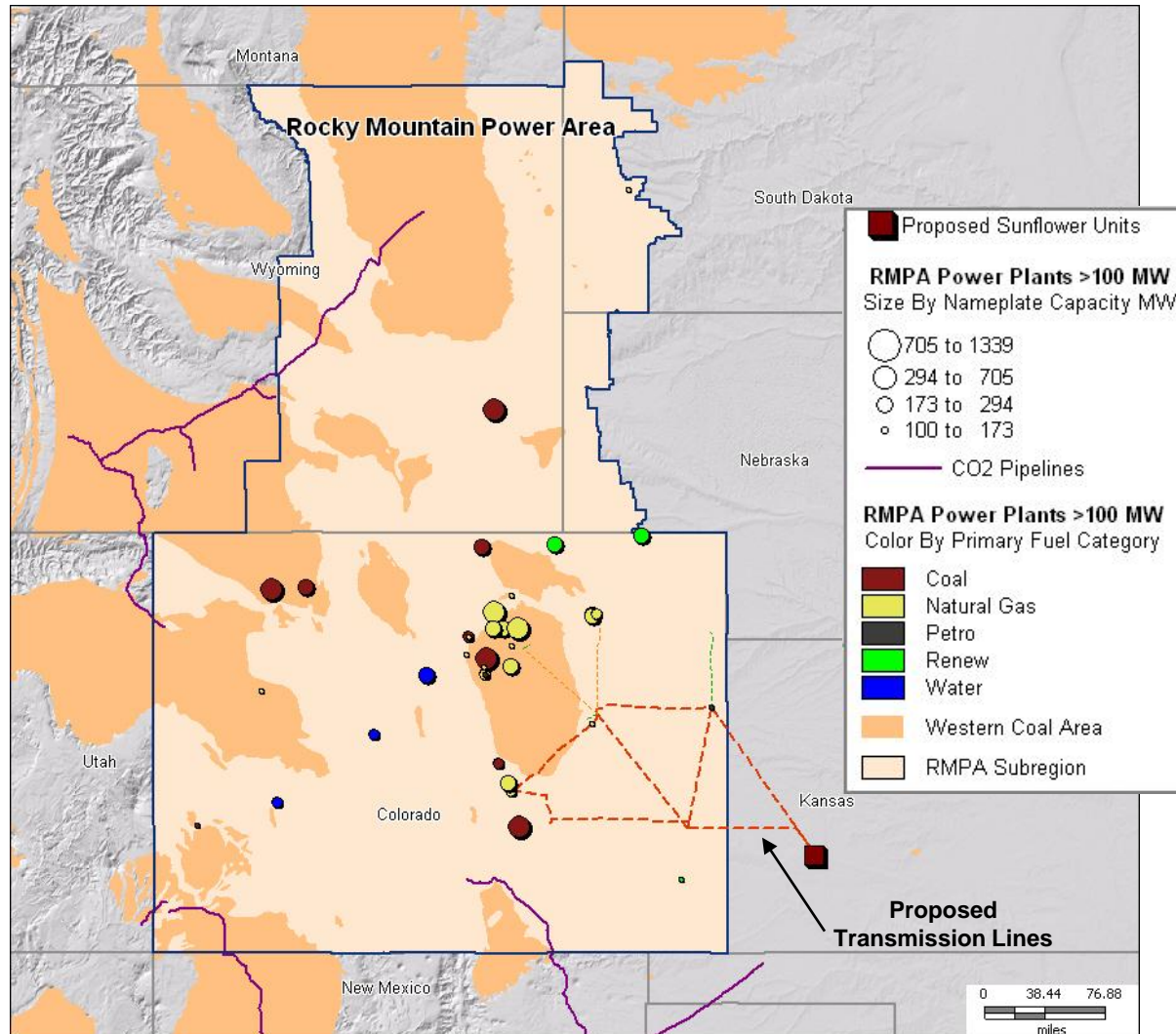
*Actual Installation Trend and EIA AEO'08 Reference Forecast Correspond;
A Significant Surplus of Developments Exists Above EIA's Forecast Demand*

NERC Region – WECC

Subregion – Rocky Mountain Power Area (RMPA)

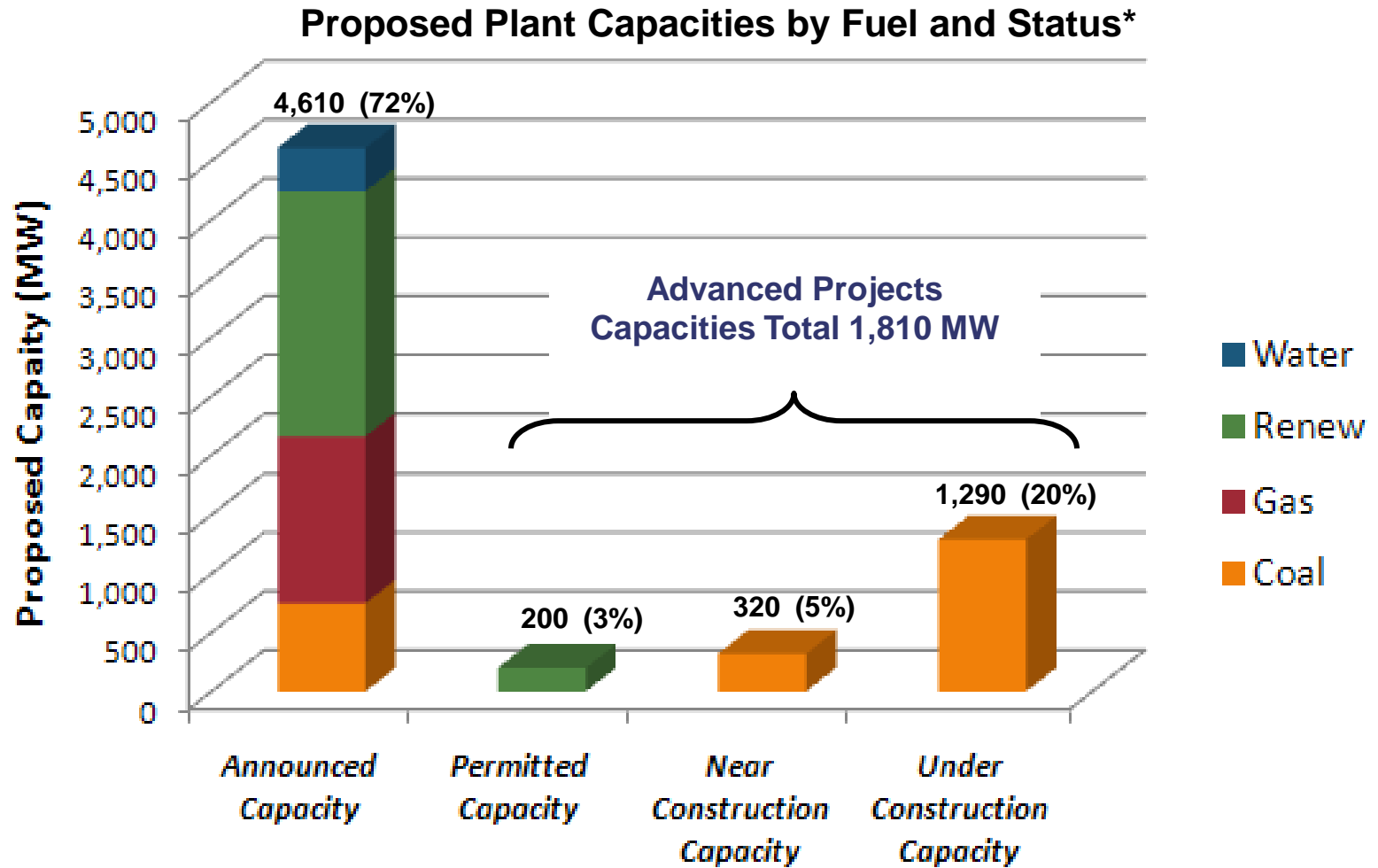


Power Plants and Infrastructure of the RMPA



Proposed Capacity Additions

RMPA Subregion – 6,420 Megawatts

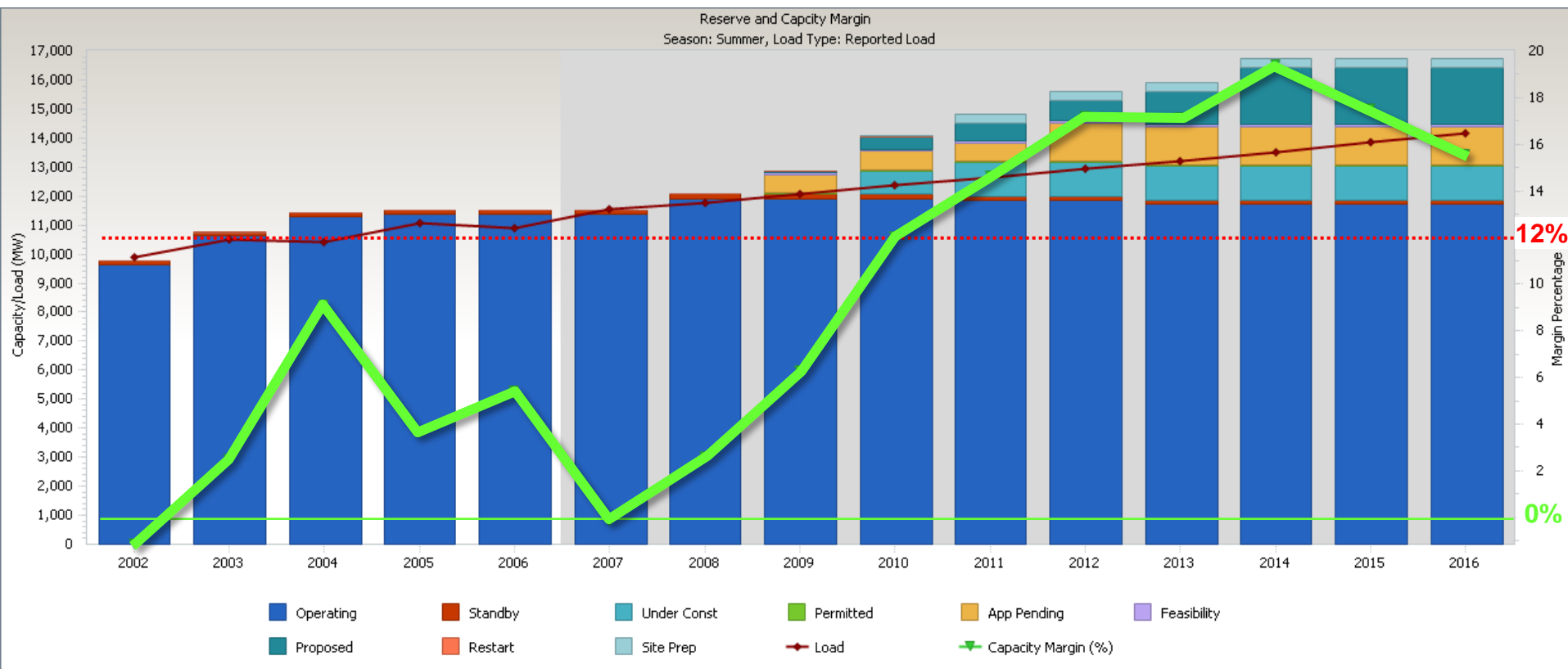


*Does not include the proposed Sunflower Plants

Data Source: Energy Velocity Suite, 4/2/2008 Query

RMPA Peak Summer Capacity Margins

Variation Based on Coal-fired Generation



All Currently Planned Developments Proceed

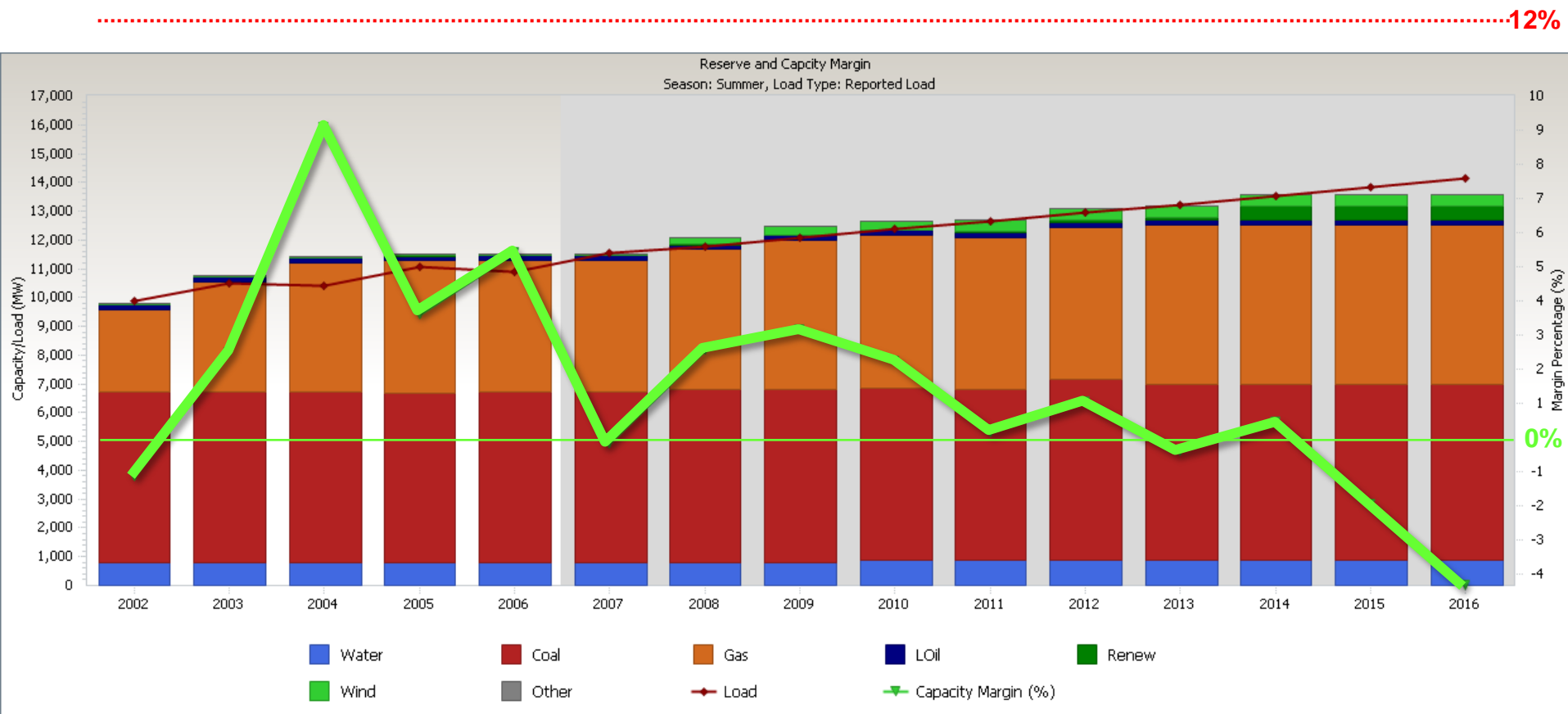
RMPA Peak Summer Capacity Margins Variation Based on Coal-fired Generation

12%



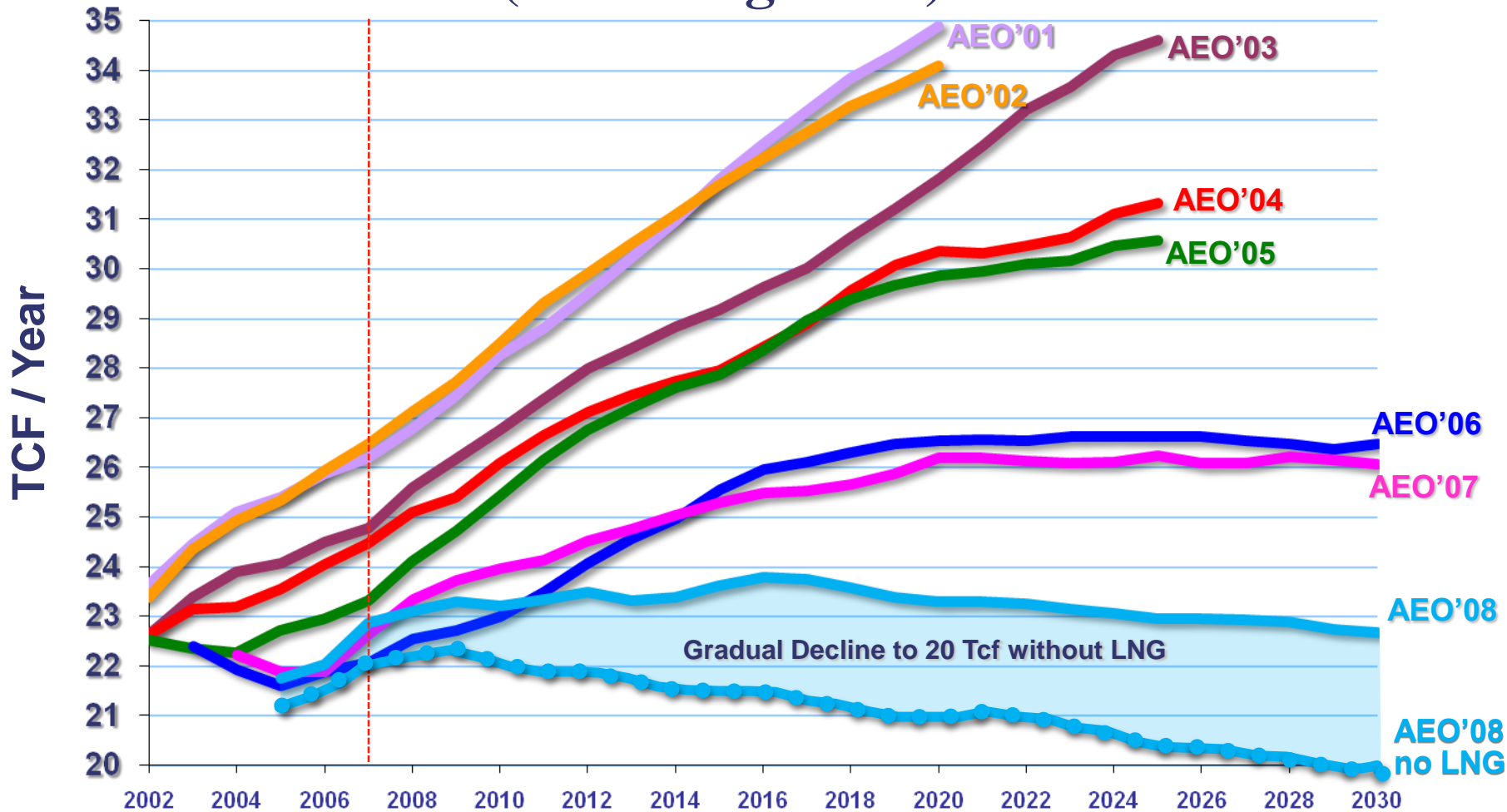
Coal-fired Generation Halted and 50% of Proposed Plants Proceed

RMPA Peak Summer Capacity Margins Variation Based on Coal-fired Generation



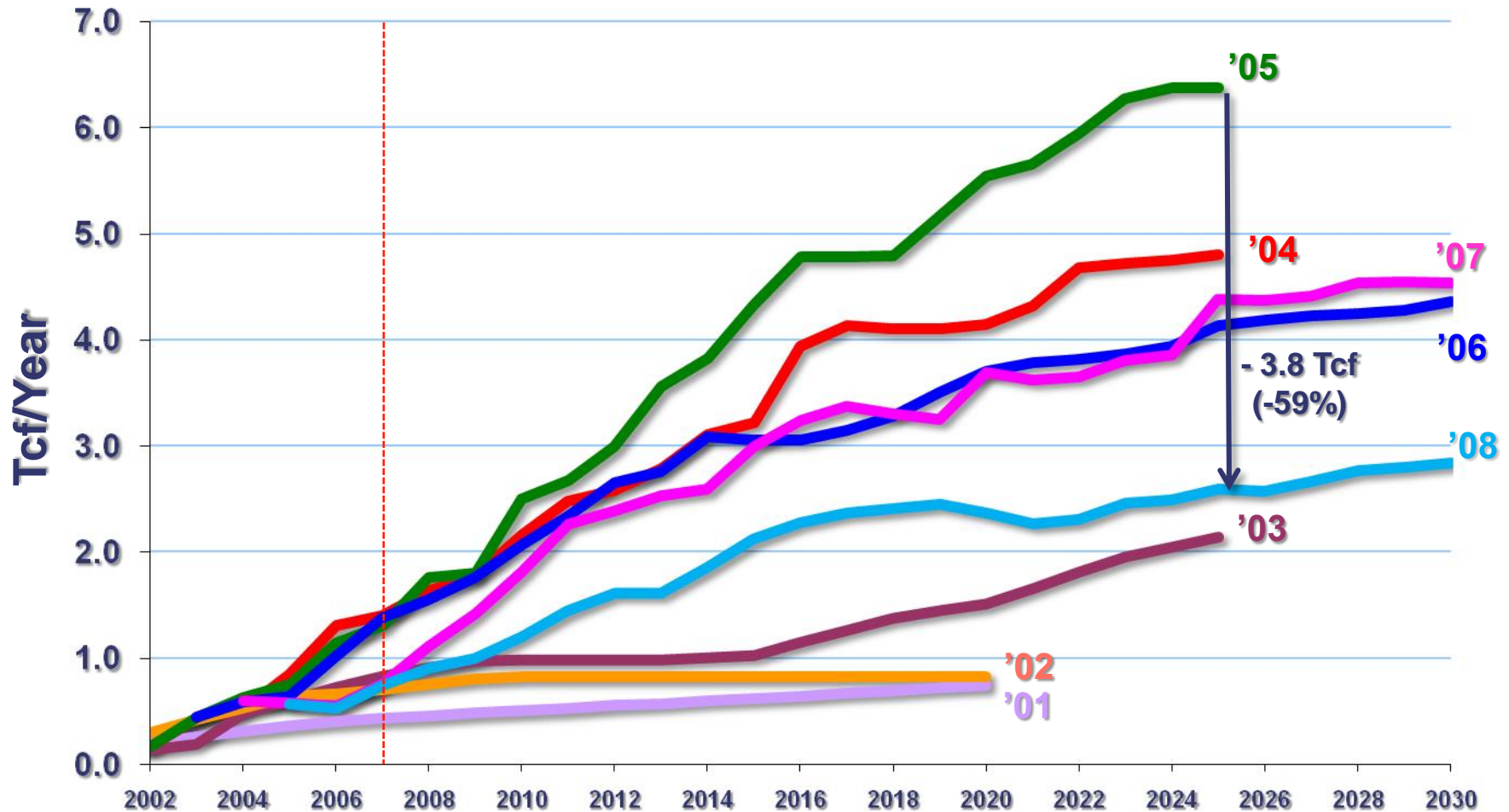
Coal-fired Generation Halted and 50% of Proposed Plants Proceed

Total Natural Gas Supply to U.S. (Including LNG)



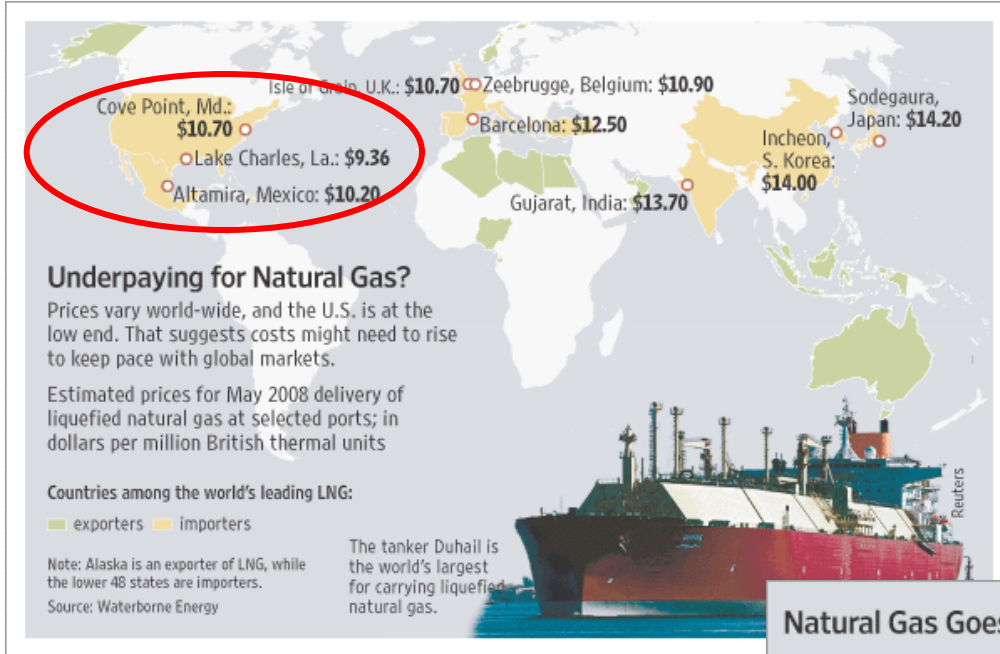
*Increased Use of Natural Gas in Electricity Will Require LNG;
North American Natural Gas Supply for U.S. Trending Down*

U.S. LNG Imports



*Reduced Optimism for LNG, but . . .
Only Source of Natural Gas Supply Growth for N. America*

WSJ On LNG (April 18, 2008)



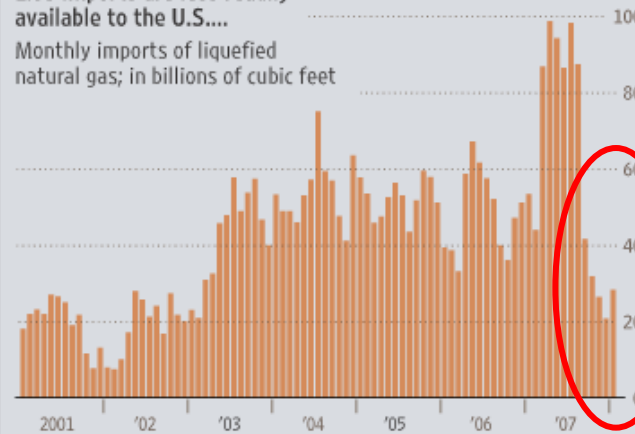
Overall, U.S. imports of LNG have slid over the past nine months to a five-year low, and natural-gas inventories are running relatively low... if the U.S. is unable to attract LNG supply this summer, prices could spike up sharply within a few months if a hot summer were to reduce the ability to build a cushion of gas going into next winter.

Meantime, as Asian buyers grab more LNG from the Atlantic basin, U.S. prices, though at 27-month highs, still look cheap.

Natural Gas Goes Global

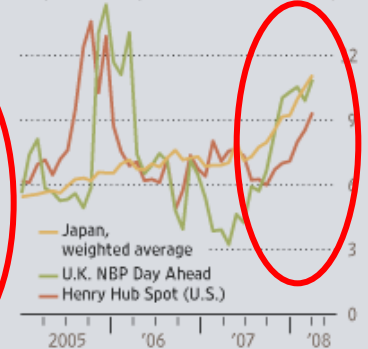
LNG imports are less readily available to the U.S....

Monthly imports of liquefied natural gas; in billions of cubic feet



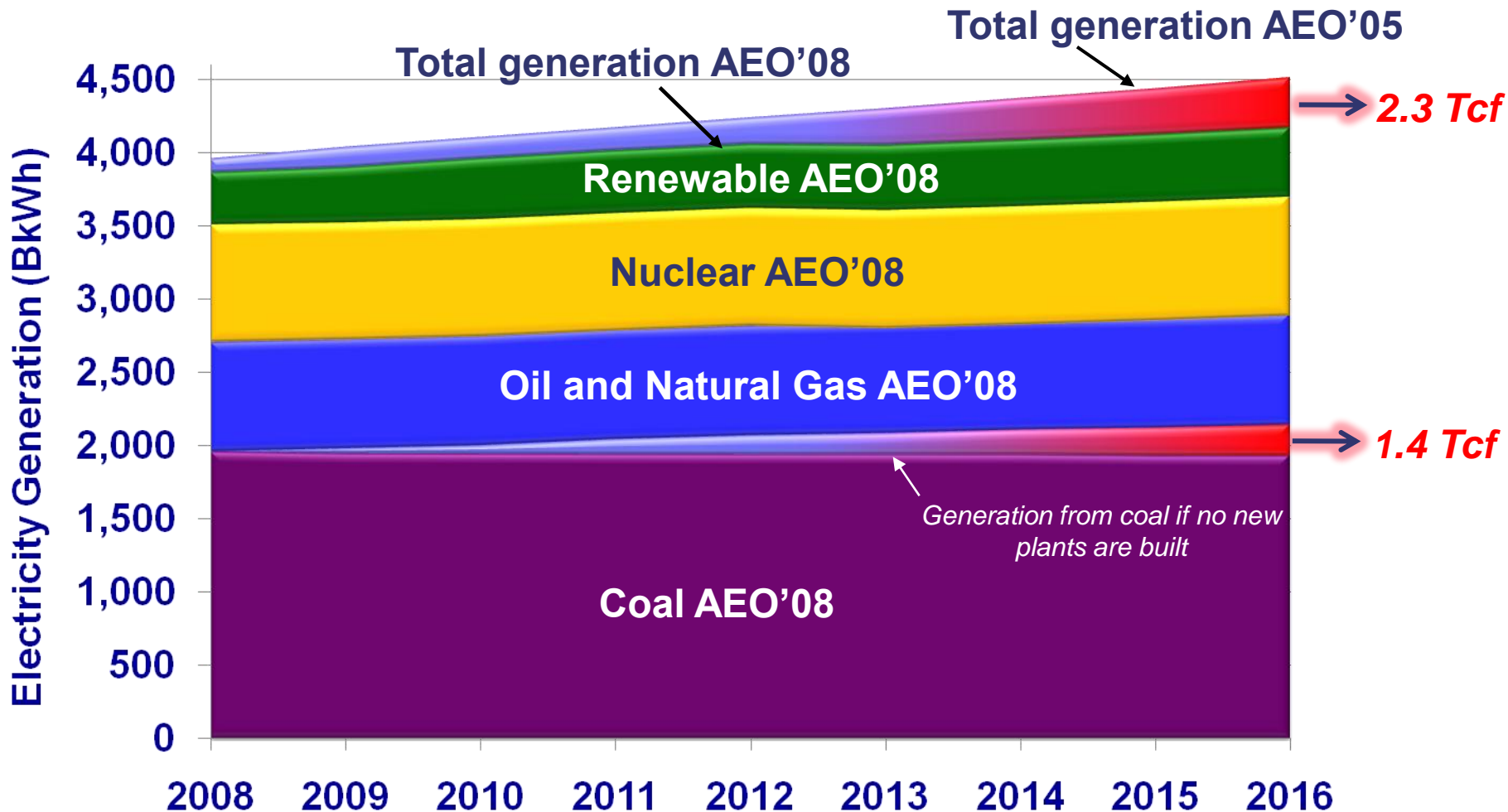
As global natural-gas markets become more competitive

Price per million British thermal units

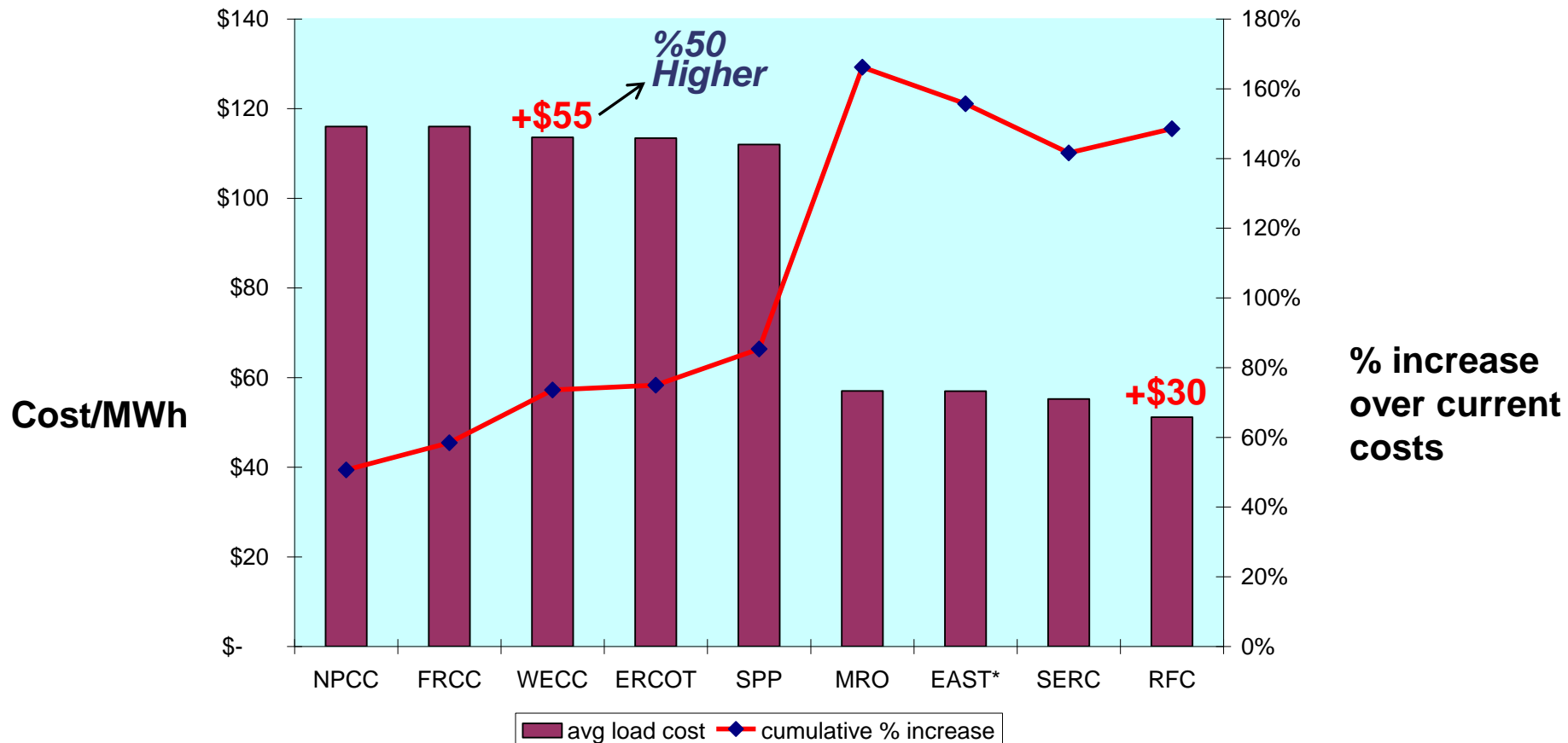


Sources: U.S. Energy Information Agency; PIRA Energy Group

Can Natural Gas Supply Support a “Dash to Gas”?



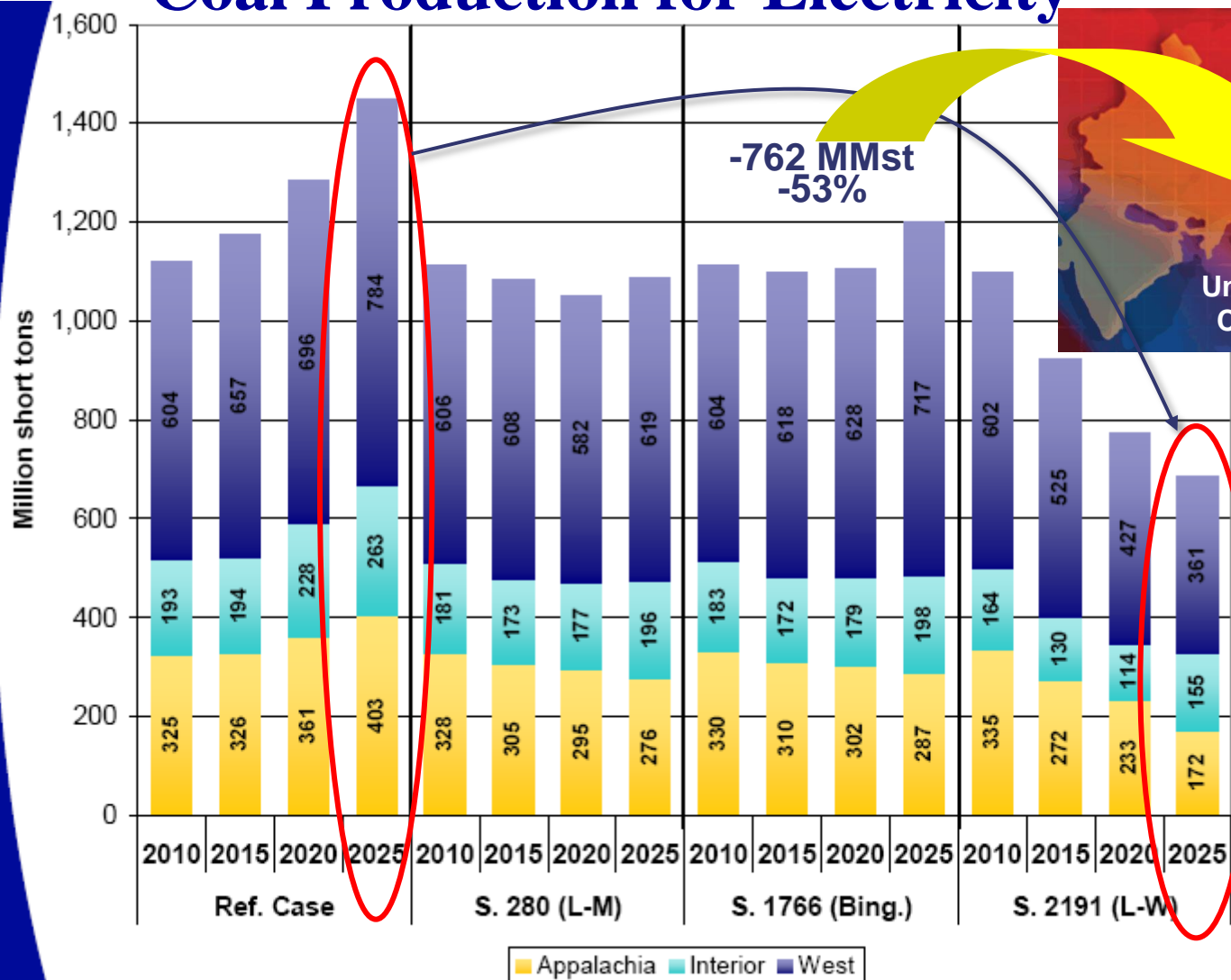
Effect of \$30/t CO2 Tax and \$14/MMBtu Natural Gas on Current Average Generating Costs, by Region



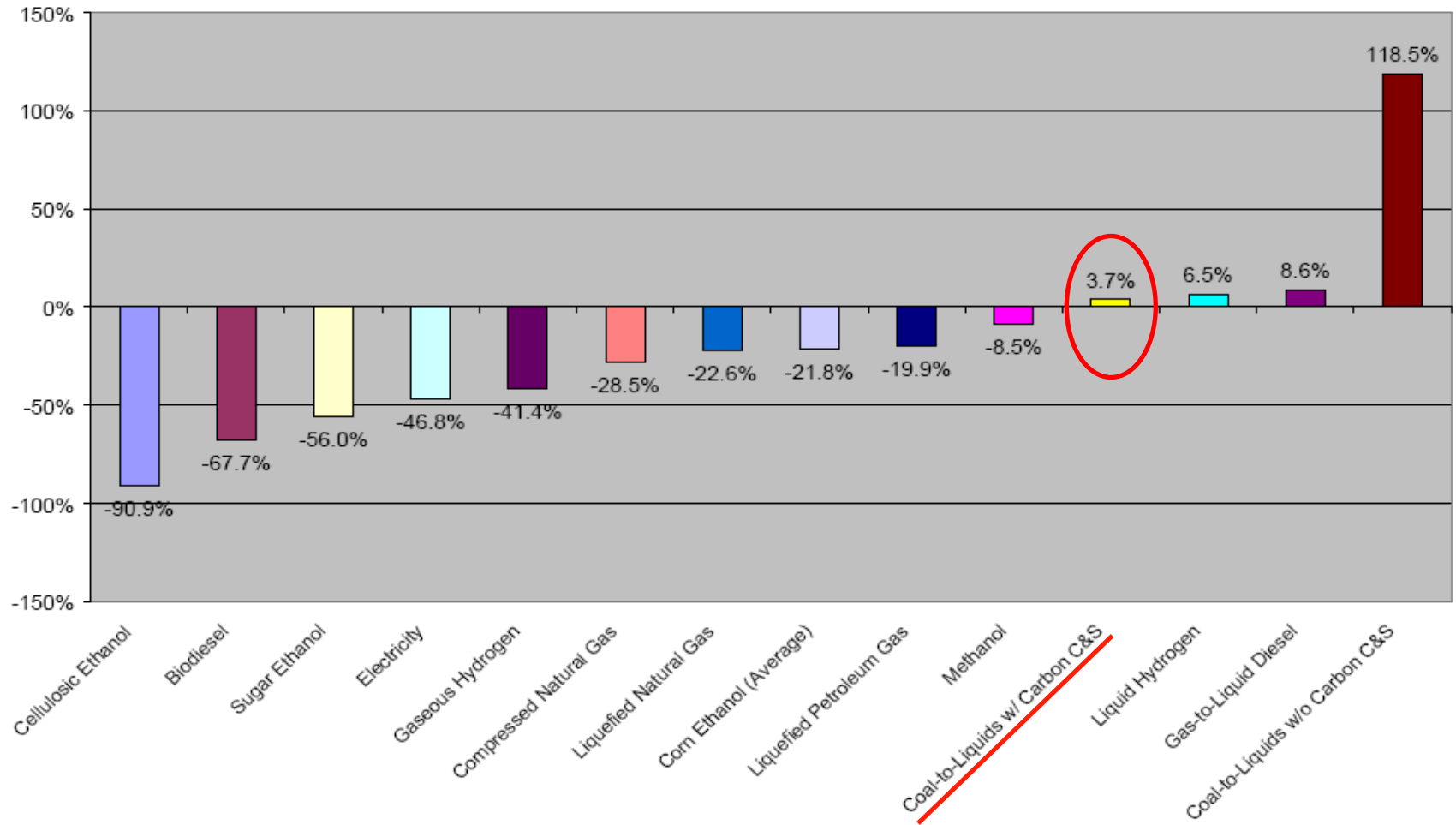
Due to Natural Gas Price Impacts, Gas Intensive Regions Will See Higher Real Electricity Cost Impact From Carbon Taxes

*East = combination of RFC, NPCC, SERC, SPP, MRO, and FRCC

EPA Analysis of S.2191 Coal Production for Electricity

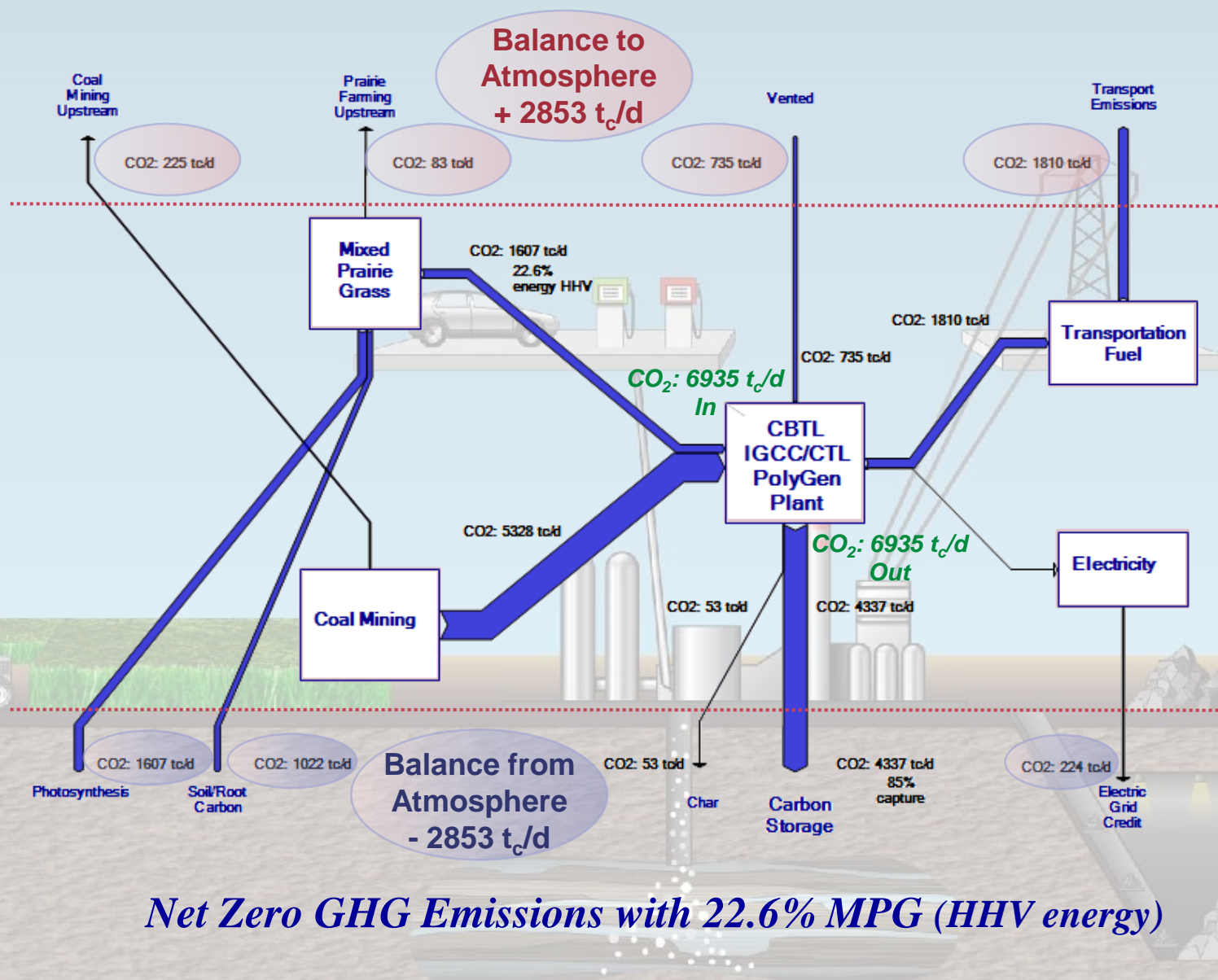


Percent Change in GHG Emissions



Sources: EPA Greenhouse Gas Impacts of Expanded Renewable and Alternative Fuels Use EPA420-F-07-035, April 2007

Carbon Balance CBTL Process w/MPG



Summary

- U.S. power generation industry is at a critical juncture, with social pressures and pending legislation demanding massive changes
- Competing demands for reliable, low-cost energy and climate change mitigation appear incongruent
- Uncertainty of regulatory outcomes and rising costs impact industry's willingness to commit capital investment, endangering near-term production capacity
- The U.S. must foster new processes that address conflicting energy objectives simultaneously
- Coal-based processes combined with biomass and CCS will offer attractive alternatives

