

# Growth From Subtraction

## *Impact of EPA Rules on Power Markets*

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DISCLOSURE APPENDIX CONTAINS IMPORTANT DISCLOSURES, ANALYST CERTIFICATIONS, INFORMATION ON TRADE ALERTS, ANALYST MODEL PORTFOLIOS AND THE STATUS OF NON-U.S ANALYSTS. FOR OTHER IMPORTANT DISCLOSURES, visit [www.credit-suisse.com/researchdisclosures](http://www.credit-suisse.com/researchdisclosures) or call +1 (877) 291-2683. U.S. Disclosure: Credit Suisse does and seeks to do business with companies covered in its research reports. As a result, investors should be aware that the Firm may have a conflict of interest that could affect the objectivity of this report. Investors should consider this report as only a single factor in making their investment decision.

## Prefer Cleaner Generators in Dirtier Markets

We see EPA rule making to limit conventional coal plant polluters as a potentially transformative event for the power sector and related industries. We assume:

- 60 GW of uncontrolled coal generation is closed
- Closures occur ratably from 2013-17, extending EPA mandated timelines
- \$100 BN + of capex for remediation through retrofitting coal plants and building replacement generation
- The power market recovery is accelerated by 4 -5 years
- Coal demand could fall 157 – 324 MM tons
- Natural Gas demand could grow 1.8 – 3.7 TCF on a 22 TCF market
- Regulated utilities annual growth rates could rise by 1- 4%

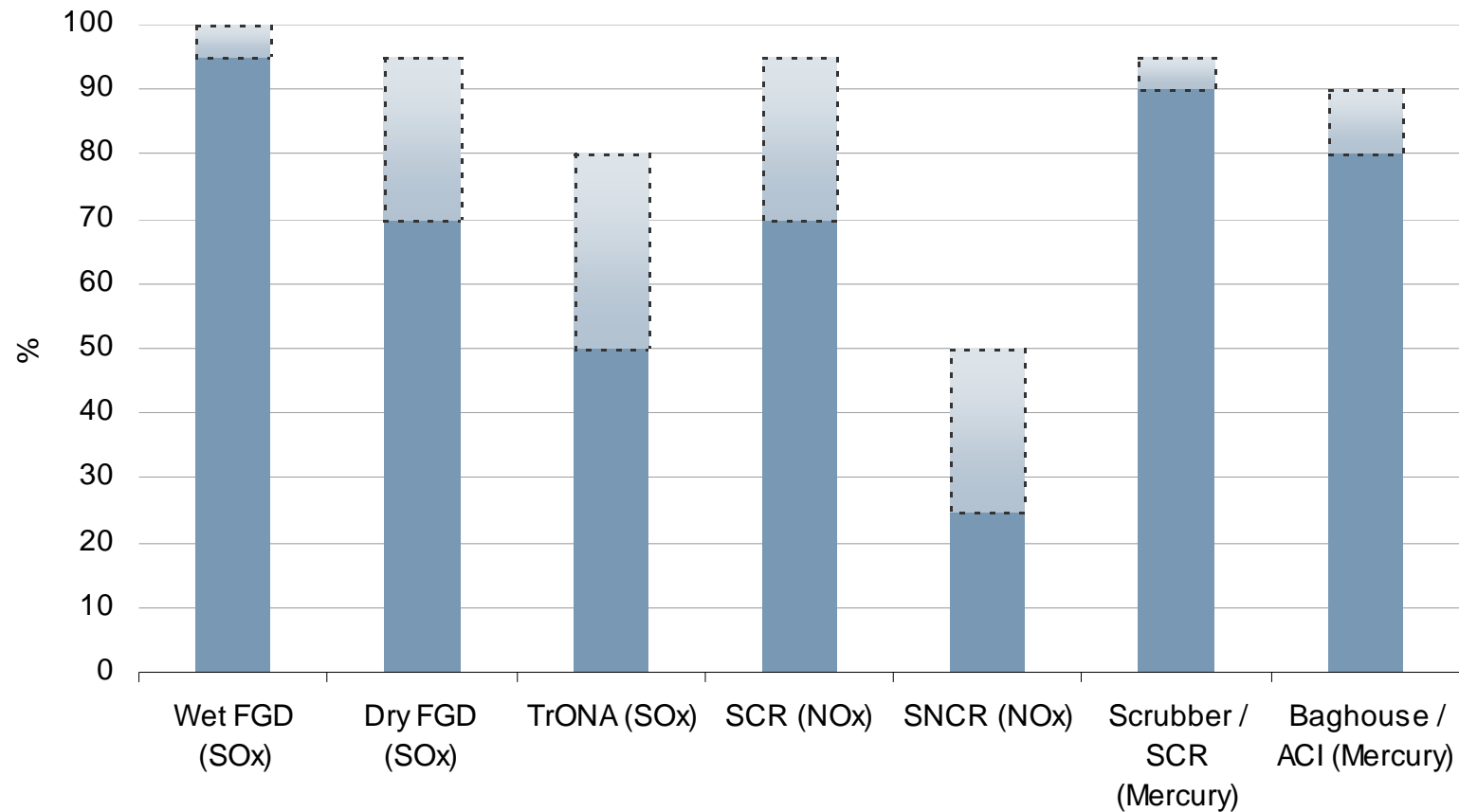
**We favor FE-AYE and RRI to take advantage of EPA action**

# EPA Calendar

RPM Auction Year	2013/2014	2014/2015	2015/2016	2016/2017	2017/2018	2018/2019	2019/2020	
	2010	2011	2012	2013	2014	2015	2016	
<b>CATR</b>		Apr 2011 Final Rule						
	7/10/2010 CATR proposed	Compliance Period				2 Year Extension Period		
<b>Mercury MACT</b>		3/16/2011 Draft Rule 11/16/2011 Final Rule	Compliance Period				2 Year Extension Period	

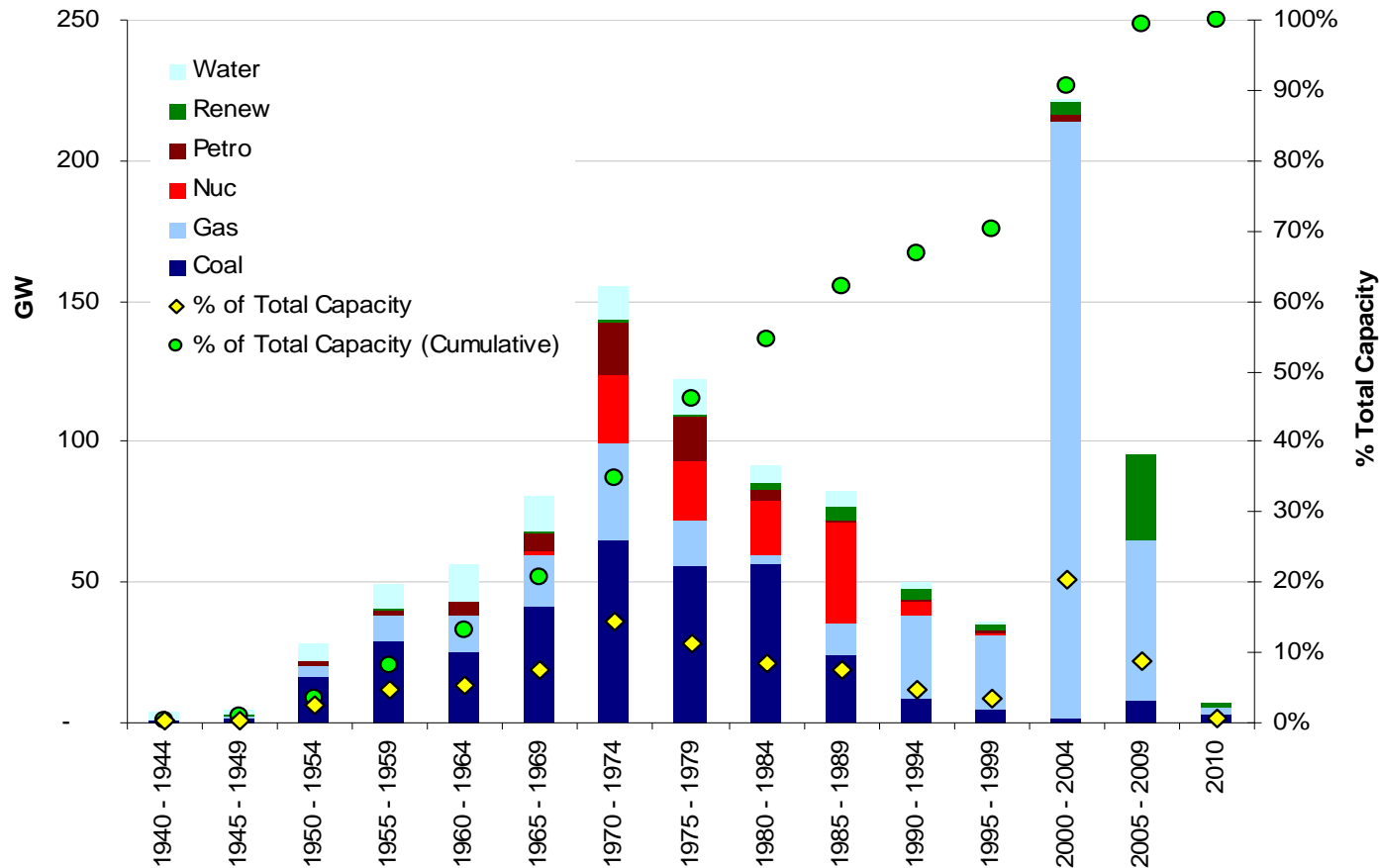
- We assume a 2 year “grace” period for compliance with new EPA rules, largely to support system reliability and logistical timing challenges of retrofit and newbuild programs

# Emissions Compliance Options



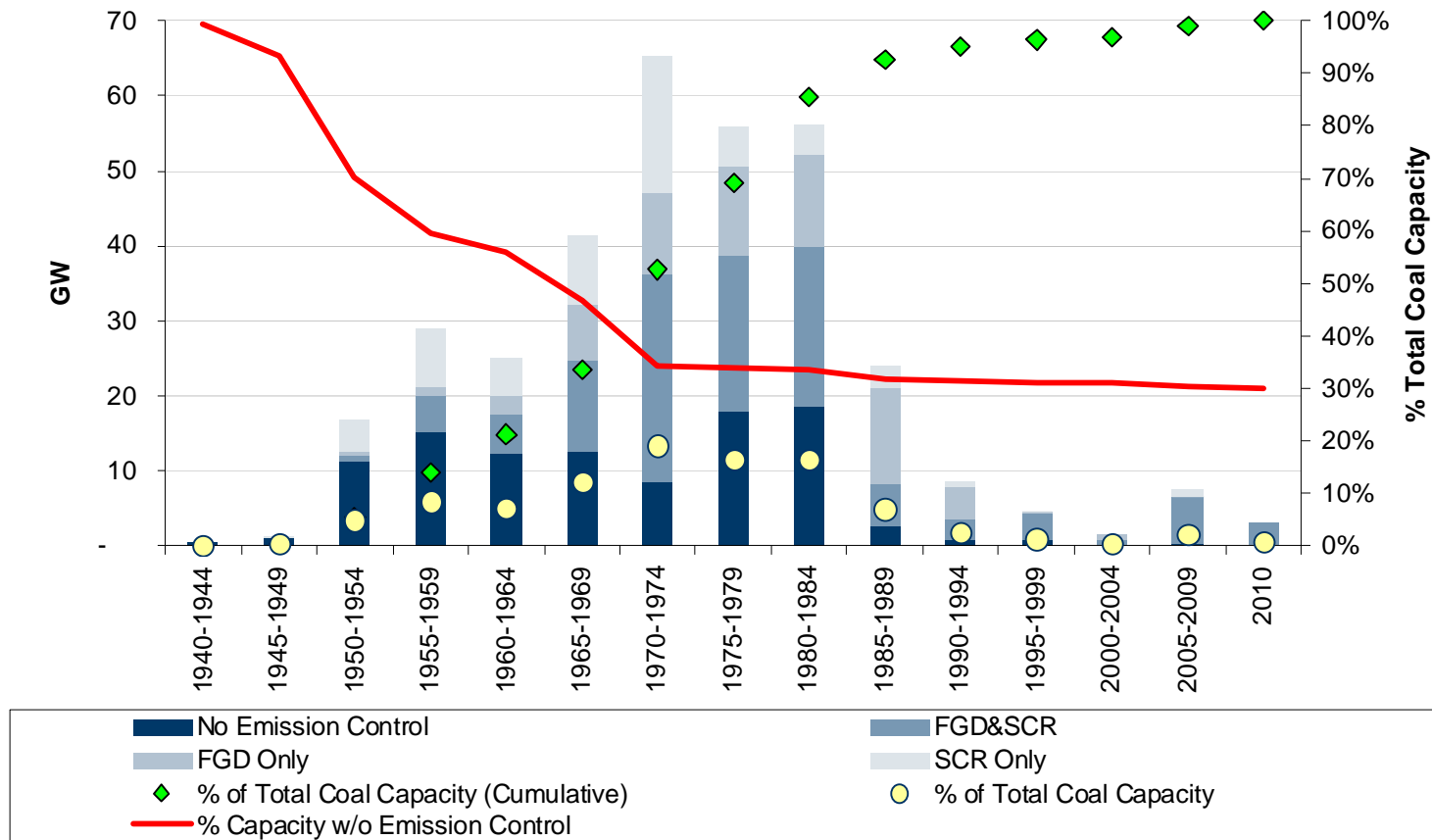
- FGD (aka scrubbers) cost \$300-500 / KW, SCR costs \$200-300 / KW, SNCR costs \$30-75 / kW, Baghouse Costs \$150 / KW

# US Power Plants by Vintage and Fuel Type



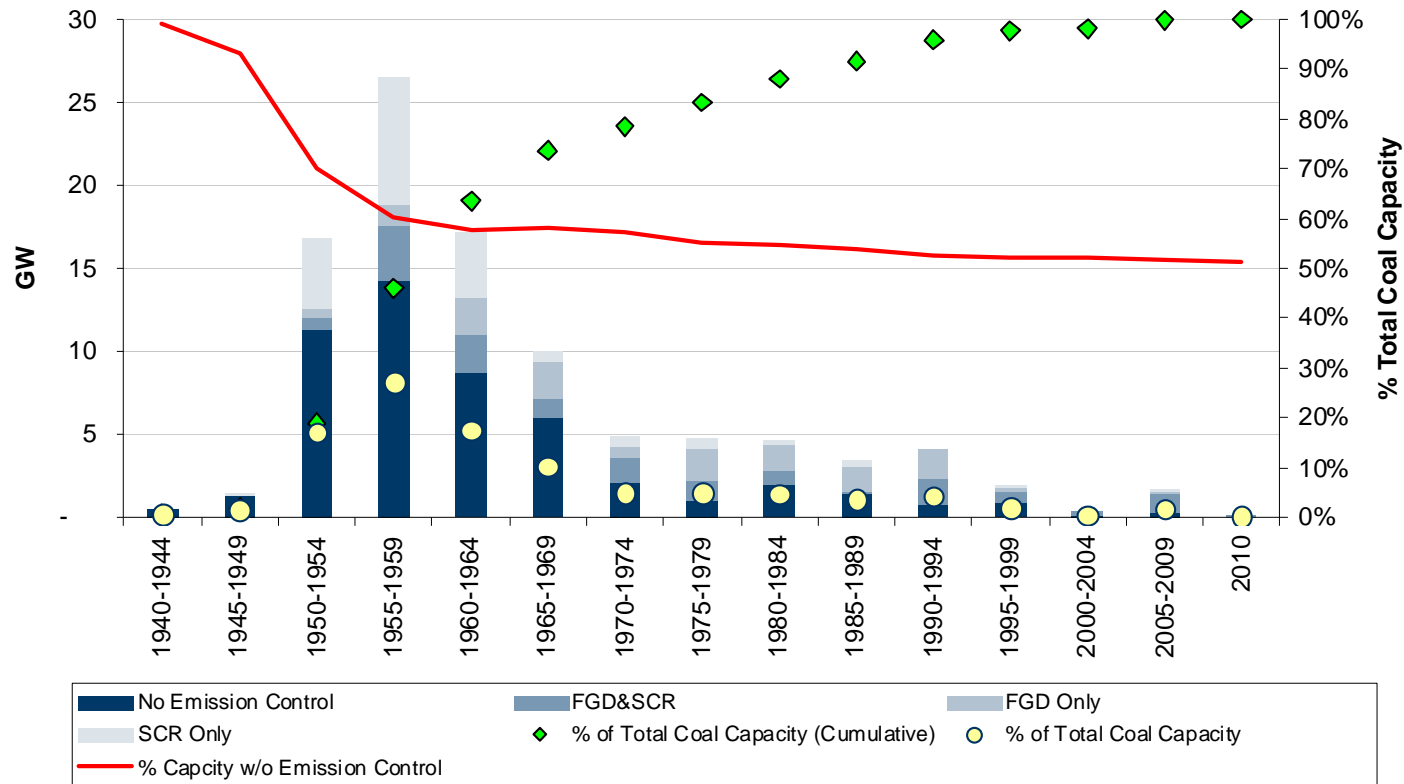
- Average age of the US coal fleet is 36 years, older than the total fleet and closing in on full depreciable life
- Average age of US generation fleet is 26 years

# Coal Fleet by Vintage and Environmental Controls



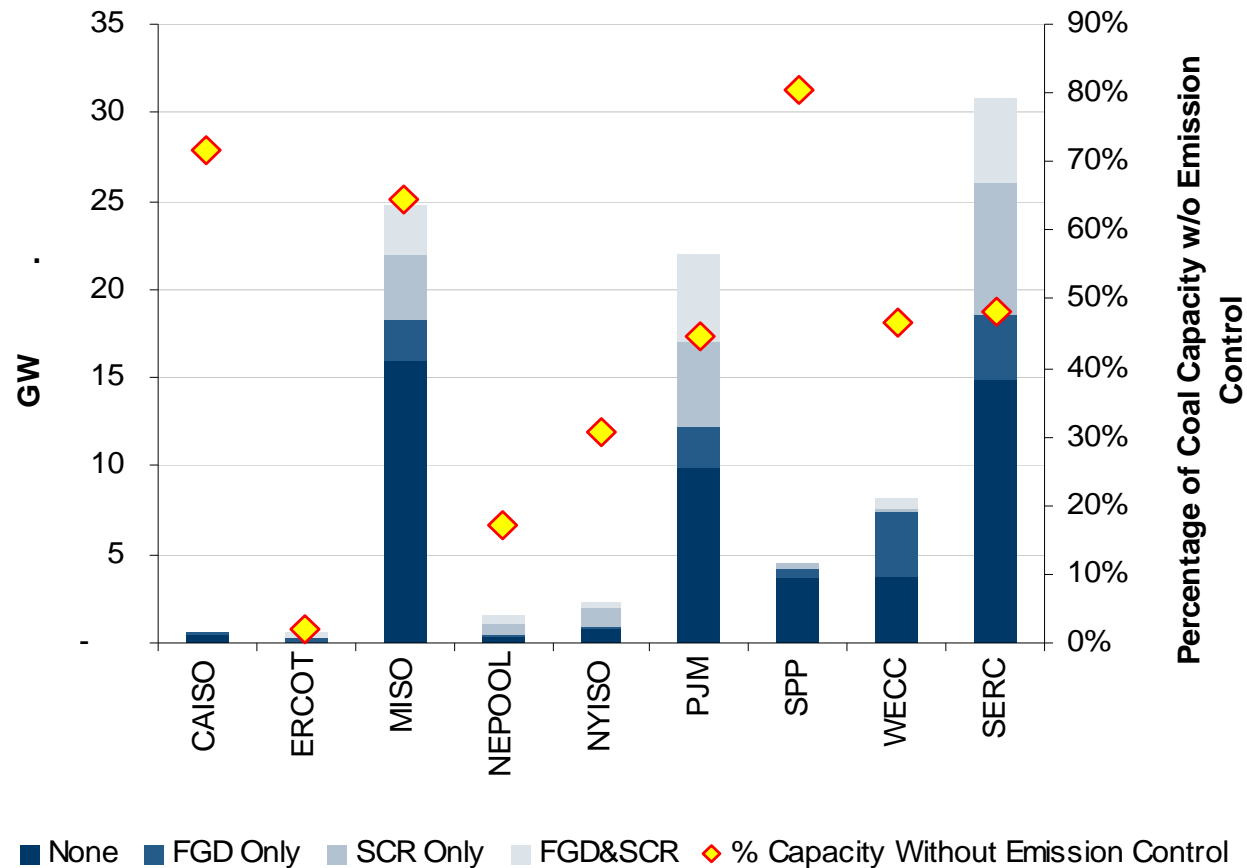
- Of the 340 GW US coal fleet:
- 103 GW (33%) has no emission controls
- 65 GW has only SCR but no scrubber
- 70% of coal fleet is over 30 years old
- 114 GW (33%) is over 40 years old

# Small Coal Plant (Unit Size < 300 MW) Vintage



- More than 70% of small coal plants (72 GW) were built over 40 years ago and should be mostly depreciated
- 50% lack any control equipment (50 GW) versus 30% for all US coal plants
- 19 GW lack scrubbers leaving even more exposure to mercury

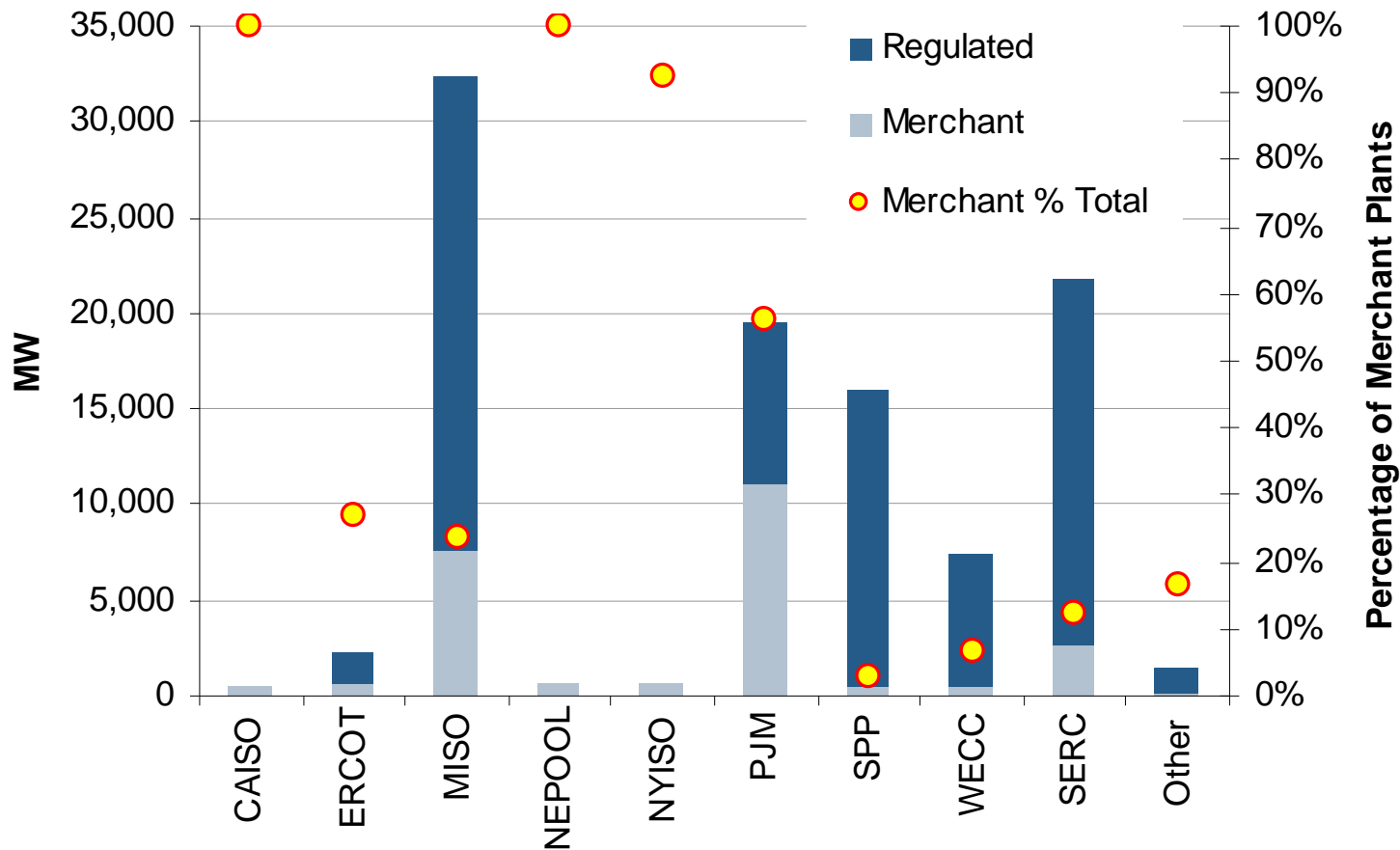
# Small Coal Plant Capacity by Emission Control



- MISO and SERC have most plants at risk
- MISO and SPP are the dirtiest in terms of relative uncontrolled capacity



# Coal Plants Without Emission Controls: Regulated vs Merchant Capacity



- Merchant coal market retirements are most concentrated in Western PJM and Eastern MISO, representing most actionable markets for EPA policy investing

# Our Coal Plant Closure Assumptions

- 60 GW: Our Base Case of closures, equating to all of the <300 MW coal plants lacking any environmental controls and half of the <300 MW just lacking a scrubber
- 35 GW: Our Low Case assumes half of all small plans lacking scrubbers (69 GW) are closed
- 100 GW: Our High Case assumes all plants lacking any control equipment (scrubbers and SCR) are closed

For earnings estimates we also ran a 60 GW closure scenario that used mark-to-market (MTM) commodity prices to put impact into today's context

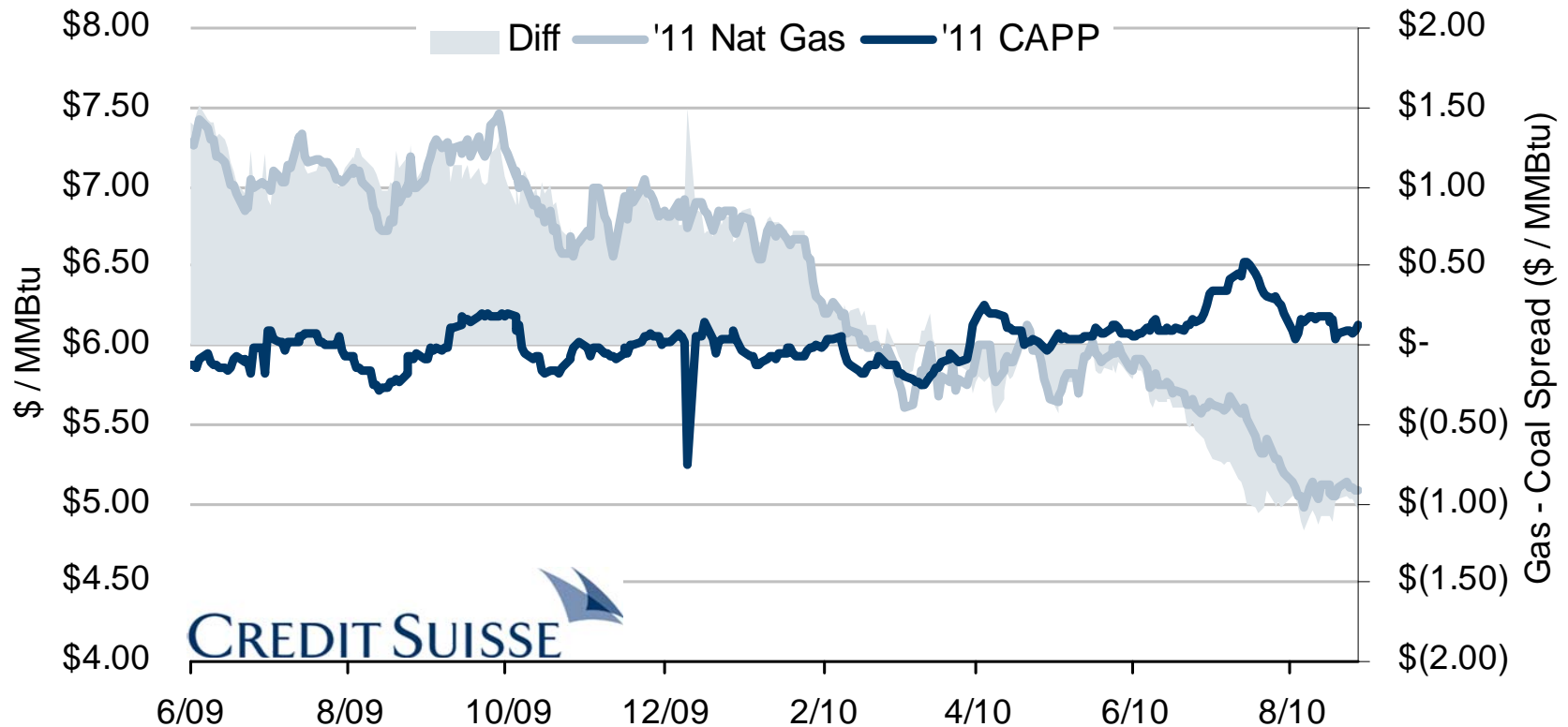
**We should note our closure assumptions will still require a significant portion of the US Coal fleet to require environmental capex to meet EPA emissions targets**

# EPA Calendar

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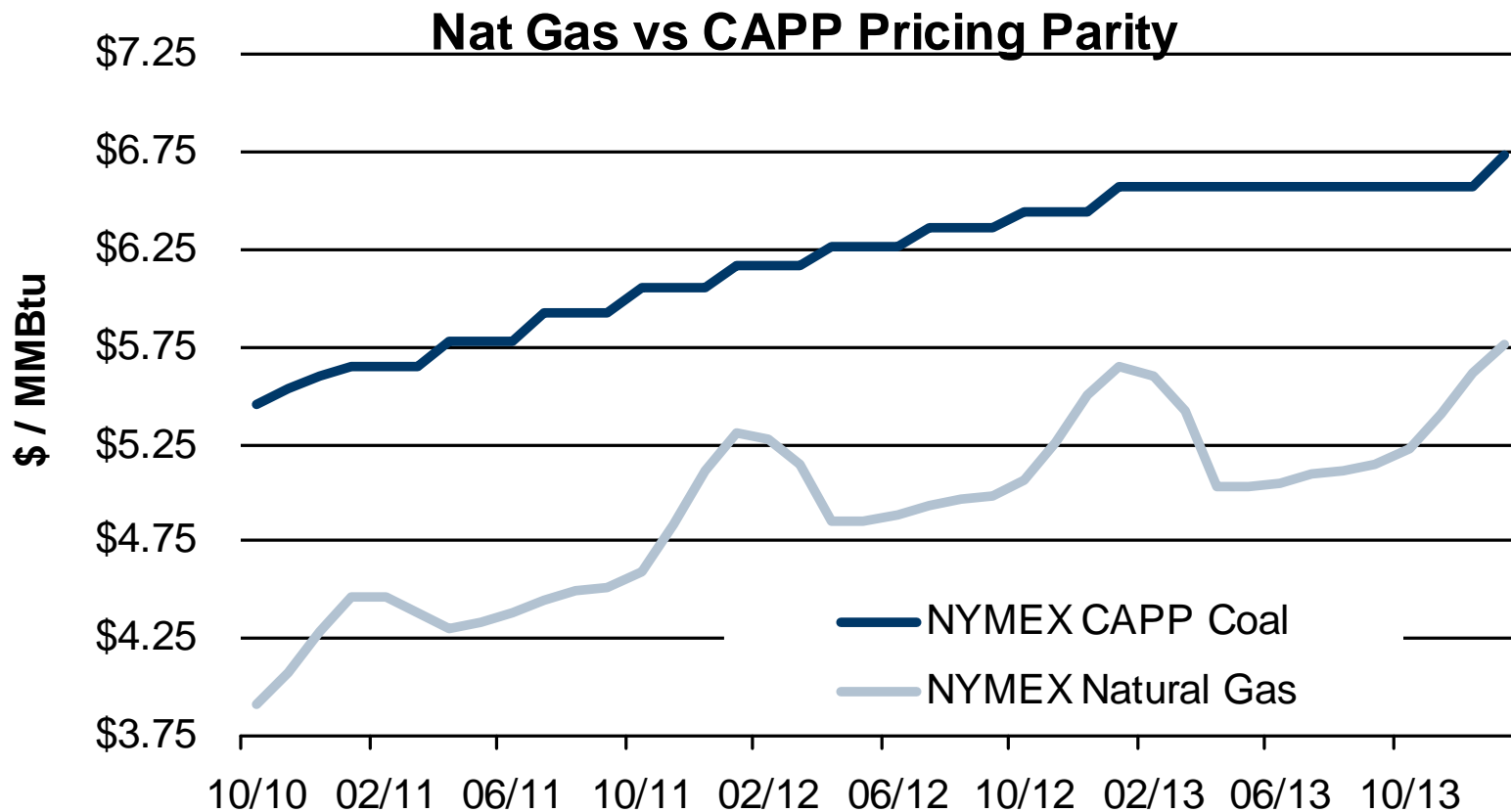
- We assume a 2 year “grace” period for compliance with new EPA rules, largely to support system reliability and logistical timing challenges of retrofit and newbuild programs
- Compliance delay arguments are heavy on ‘myth’ – Presidential 2-year delay, Congressional action, EPA discretion

# Coal-Gas Parity: 2011 Forwards



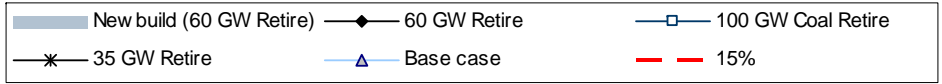
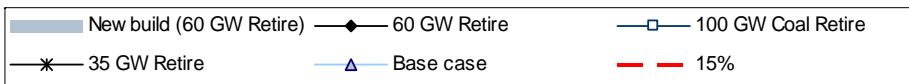
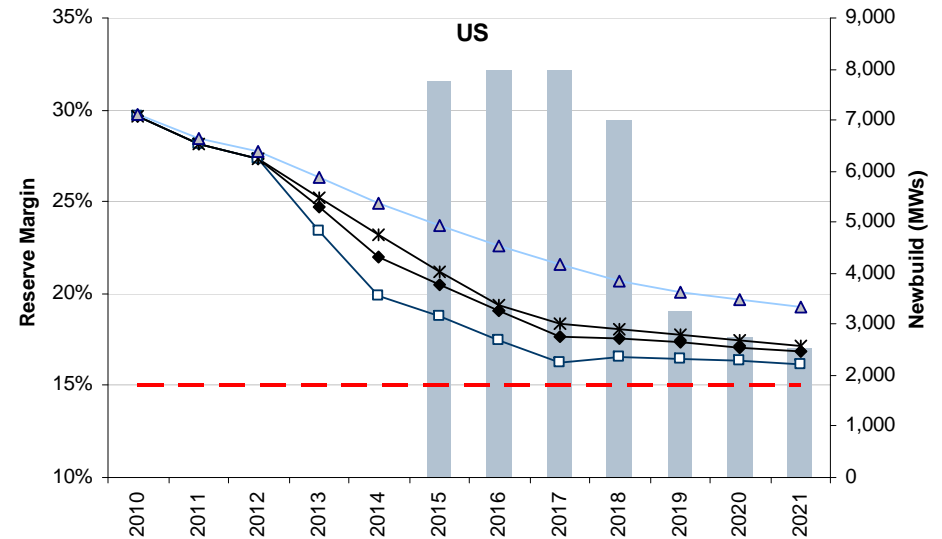
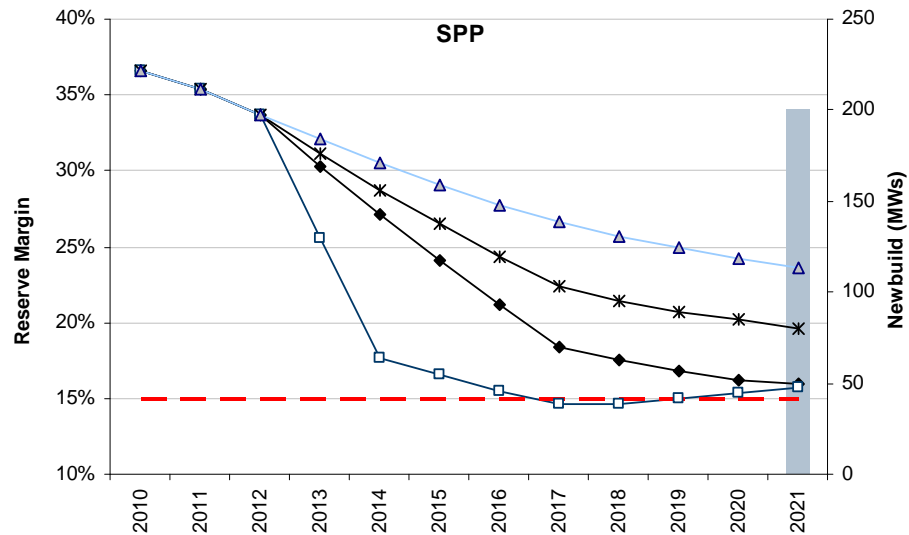
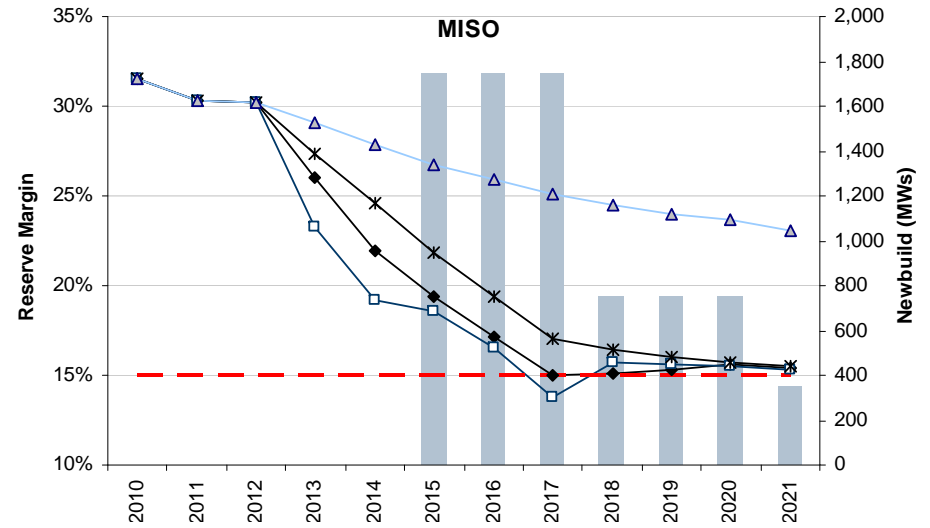
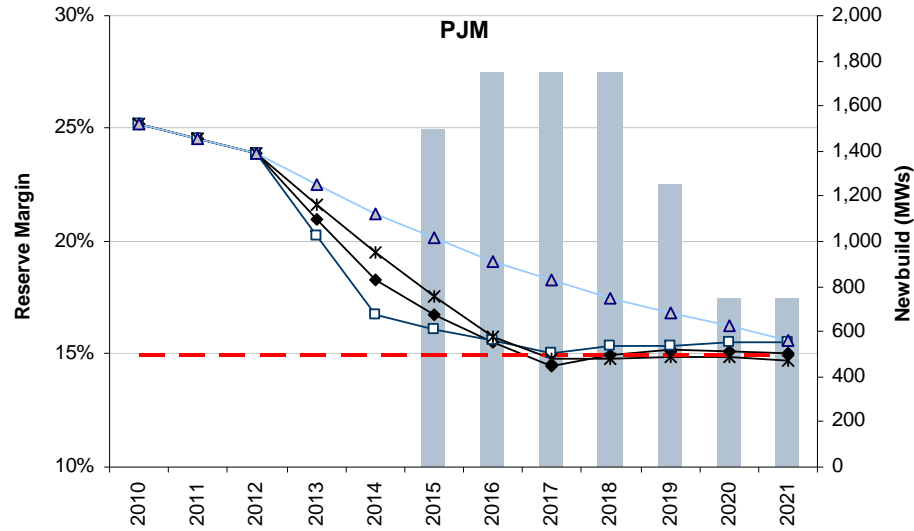
- On an electricity equivalent basis, looking out the forward curve coal prices at a premium to natural gas for the first sustained period in time

# Coal-Gas Parity (2010 – 13)



- Looking out the forward curve coal prices at a sustained premium to natural gas, showing reasonable doubt about the profitability of conventional coal generators

# Regional Reserve Margins



■ EPA policy looks to accelerate market recovery by 4-5 years vs do nothing outlook

## Newbuild Generation Forecast (2013 – 17)

Capacity (GW) MW to Retire	Retirement (2013-17)			Newbuild Projection (2013-17)		
	60 GW	35 GW	100 GW	60 GW	35 GW	100 GW
PJM	24	12	20	5	1	11
ERCOT	0	0	2	0	0	0
ISO New England	1	0	1	0	0	0
ISO New York	1	1	1	0	0	0
MISO	18	9	32	5	0	19
SERC	19	9	22	14	5	24
SPP	4	2	16	0	0	10
<b>US</b>	<b>60</b>	<b>30</b>	<b>103</b>	<b>24</b>	<b>6</b>	<b>65</b>

- We forecast new generation construction to meet some lost capacity needs, although replacements will likely be well below retirements as 20%+ reserve margins are inevitably tightened
- Our 60 GW retirement scenario would require 24 GW of newbuild to support regional reserve margins at 15%

# Capex: CCGT Newbuild versus Retrofit

\$ BN	% of Coal Plants with No Emission Control to be Scrubbed					
	\$/KW	0%	25%	50%	75%	100%
Blended Emission Control Cost	300	115	96	77	57	38
	350	115	97	80	62	45
	400	115	99	83	67	51
	450	115	101	86	72	57
	500	115	102	89	77	64
	550	115	104	93	81	70
	600	115	105	96	86	77
	650	115	107	99	91	83
	700	115	109	102	96	89

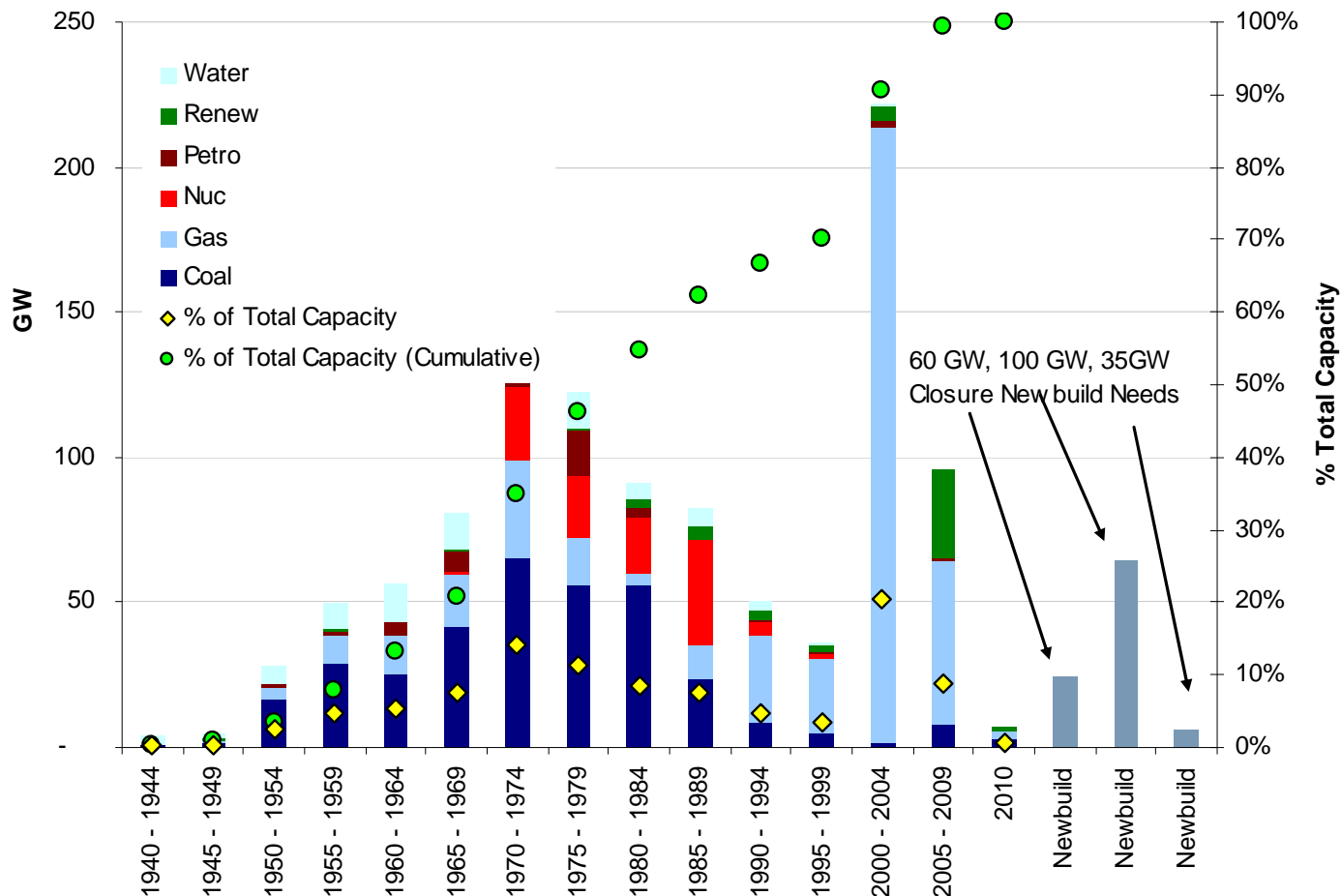
- Retrofitting all plants without any emission controls would cost \$40-90 BN; replacing with CCGTs would cost \$115 BN

- Retrofit all plants lacking a scrubber or a SCR would cost \$80 – 110 BN

\$ BN	SCR				
	\$/ KW	75	150	225	300
FGD	300	54	65	75	86
	350	61	72	83	93
	400	68	79	90	100
	450	75	86	97	108
	500	83	93	104	115
	550	90	101	111	122
	600	97	108	118	129
	650	104	115	126	136
	700	111	122	133	144

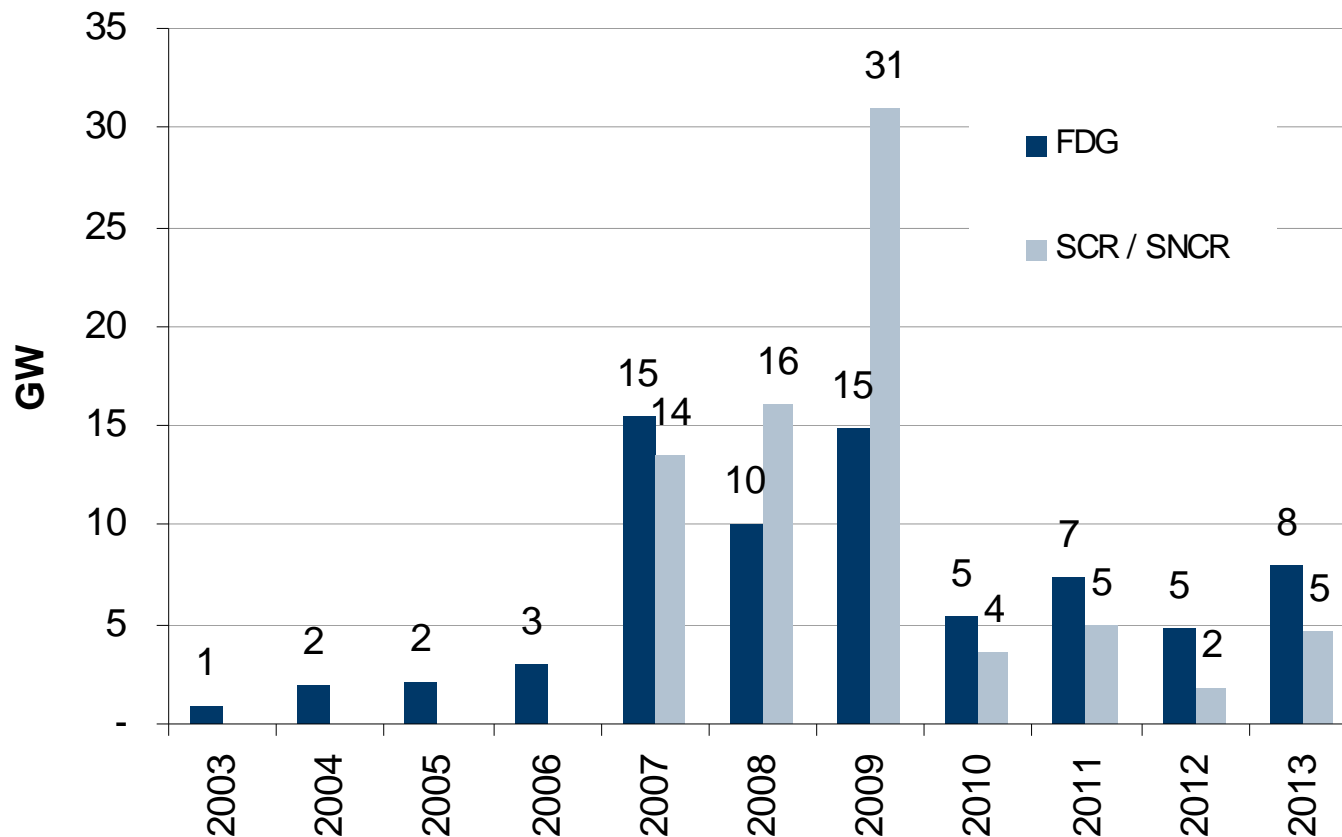


# Putting in Context: Newbuild Needs vs History



- Newbuild requirements to support 15% reserve margins after EPA impacted plant closures looks manageable over the next 5-7 years after huge construction programs throughout the last decade

# Emission Control Construction Activity



- Active construction cycle for environmental equipment before ramping to address the remaining uncontrolled US generation fleet

# Revenue Requirement: CCGT versus Retrofit

Gas Price (\$ / MMBtu)	Coal Price (\$/ton)									
	50	55	60	65	70	75	80	85	90	95
4.0	(3.2)	(5.3)	(7.4)	(9.5)	(11.6)	(13.7)	(15.8)	(17.9)	(20.0)	(22.1)
4.5	0.2	(1.9)	(4.0)	(6.1)	(8.2)	(10.3)	(12.4)	(14.5)	(16.6)	(18.7)
5.0	3.6	1.5	(0.6)	(2.7)	(4.8)	(6.9)	(9.0)	(11.1)	(13.2)	(15.3)
5.5	7.0	4.9	2.8	0.7	(1.4)	(3.5)	(5.6)	(7.7)	(9.8)	(11.9)
6.0	10.4	8.3	6.2	4.1	2.0	(0.1)	(2.2)	(4.3)	(6.4)	(8.5)
6.5	13.8	11.7	9.6	7.5	5.4	3.3	1.2	(0.9)	(3.0)	(5.1)
7.0	17.2	15.1	13.0	10.9	8.8	6.7	4.6	2.5	0.4	(1.7)
7.5	20.6	18.5	16.4	14.3	12.2	10.1	8.0	5.9	3.8	1.7
8.0	24.0	21.9	19.8	17.7	15.6	13.5	11.4	9.3	7.2	5.1
8.5	27.4	25.3	23.2	21.1	19.0	16.9	14.8	12.7	10.6	8.5
9.0	30.8	28.7	26.6	24.5	22.4	20.3	18.2	16.1	14.0	11.9

## For Regulated Utilities:

- At current commodity forwards, a newbuild CCGT is cheaper than retrofit for rate payers
- If the gas price is over \$7 / MMBtu, retrofit could be economically more attractive

# Retrofit Economics (Eastern Coal)

		Remaining Life							
		5	10	15	20	25	30	35	40
Retrofit Capex \$/KW	300	26.5	21.4	19.7	18.9	18.4	18.1	17.8	17.6
	400	31.9	25.2	23.0	21.8	21.2	20.7	20.4	20.2
	500	37.4	29.0	26.2	24.8	23.9	23.4	23.0	22.7
	600	42.8	32.8	29.4	27.7	26.7	26.0	25.6	25.2
	700	48.3	36.5	32.6	30.7	29.5	28.7	28.1	27.7
	800	53.8	40.3	35.8	33.6	32.3	31.4	30.7	30.2

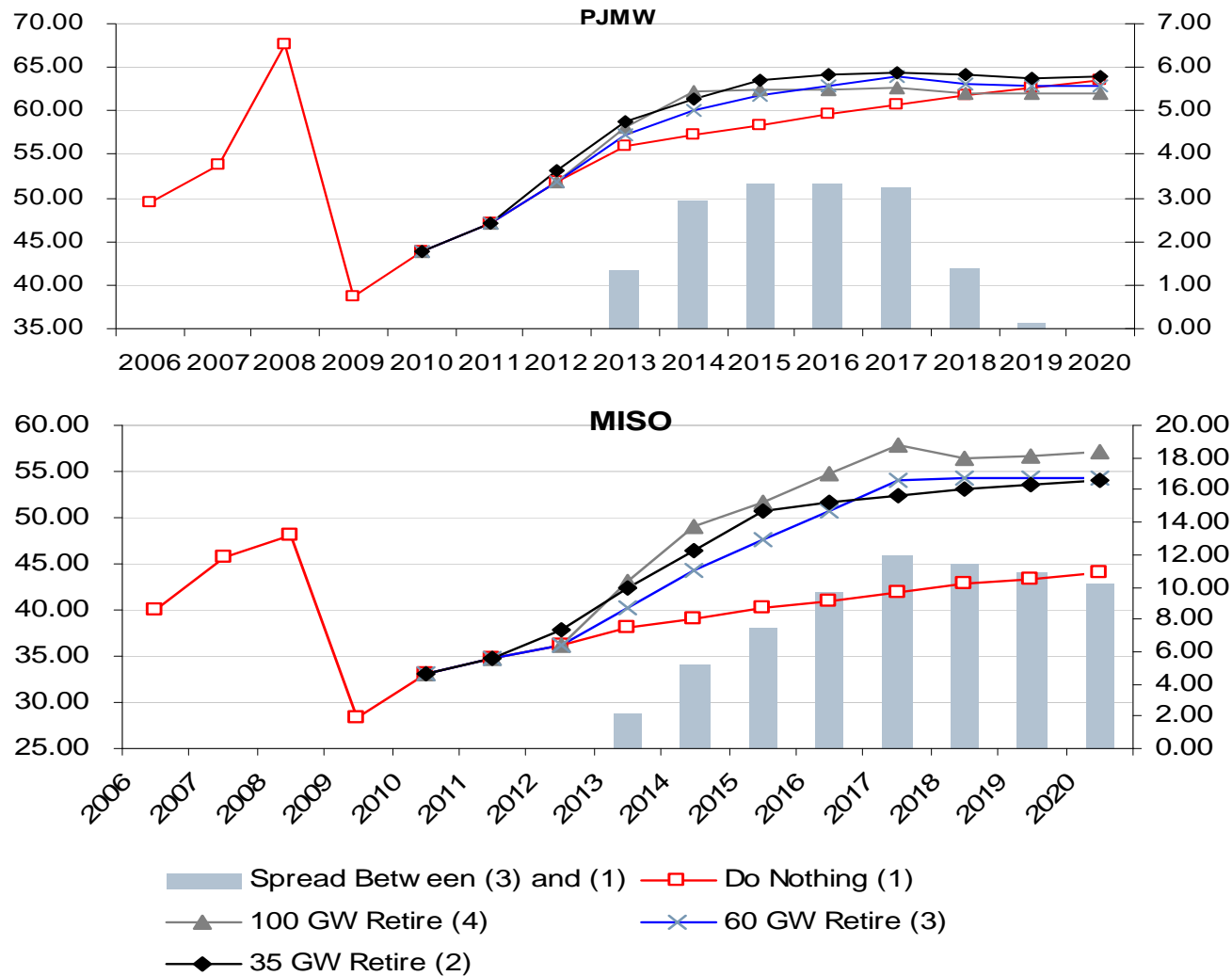
  

		Capacity Payment (\$ / MW- Day)							
		25	50	75	100	125	150	175	200
Retrofit Capex \$/KW	300.0	20.4	18.9	17.4	16.0	14.5	13.1	11.6	10.2
	400.0	23.3	21.8	20.4	18.9	17.5	16.0	14.6	13.1
	500.0	26.2	24.8	23.3	21.9	20.4	19.0	17.5	16.0
	600.0	29.2	27.7	26.3	24.8	23.3	21.9	20.4	19.0
	700.0	32.1	30.7	29.2	27.7	26.3	24.8	23.4	21.9
	800.0	35.1	33.6	32.1	30.7	29.2	27.8	26.3	24.9

To earn a 12% ROE on non-regulated environmental retrofits would require:

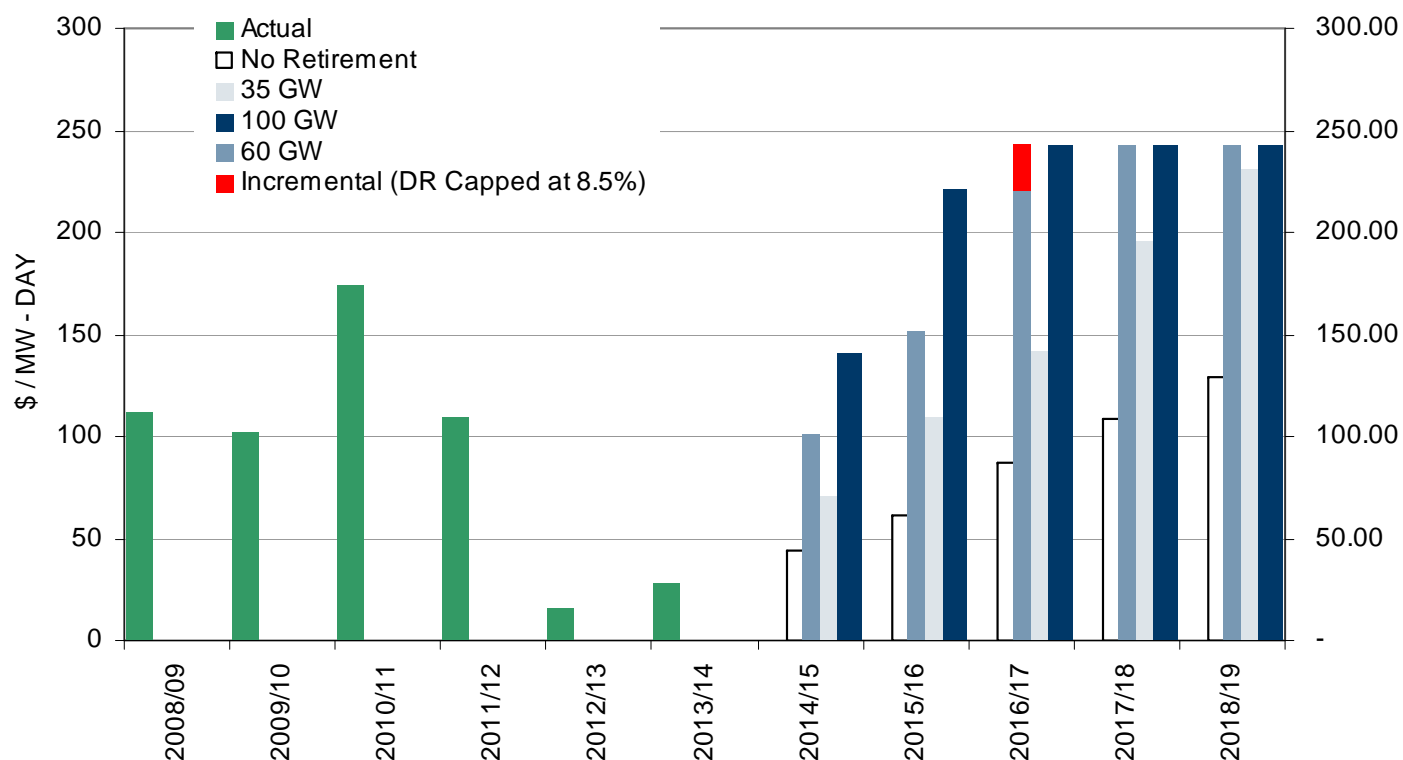
- At \$50 / MW – Day capacity price, \$25 / MWH dark spread is required to make retrofit of economic
- At \$ 200 / MW – Day, dark spread still needs to be in the high teens

# Power Prices



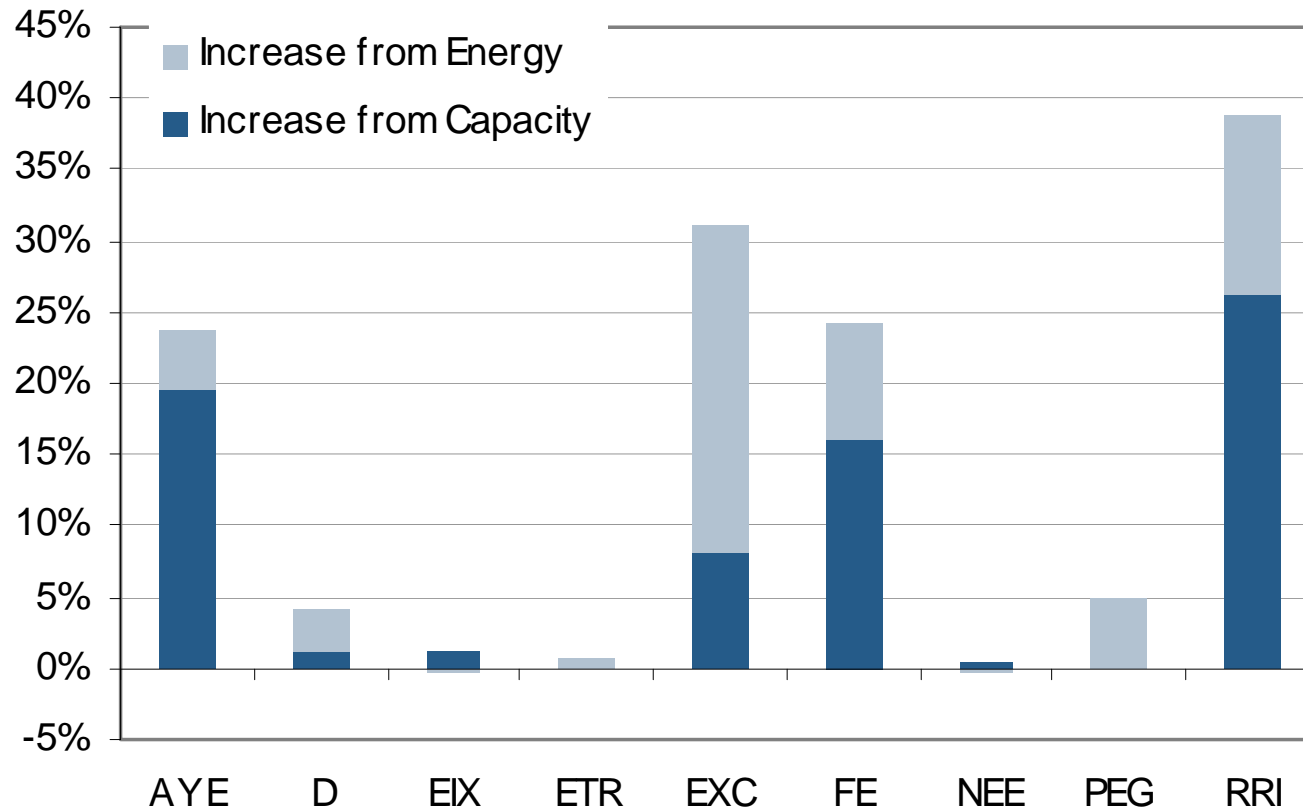
- Plant closures will drive power prices appreciably higher (\$5-10 / MWH) to provide an economic return that attracts new investment

# PJM-RTO Capacity Price Forecasts



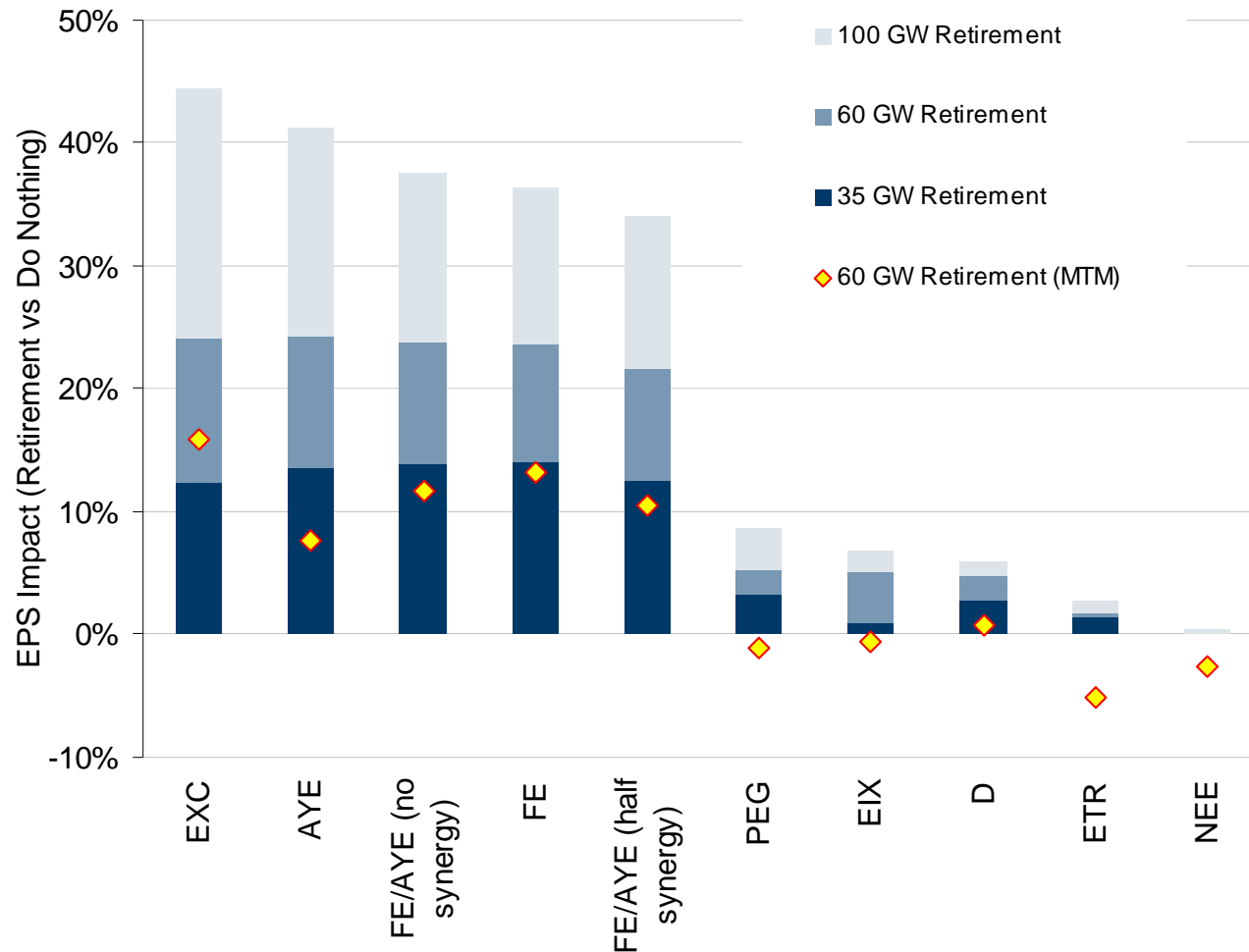
- Depending on plant closure scenario, RTO capacity prices should rally significantly over coming auctions to attract needed new investment
- Interestingly, capacity prices converge on similar levels within a couple auction cycles highlighting the acceleration of recovery created by EPA policy
- We assumed 10% demand response market share; current proposals would limit at 8.5% for RTO which would reshape our forecasts (see red bar)

# 2015 EBITDA Impact – Energy vs Capacity Breakdown



- A significant component of earnings upside will come from higher capacity prices in RTO; this is hardly just an energy pricing conversation

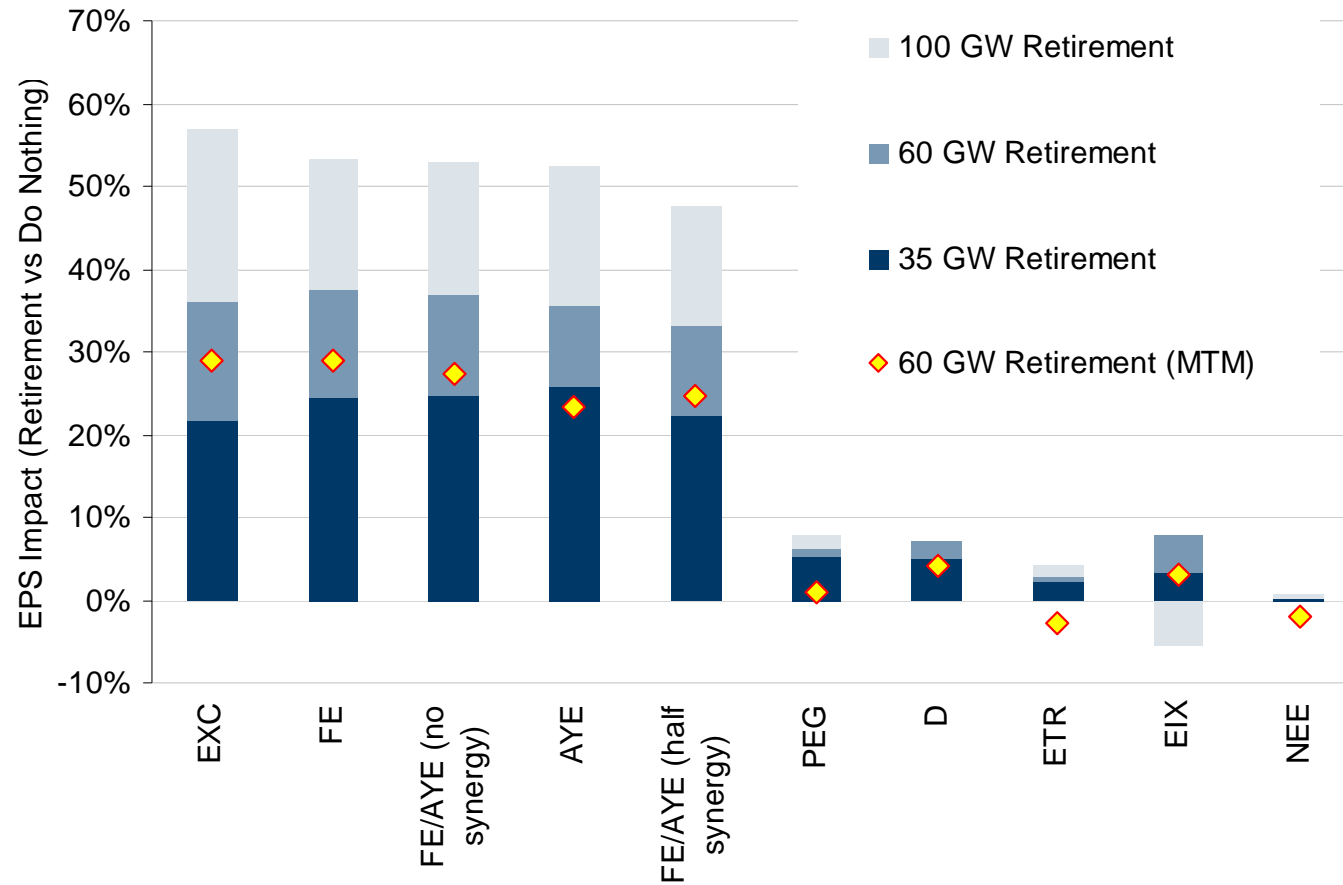
# 2014 EPS Impact from Coal Plant Retirements



- EPS leverage to different retirement scenarios for PJM-West players could be 15-30% realistically

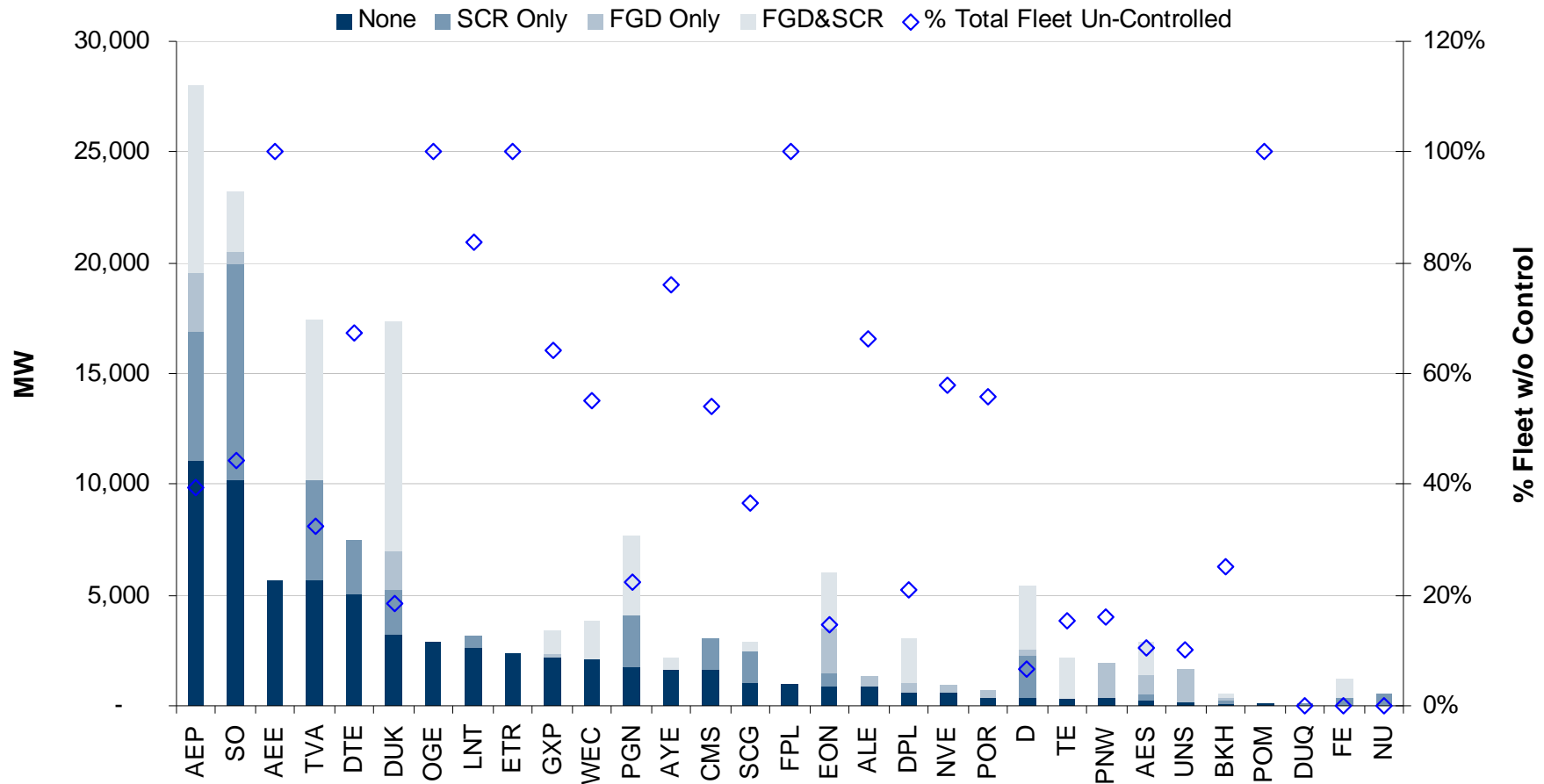


# 2015 EPS Impact from Coal Plant Retirements



- EPS leverage to different retirement scenarios for PJM-West players could be 25-50% realistically

# Regulated Utilities Coal Plant By Emission Control

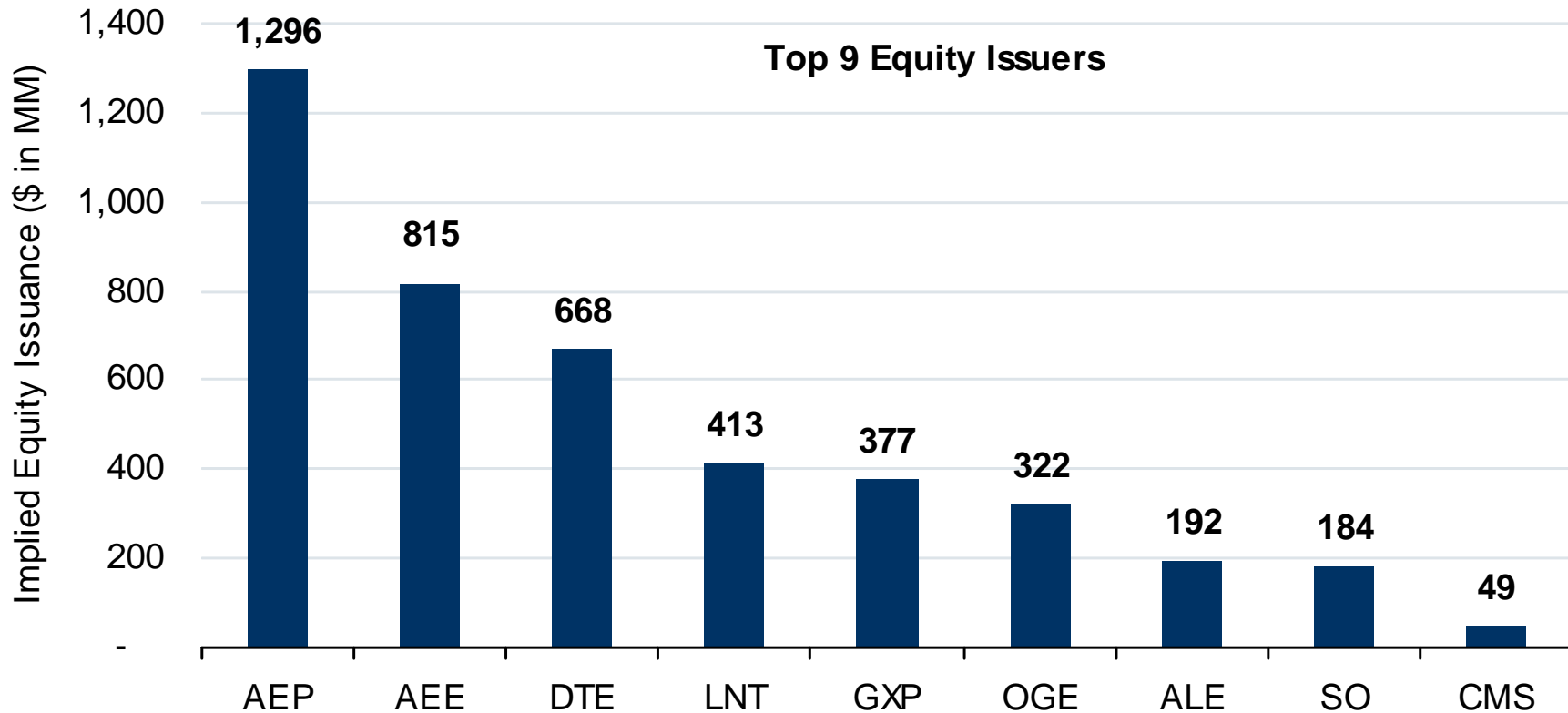


- Regulated Utilities have significant coal plant retirement exposure
- As a percentage of capacity, AEE, OGE and DTE have work to do

# Regulated Utilities: Prospective Capex and EPS Growth

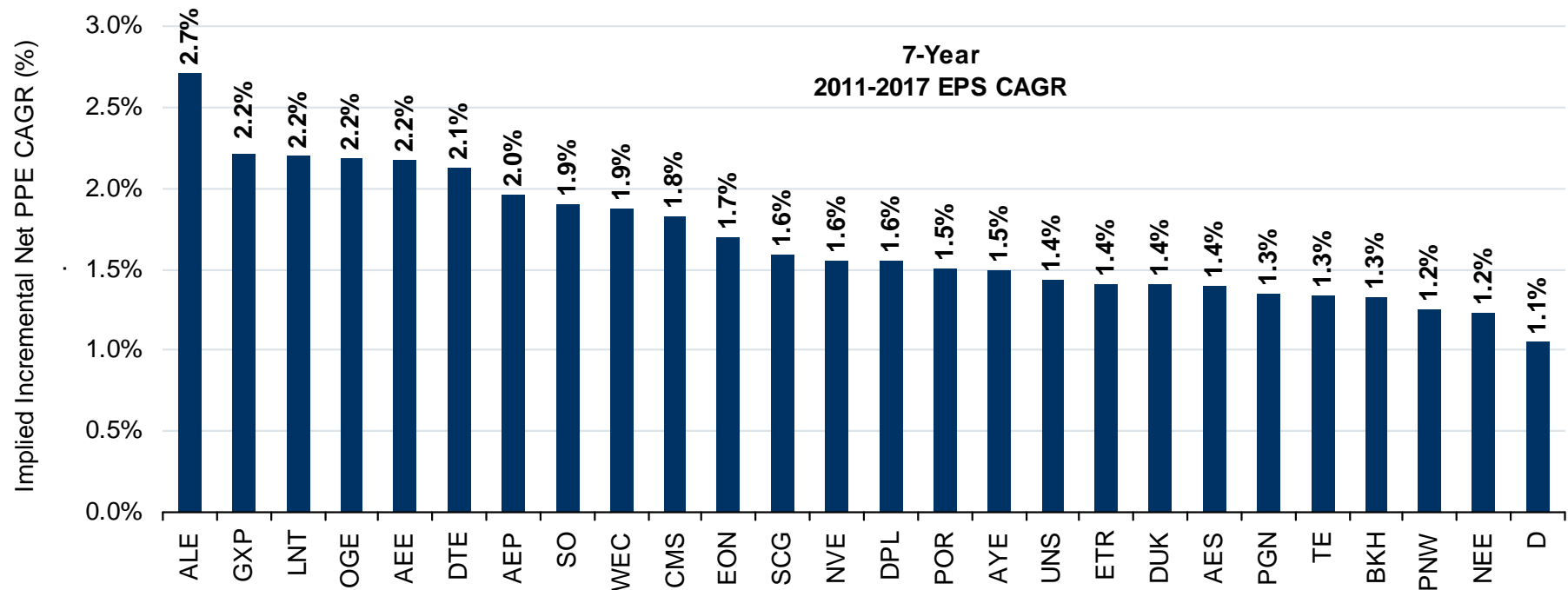
Ticker	Generation Mix		Implied Capital Expenditures			% Net PPE	EPS Impact			
	Un-Scrubbed Plant (Not Inc. Planned Emission Ctrl)		Replace Small Plant with CCGT \$900/kW	Retrofit Big Plant \$600/kW	Total Implied Capex		Incremental Diluted EPS	5-Year EPS CAGR	7-Year EPS CAGR	Cumulative Earnings Growth
	Small (MW)	Large (MW)	\$MM	\$MM	\$MM		\$ / Share	%	%	%
ALE	518	365	466	219	685	42%	0.83	3.8%	2.7%	20.6%
GXP	759	1,400	683	840	1,523	23%	0.46	3.1%	2.2%	16.5%
LNT	1,210	1,425	1,089	855	1,944	33%	0.75	3.1%	2.2%	16.5%
OGE	-	2,854	-	1,712	1,712	29%	0.76	3.1%	2.2%	16.4%
AEE	564	5,090	508	3,054	3,561	20%	0.63	3.1%	2.2%	16.3%
DTE	1,661	3,391	1,495	2,034	3,530	28%	0.91	3.0%	2.1%	15.9%
AEP	4,402	6,632	3,962	3,979	7,941	23%	0.72	2.7%	2.0%	14.5%
SO	5,259	4,970	4,733	2,982	7,715	20%	0.43	2.7%	1.9%	14.1%
WEC	1,715	419	1,543	251	1,794	20%	0.70	2.6%	1.9%	13.9%
CMS	1,236	404	1,112	242	1,355	14%	0.25	2.6%	1.8%	13.5%
EON	443	446	399	268	667	1%	0.02	2.4%	1.7%	12.5%
SCG	1,061	-	955	-	955	11%	0.36	2.2%	1.6%	11.7%
NVE	576	-	518	-	518	6%	0.11	2.2%	1.6%	11.4%
DPL	414	230	373	138	511	18%	0.21	2.2%	1.6%	11.4%
POR	-	391	-	234	234	6%	0.15	2.1%	1.5%	11.0%
AYE	532	-	479	-	479	5%	0.14	2.1%	1.5%	10.9%
UNS	173	-	156	-	156	6%	0.19	2.0%	1.4%	10.5%
ETR	2	2,352	2	1,411	1,413	6%	0.37	2.0%	1.4%	10.3%
DUK	2,657	560	2,391	336	2,727	7%	0.10	2.0%	1.4%	10.3%
AES	302	-	271	-	271	1%	0.02	2.0%	1.4%	10.3%
PGN	747	964	672	579	1,251	6%	0.21	1.9%	1.3%	9.8%
TE	326	-	294	-	294	5%	0.07	1.9%	1.3%	9.8%
BKH	125	-	112	-	112	5%	0.14	1.9%	1.3%	9.7%
PNW	312	-	281	-	281	3%	0.13	1.8%	1.2%	9.1%
NEE	-	952	-	571	571	2%	0.07	1.7%	1.2%	8.9%
D	367	-	330	-	330	1%	0.03	1.5%	1.1%	7.6%
TVA	5,634	-	5,071	-	NA	NA	n/a	n/a	n/a	n/a
<b>Total</b>	<b>31,872</b>	<b>36,961</b>	<b>28,685</b>	<b>22,177</b>	<b>45,791</b>	<b>10%</b>		<b>2.3%</b>	<b>1.6%</b>	<b>11.9%</b>

# Funding Capex: Top 9 Equity Issuers (Absolute)



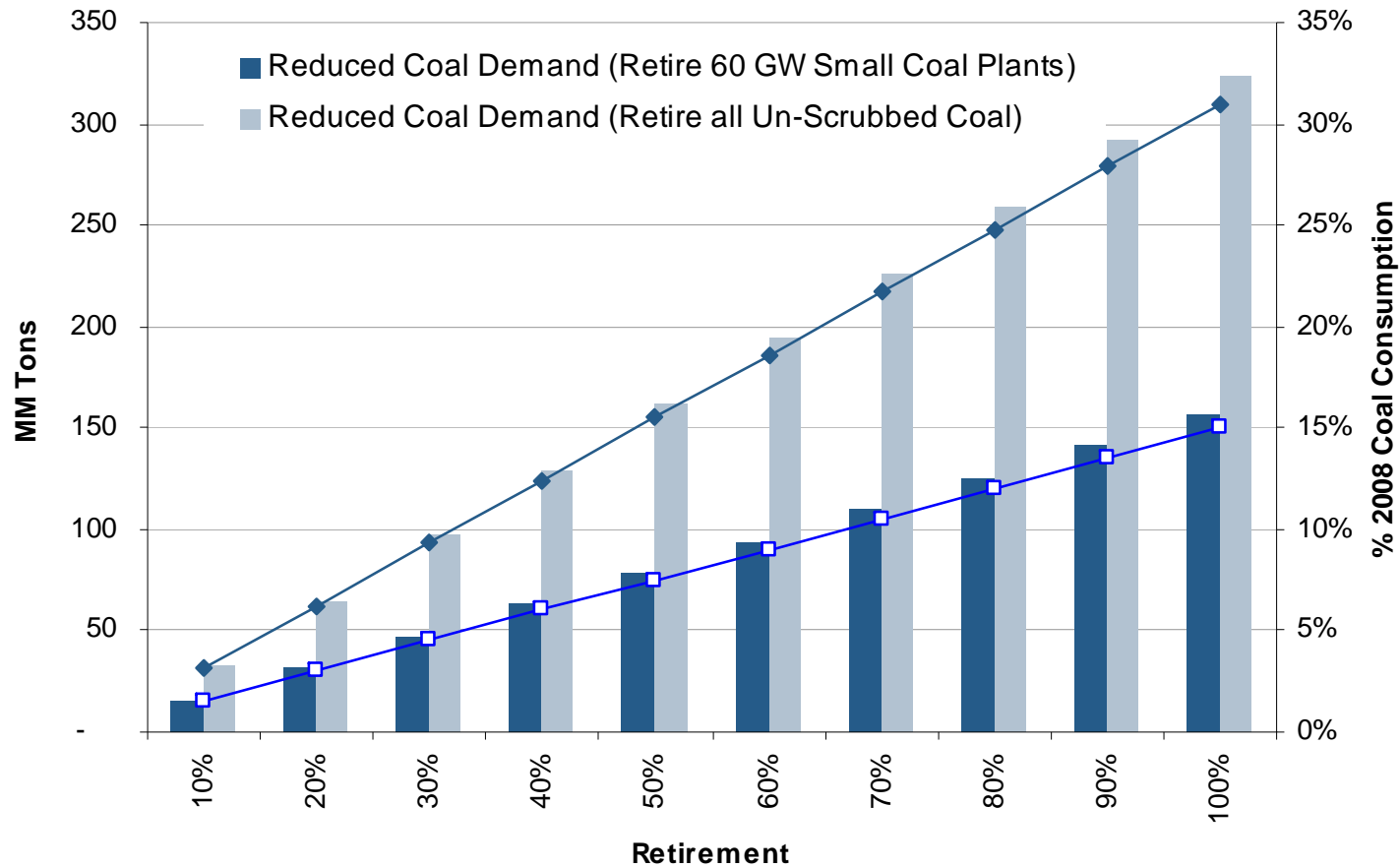
- Funding higher growth rates will require additional outside equity for many over the 7 year time horizon

# Regulated Growth: 2011-2017 EPS CAGR



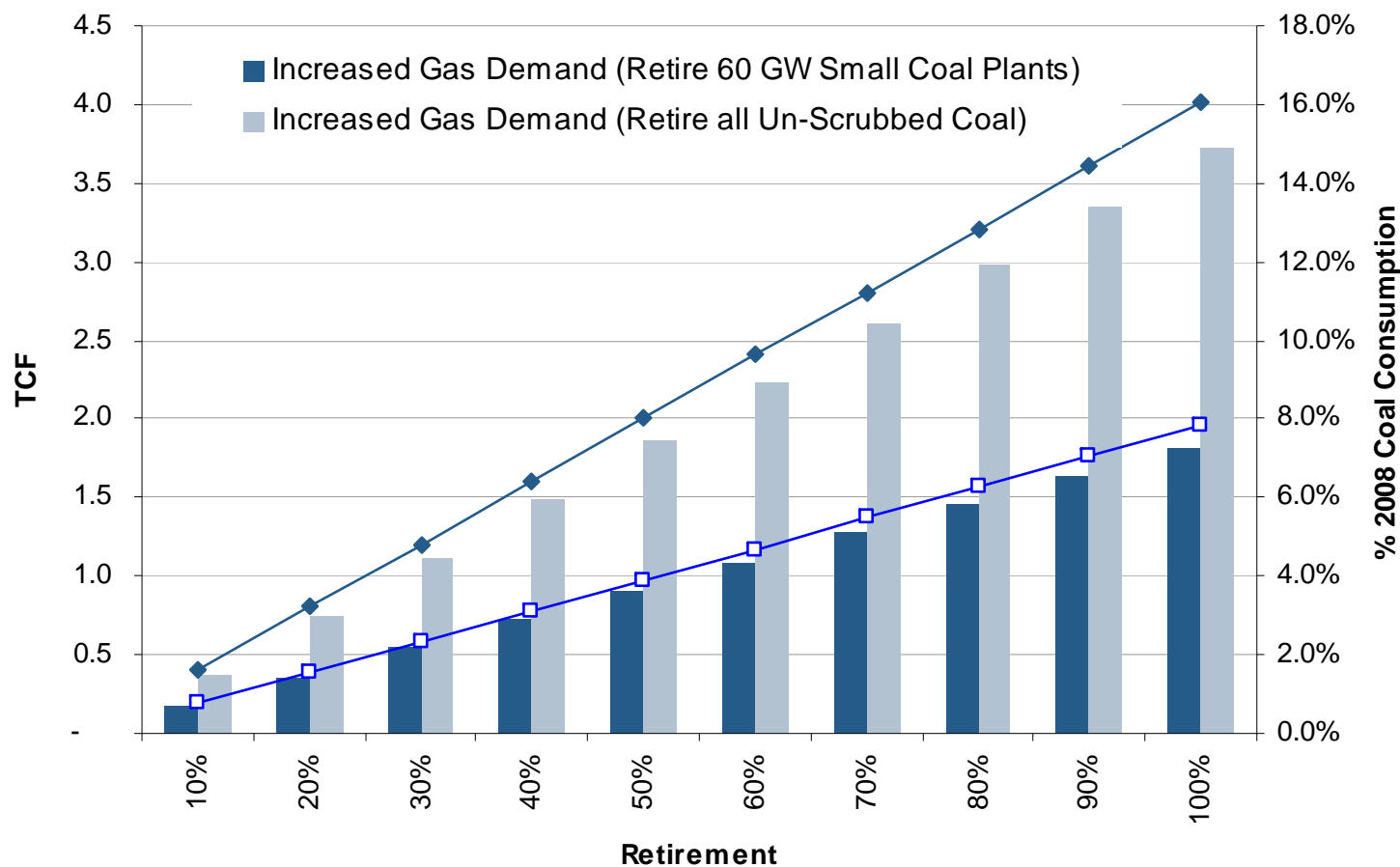
- Coal plant retirement related spending will likely boost EPS growth rates for many Regulated Utilities by 1-3% annually
- AEE, DTE, AEP, and SO will be stocks to watch

# Impact on Coal Demand from Coal Plant Retirement



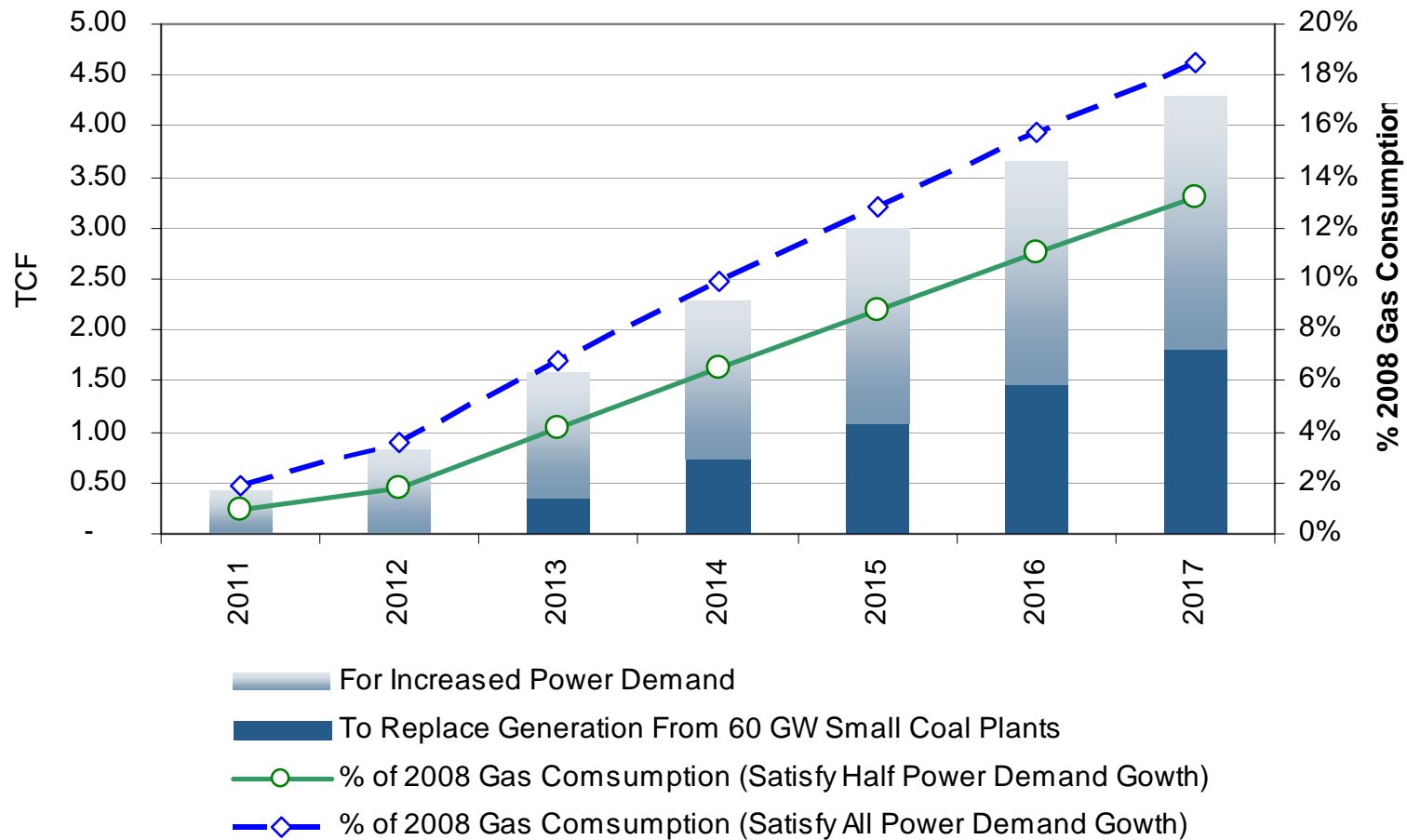
- Steam coal demand could fall by 157-324 MM tons annually (15-31%) depending on retirement assumptions

# Impact on Gas Demand from Coal Plant Retirement



- Natural gas demand could grow by 2.0-4.0 TCF annually to replace electricity produced from retiring coal plants

# Gas Demand Growth: Replacement plus Consumption



- Layering a reasonable coal plant closure scenario with sustained power demand growth served by gas generation could see growth of 3.5-4.5 TCF annually



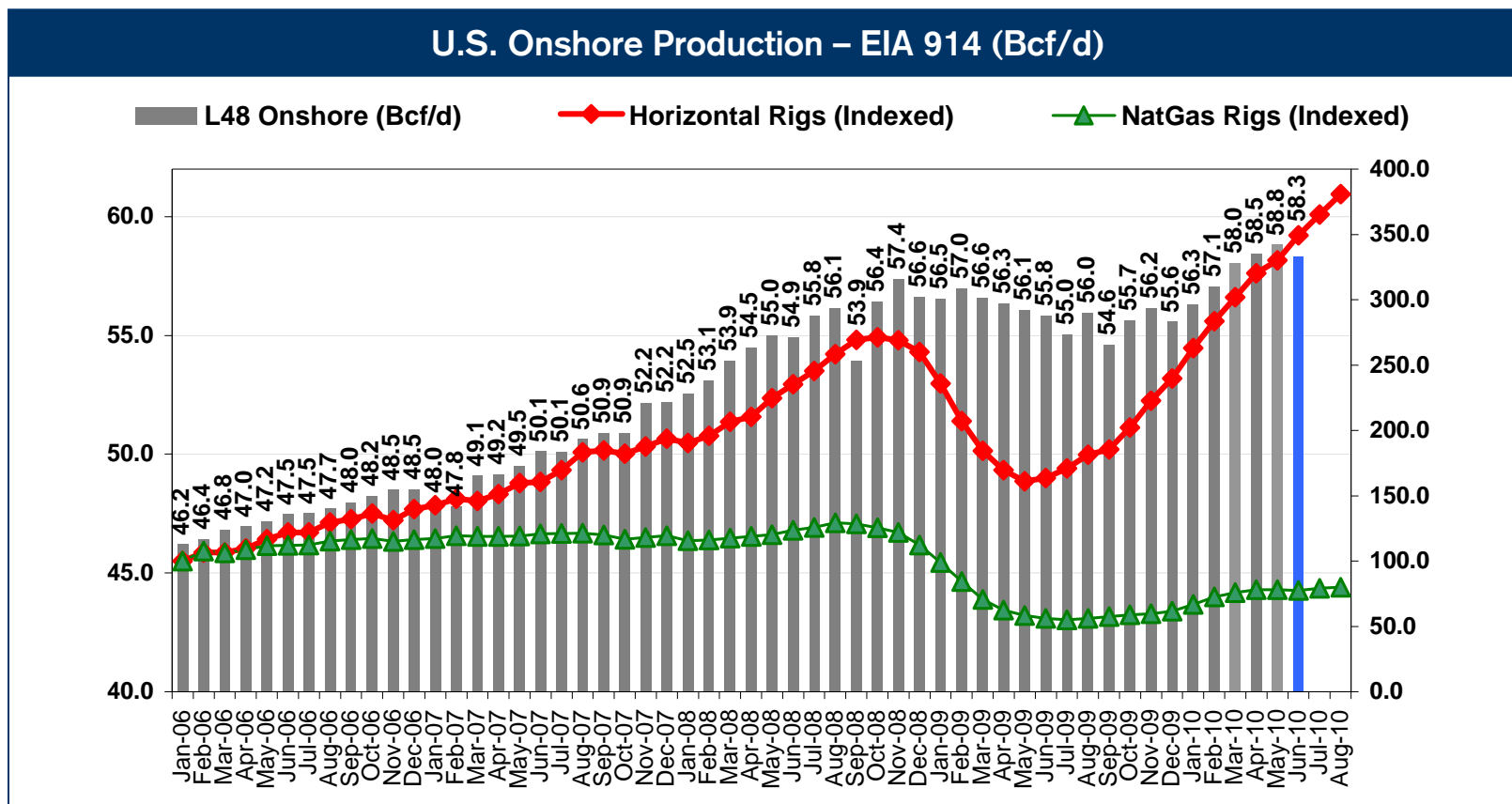
# Impact of shale on natural gas market

- **The U.S. is Now ‘Long’ Natural Gas:** Emergence of **numerous prolific shale basins** (*Barnett, Haynesville, Marcellus*) has expanded the U.S. natural gas reserve base and changed perception of U.S. being 'short' natural gas to U.S. being 'long' natural gas.
  - Natural gas reserve life has risen substantially
  - The Industry is building 'trust' on ability to deliver supply reliably
  - We expect substantial future demand growth as gas is 'cheap' to coal and offers environmental benefits
  - LNG import story has taken a back-seat as U.S. has become self-sufficient
- **The U.S. Gas Cost Curve Has Fallen:** Increasing production of natural gas from shales is lowering the cost curve as **shale gas is the lowest cost domestic source of natural gas.**
  - F&D costs are materially lower for shale gas producers
  - Most shale plays generate a reasonable return (*15% ATAX*) under \$6.00 per MMBtu
  - Current over-investment (*140% of internal cash flow*) and slack demand causing weak prices
- **IOC's and NOC's Making U.S. Shale Push:** International players are attracted by low risk nature of big U.S. shale reserves, easy reserve replacement.

# Supply has grown fast, but demand outlook is positive

- **Shales have improved productivity vs. conventional drilling. Also helping supply are:**
  - 1) **Horizontal Drilling.** A record high horizontal rig count (*up 60% in 2010*) which adds supply at 3.0x+ the rate of traditional vertical drilling,
  - 2) **Externally Funded Spending.** Capex running 140% of internal hedged cash flow (*170% unhedged*) helped by hospitable equity and debt markets and cash infusions from JVs with large international companies, and
  - 3) **Drilling to Hold Leases.** Aggressive lease capture (*'HBP'*) strategies which is forcing low rate of return drilling (*'use it or lose it'*)
- **Longer-term, U.S. cost curve is falling due to exploitation of low-cost shale gas...**
- **...But rising demand from the power sector could require an additional 6.0 Bcf/d by 2015, marking a fresh source of secular growth for U.S. gas demand.**
- **Our \$6.50 per MMBtu long-term natural gas price provides sufficient cash to balance a growing market.**

# Onshore U.S. production tracking horizontal rig surge



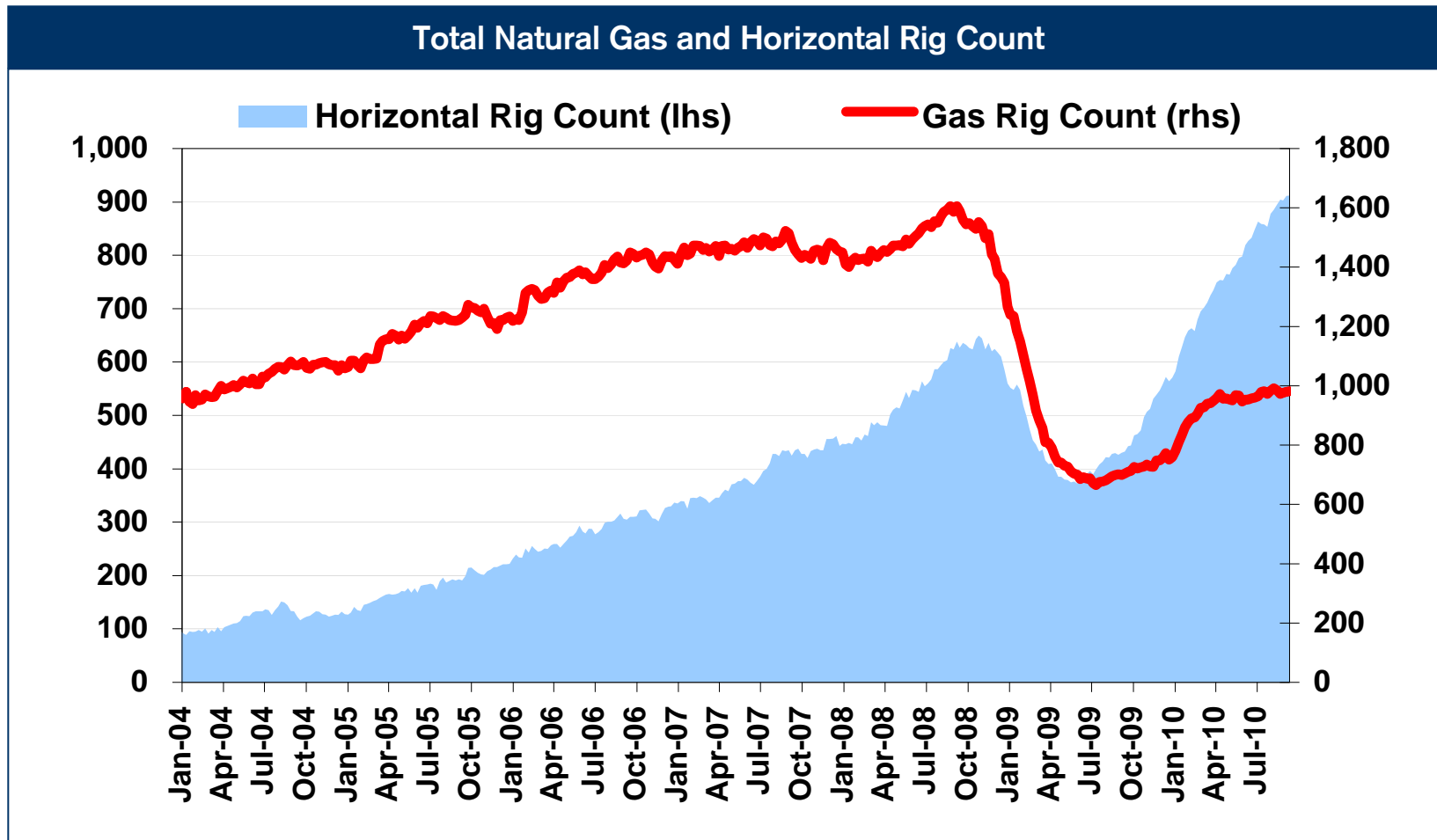
Source: EIA 914 Report

- June 2010 onshore U.S. production up 4.4% or 2.5 Bcf/d yr/yr
- Production continues to rise from shale gas

**Horizontal Rigs: 912 as of 9/17/10 and 40% above the 2008 peak of 650 set on 10/31/08.**

**Gas Rig count now at 982 as of 9/17/10, up 48% from 2009 trough of 665 on 7/17/09.**

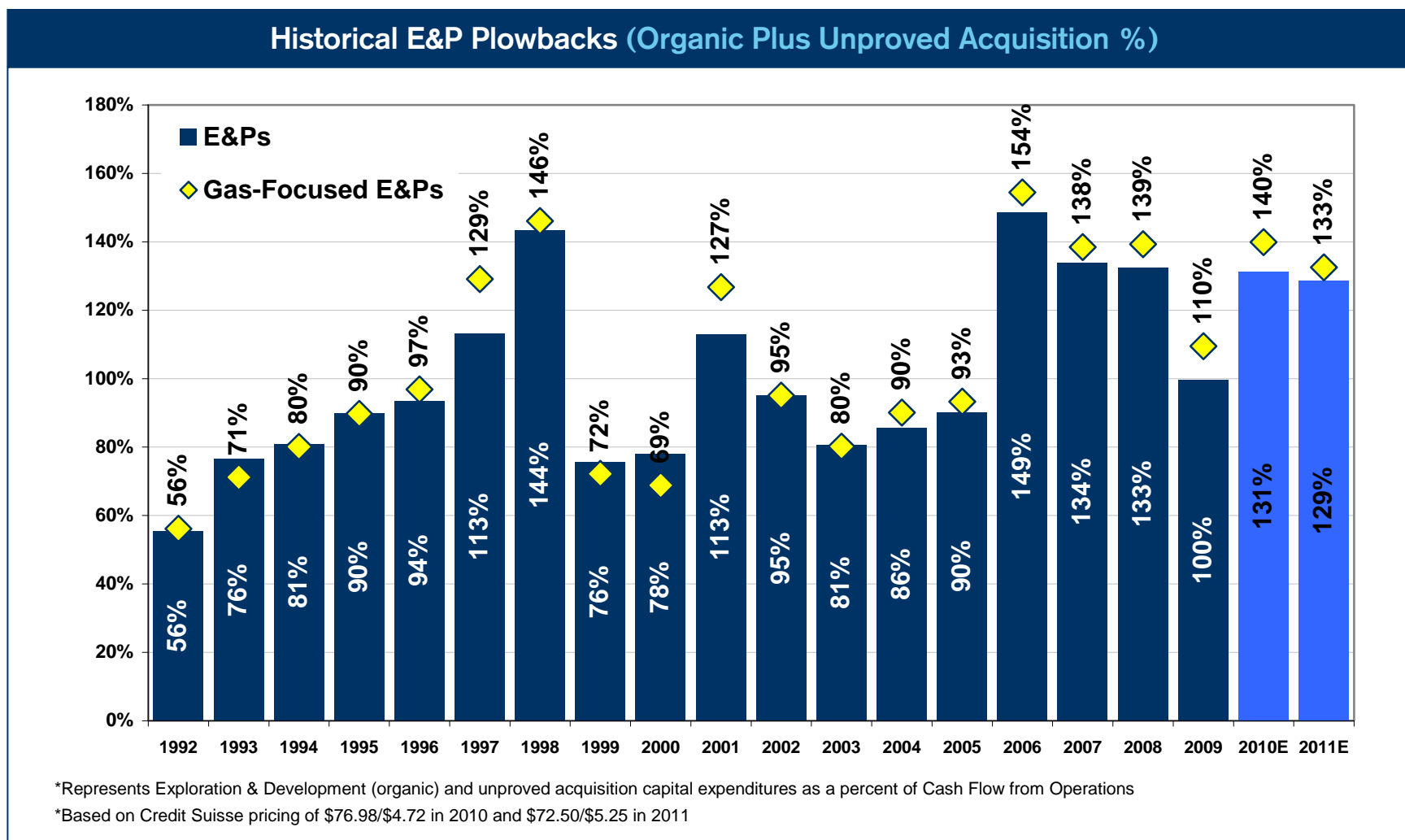
# Gas rig count off peak, horizontal at highs



Source: Baker Hughes

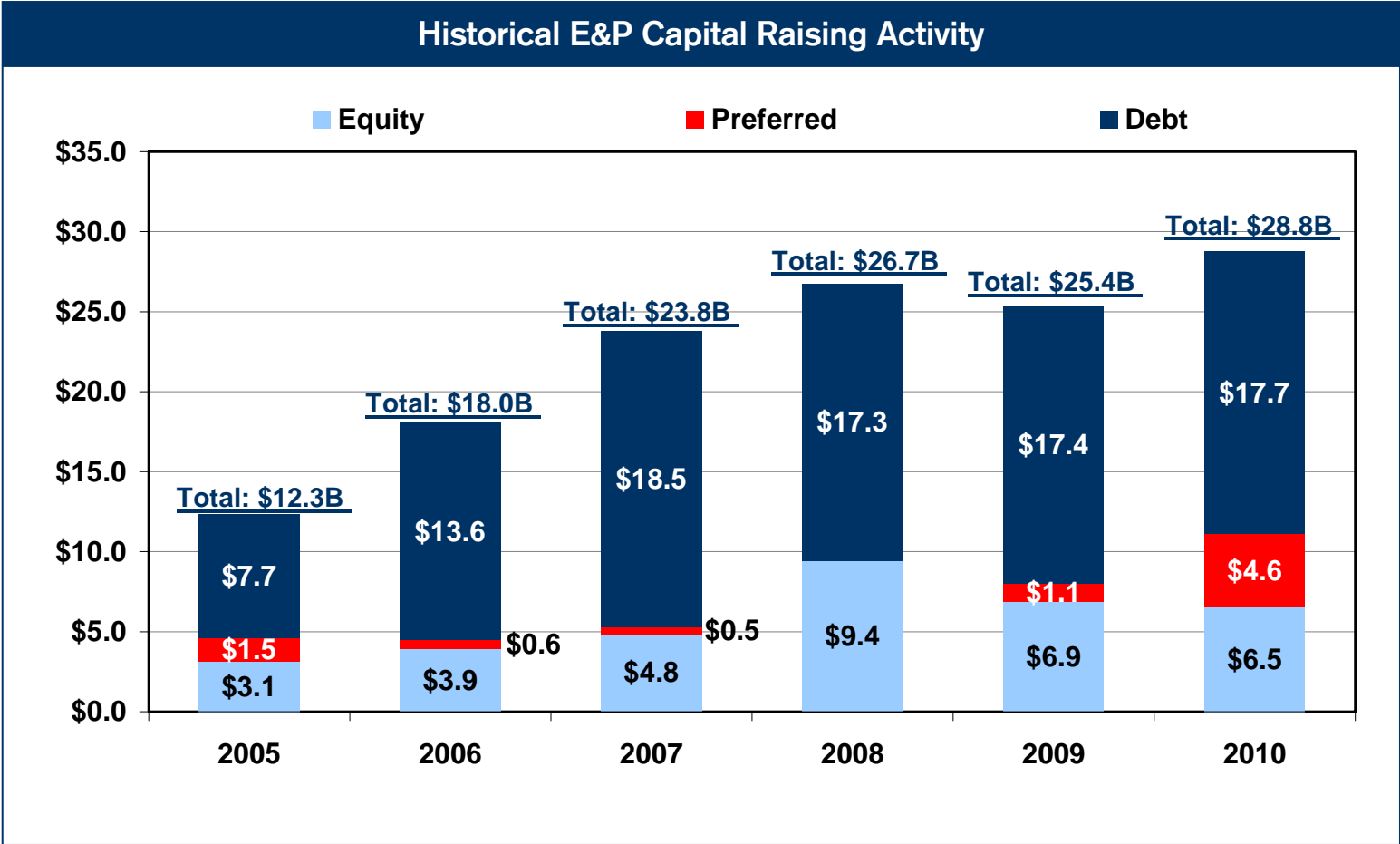
- Horizontal Rigs: 912 as of 9/17/10 and 40% above the 2008 peak of 650 set on 10/31/08.
- Gas Rig count now at 982 as of 9/17/10, up 48% from 2009 trough of 665 on 7/17/09.

# Overinvestment hurting U.S. gas prices



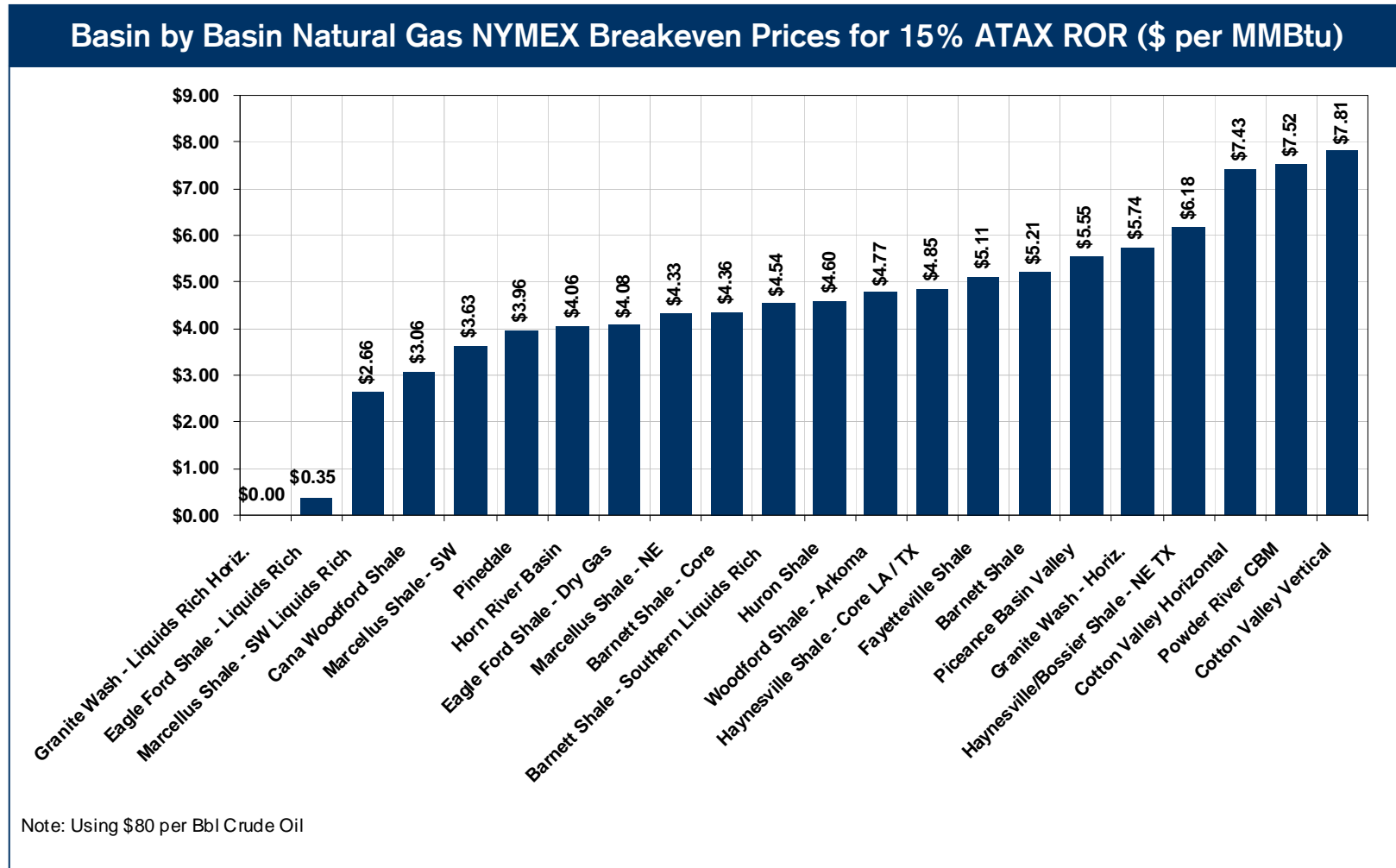
Source: Company Data, Credit Suisse estimates

# Equity and debt markets have been funding E&Ps



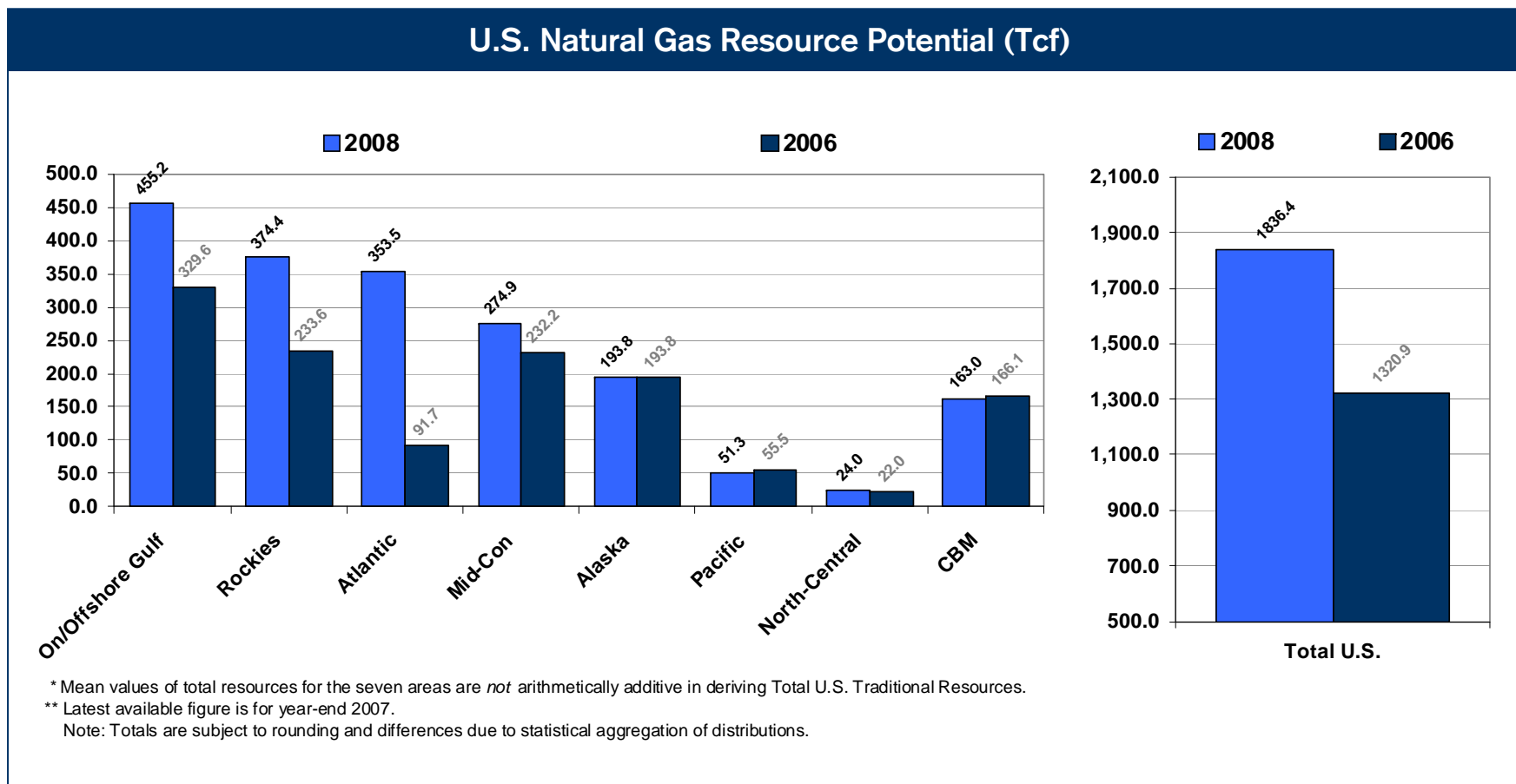
Source: Bloomberg, Company data, Credit Suisse estimates

# Most shale gas plays work below \$6.00 per MMBtu



Source: Company data, Credit Suisse estimates

# U.S. resource base much larger than proved reserves

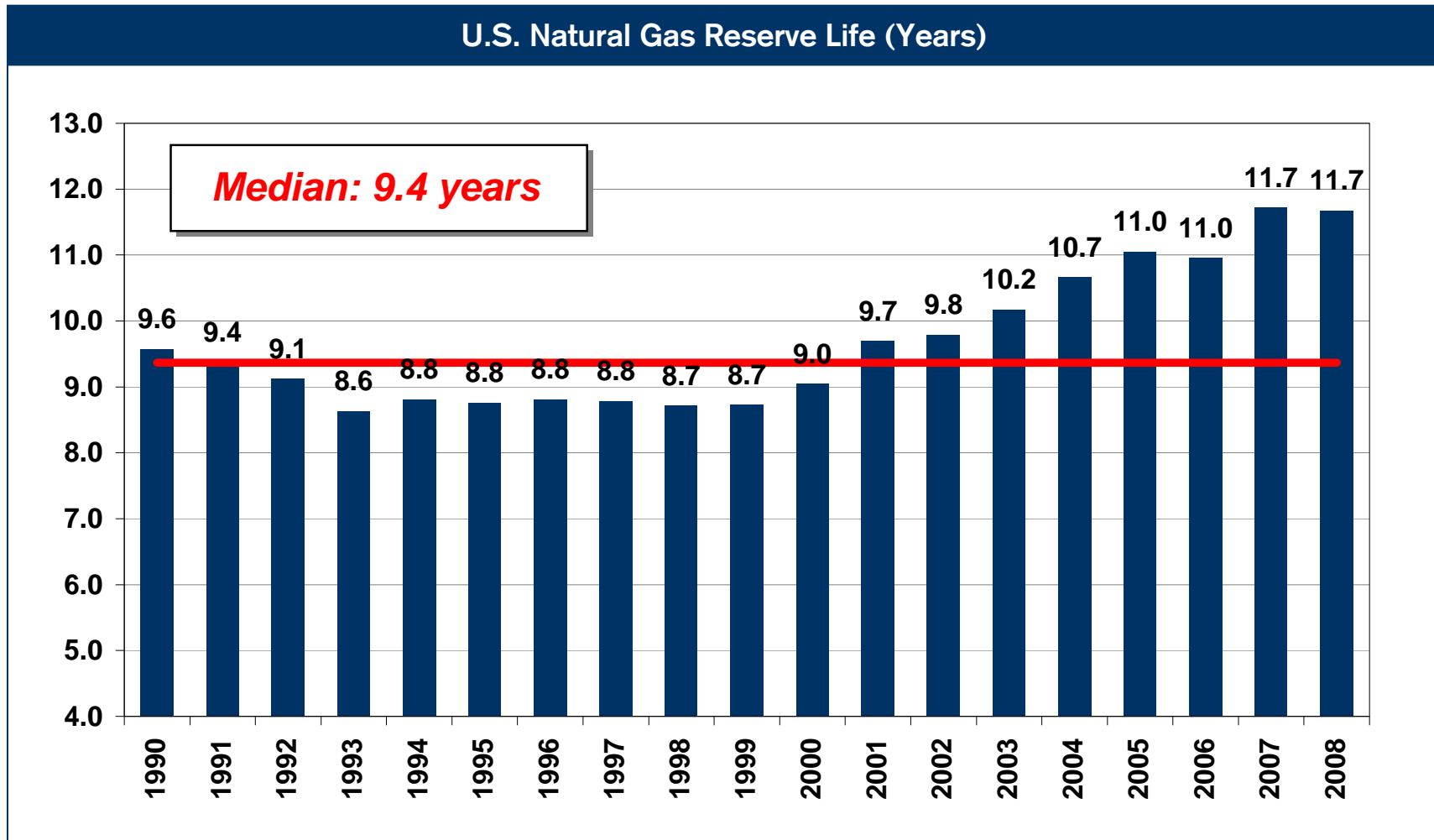


Source: Potential Gas Committee

- U.S. natural gas as a proved reserve life of 11.6 years based on current dry gas production and 84.8 years when including unproved reserves.

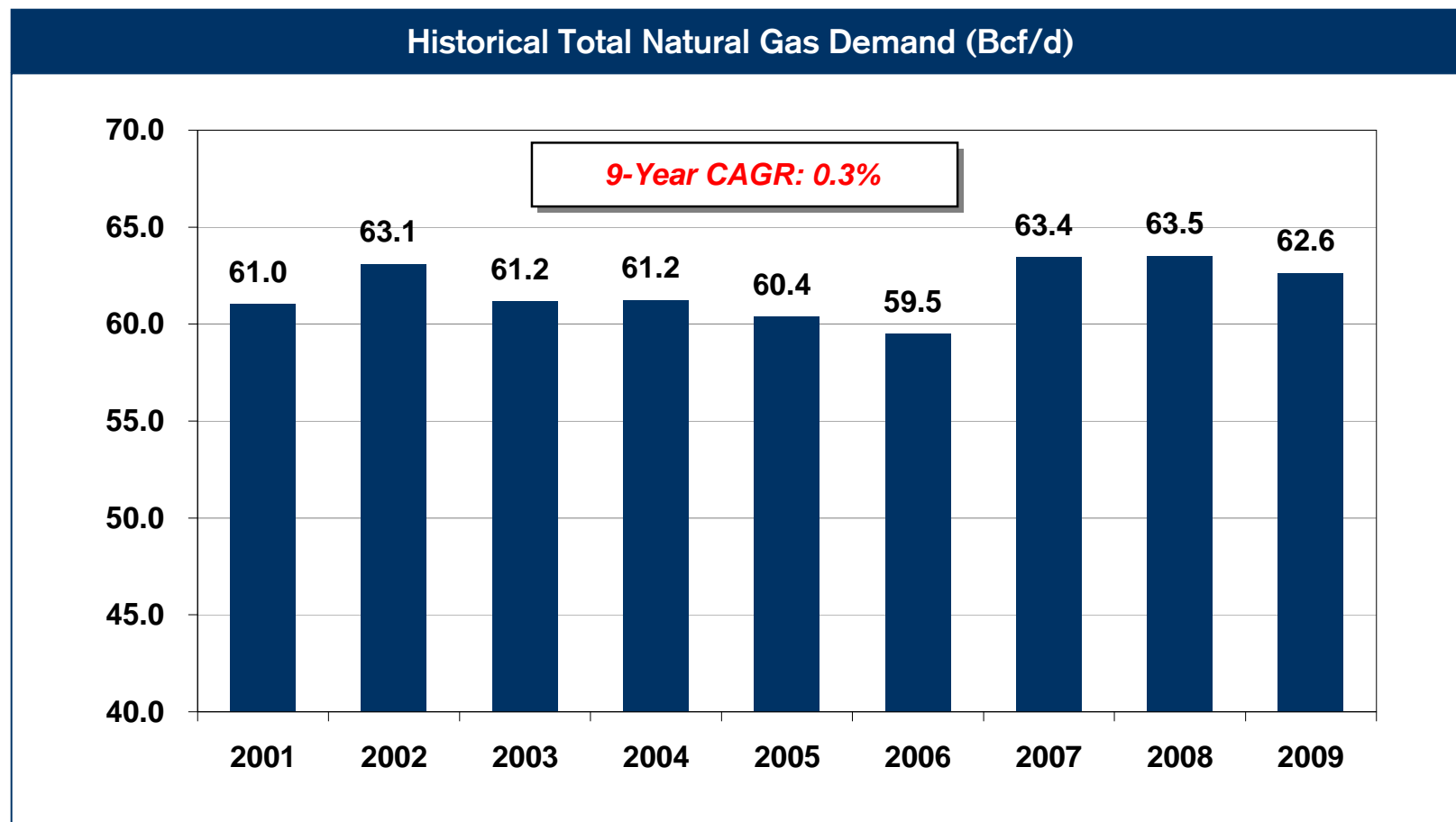


# Natural gas reserve lives up on shale development



Source: EIA

# Total gas demand has been flat since 2001



Source: EIA

## Prefer Cleaner Generators in Dirtier Markets

We see EPA rule making to limit conventional coal plant polluters as a potentially transformative event for the power sector and related industries. We assume:

- 60 GW of uncontrolled coal generation is closed
- Closures occur ratably from 2013-17, extending EPA mandated timelines
- \$100 BN + of capex for remediation through retrofitting coal plants and building replacement generation
- The power market recovery is accelerated by 4 -5 years
- Coal demand could fall 157 – 324 MM tons
- Natural Gas demand could grow 1.8 – 3.7 TCF on a 22 TCF market
- Regulated utilities annual growth rates could rise by 1- 4%

**We favor FE-AYE and RRI to take advantage of EPA action**

# Disclosures

## Companies Mentioned (Price as of 29 Sep 10)

Allegheny Energy Inc. (AYE, \$24.29, OUTPERFORM, TP \$28.00)  
Alliant Energy Corp. (LNT, \$36.36)  
Ameren Corp. (AEE, \$28.37)  
American Electric Power Co., Inc. (AEP, \$36.72, OUTPERFORM, TP \$40.00)  
Black Hills Corporation (BKH, \$31.18)  
CenterPoint Energy, Inc. (CNP, \$15.84)  
Central Vermont Pub Serv (CV, \$20.20)  
CMS Energy (CMS, \$18.02, OUTPERFORM [V], TP \$17.50)  
Con Edison (ED, \$48.50, NEUTRAL, TP \$48.00)  
Constellation Energy Group Inc. (CEG, \$32.56, RESTRICTED)  
Dominion Resources (D, \$44.19, NEUTRAL, TP \$39.00)  
DPL (DPL, \$26.19)  
DTE Energy (DTE, \$45.98, NEUTRAL, TP \$47.00)  
Duke Energy (DUK, \$17.94, NEUTRAL, TP \$17.00)  
Edison International (EIX, \$34.77, NEUTRAL, TP \$37.00)  
El Paso Electric Co (EE, \$23.63)  
Energy Corporation (ETR, \$77.56, NEUTRAL, TP \$81.00)  
Exelon Corporation (EXC, \$43.04, NEUTRAL, TP \$47.00)  
FirstEnergy (FE, \$38.34, OUTPERFORM, TP \$43.00)  
Great Plains Energy (GXP, \$18.81)  
Integrus Energy Group Inc. (TEG, \$52.27)  
ITC Holdings Corp (ITC, \$62.48, OUTPERFORM, TP \$63.00)  
Minnesota Power Inc. (ALE, \$36.28)  
NextEra Energy Inc. (NEE, \$55.01, OUTPERFORM, TP \$58.00)  
Northeast Util (NU, \$29.81)  
NSTAR (NST, \$39.59)  
NV Energy Inc (NVE, \$13.02, NEUTRAL, TP \$13.00)  
OGE (OGE, \$40.11)  
Pepco Holdings Inc. (POM, \$18.75, RESTRICTED)  
PG&E Corporation (PCG, \$45.55, NEUTRAL, TP \$45.00)  
Pinnacle West Capital Corp. (PNW, \$41.69, OUTPERFORM, TP \$40.00)  
Progress Energy (PGN, \$44.72, NEUTRAL, TP \$40.00)  
Public Services New Mexico (PNM, \$11.49)  
Public Svc Ent (PEG, \$33.14, OUTPERFORM, TP \$36.00)  
RRI Energy Inc. (RRI, \$3.59, OUTPERFORM [V], TP \$6.00)  
SCANA Corporation (SCG, \$40.46)  
Sempra Energy (SRE, \$53.93)  
Southern Company (SO, \$37.52, NEUTRAL, TP \$37.00)  
TECO Energy (TE, \$17.40, NEUTRAL, TP \$16.00)  
Unisource Energy Corp (UNS, \$33.48, NEUTRAL, TP \$34.00)  
Wisconsin Energy (WEC, \$58.46)

## Disclosure Appendix

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Underperform/Sell*	12%	(50% banking clients)
Restricted	2%	

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