



Coal Capacity at Risk for Retirement in PJM: Potential Impacts of the Finalized EPA Cross State Air Pollution Rule and Proposed National Emissions Standards for Hazardous Air Pollutants

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October 20, 2011



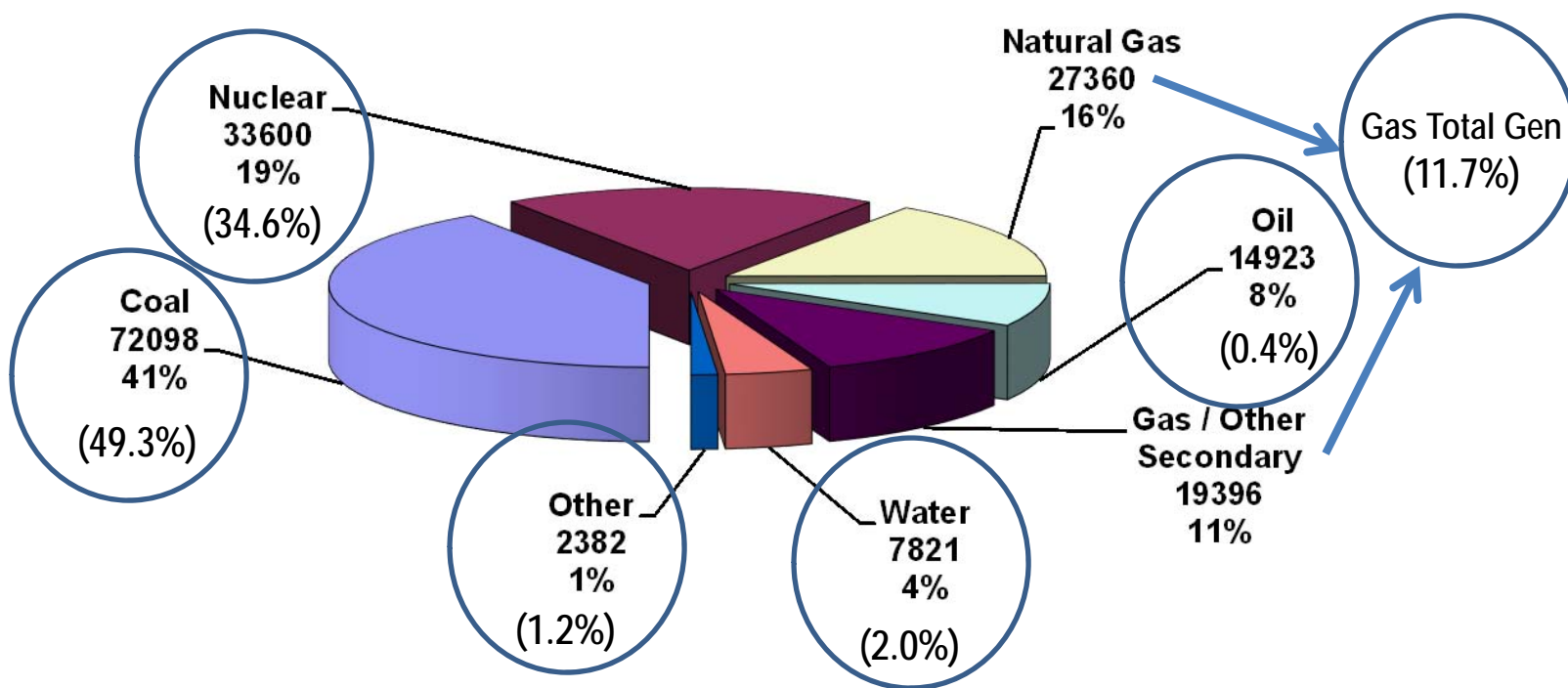
Stylized Summary of Environmentally Related Rules Impacting Resource Adequacy

	GHG Tailoring Rule	Cross State Air Pollution Rule	NESHAP	CWA 316(b)	High Electricity Demand Day	Renewable Portfolio Standards
Pollutant or target issue	CO ₂ and other GHG	SO ₂ and NO _x annual limits NO _x seasonal limit	Mercury, other Heavy Metals, and Acid Gases	Cooling water intake structures	Ozone formation from NO _x on hot days	Ensure a certain percentage of renewables
Relevant Dates	1/1/2011	1/1/2012: Phase 1 1/1/2014: Phase 2	2011 rulemaking, 1/1/2015, extension to 2016 in some cases	2011 2015-2018	NJ currently 2015-2018	various
Units impacted	All fossil units	All fossil units Primarily coal	Coal and oil, primarily coal	All existing units	Oil and gas peaking	All units
Standard	BACT case-by-case, state-by-state	Limited cap & trade. Use of FGD or DSI and SCR likely	MACT to be defined, likely FGD or DSI, ACI, fabric filter	BTA to be defined, likely not once thru cooling	NO _x rate standard. Use of SCR and other controls likely	Mandated percentage of electricity sales from renewables
Impact on Units	Mostly fixed costs	Fixed and variable costs -- allowance prices	Mostly fixed costs, but also some VOM	Mostly fixed costs	Mostly fixed costs	Reduced net energy market revenues

PJM RTO

(MidAtlantic, AP, ComEd, AEP, Dayton, Duquesne, Dominion, & ATSI Regions)

Capacity By Fuel Type -- 177,579 MW installed generation capacity



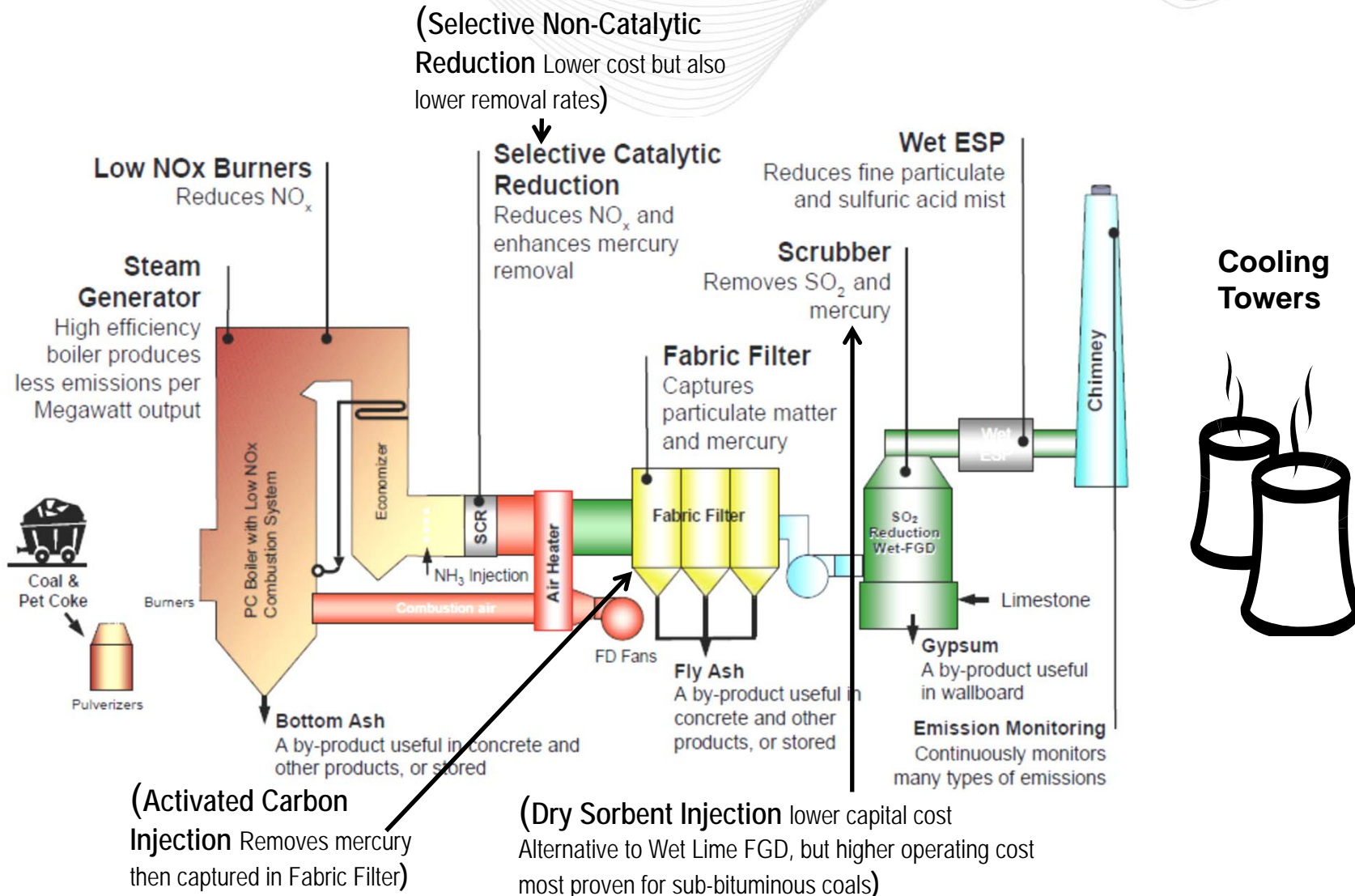
Percentage of 2010 Generation in parentheses

- How many megawatts (MW) of coal-fired generation are at risk for retirement?
 - Proposed EPA rules would effectively require costly environmental retrofits or repowering to natural gas or force units to retire
 - How many coal units will retire, repower, or retrofit?
 - What is the current retrofit status of coal generation
 - What are the prospects for retaining existing coal units?

Big Question: What are the reliability implications of the CSAPR and NESHAP rules?

- Resource adequacy
 - Will there be sufficient resources to meet peak loads plus the installed reserve margin?
- Local transmission reliability
 - Will transmission upgrades be necessary to allow units to retire reliably?
 - Managing retrofit tie-in outages reliably

- Units more than 40 years old and less than 400 MW are the most at risk for retirement due to the CSAPR and NESHAP rules
 - This is about 30 percent of the current coal fleet in PJM
- 11,051 MW of coal requires more than the Net Cost of New Entry (Net CONE) of a natural gas combustion turbine to be economically viable under the CSAPR and NESHAP rules
 - On average these units are more than 50 years old and less than 200 MW and are considered at “high risk” for retirement
 - An additional 14,147 MW are at risk as they require between ½ Net CONE and Net CONE to be economically viable
- PJM anticipates resource adequacy over the entire RTO will be maintained
- Retirements may pose local reliability issues requiring transmission upgrades to ensure transmission and operating reliability





Total Coal Capacity in PJM without Pollution Controls

	PJM RTO	MAAC	Rest of PJM
Total Coal	78,613	18,761	59,852
No SO ₂ Controls	30,069	4,281	25,788
No SCR for NO _x Reduction	36,618	8,805	27,813
No Fabric Filter	69,115	13,020	56,095
No SO ₂ and No SCR	22,866	2,723	20,143
No SO ₂ and No Fabric Filter	29,457	3,756	25,701

Inclusive of DEOK and ATSI

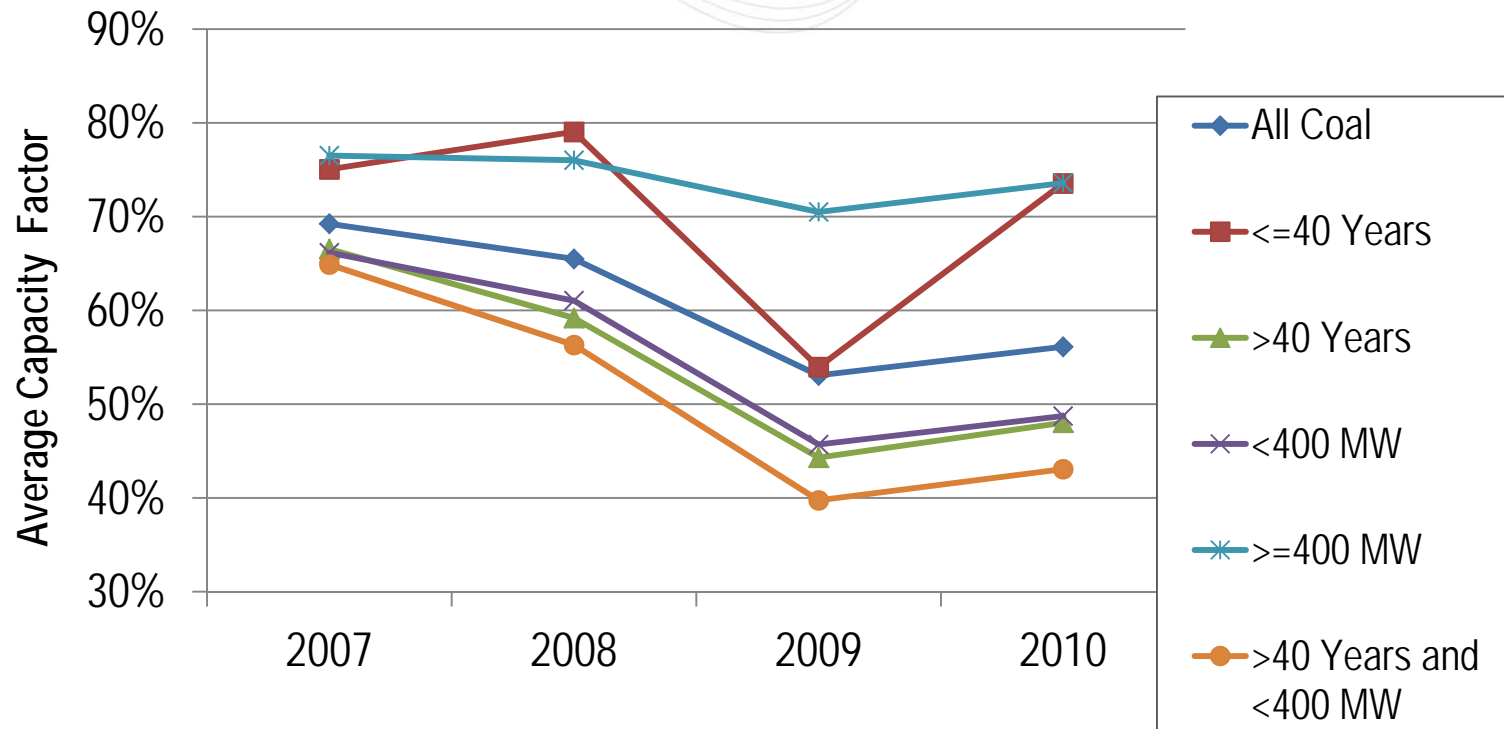


Pollution Control Retrofit Costs for a 500 MW Coal Unit vs. Costs of New Natural Gas Technologies

Control Technology	Capital Cost (\$/kW)	Fixed O&M (\$/MW-yr)	Variable O&M (\$/MWh)
FGD	\$501	\$8,150	\$1.81
DSI	\$40	\$590	\$7.92
SCR	\$197	\$720	\$0.66
SNCR	\$19	\$260	\$1.33
Fabric Filter + ACI	\$155+\$9	\$630+\$40	\$0.15+\$0.93

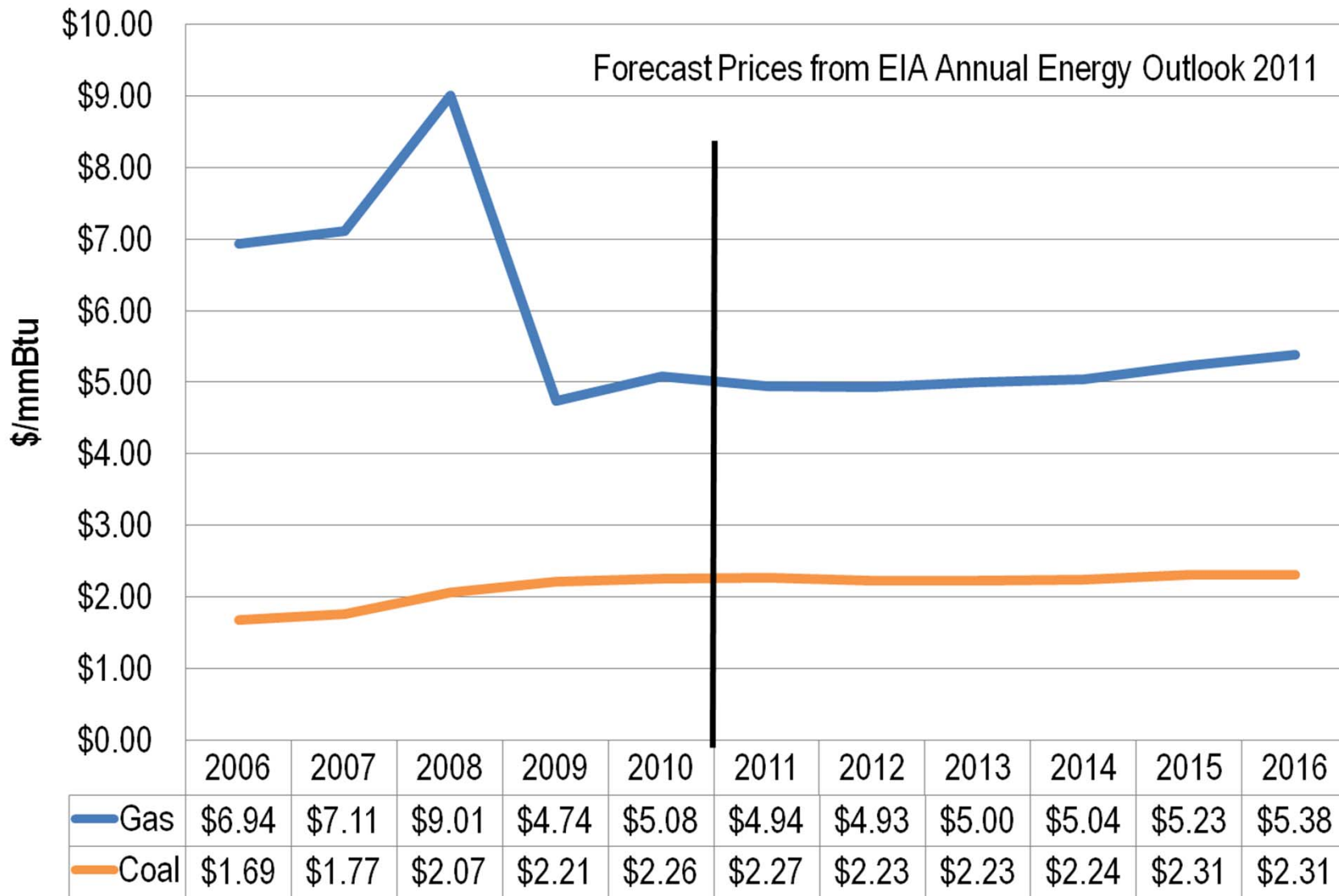
	Capital Cost (\$/kW)	Fixed O&M (\$/MW-yr)	Variable O&M (\$/MWh)
Simple Cycle CT	\$665-\$975	\$6,700-\$6,980	\$9.87-\$14.60
Combined Cycle CT	\$1,000-\$1,150	\$21,600	\$3.23

Coal Capacity Factors Inclusive of ATSI and DEOK

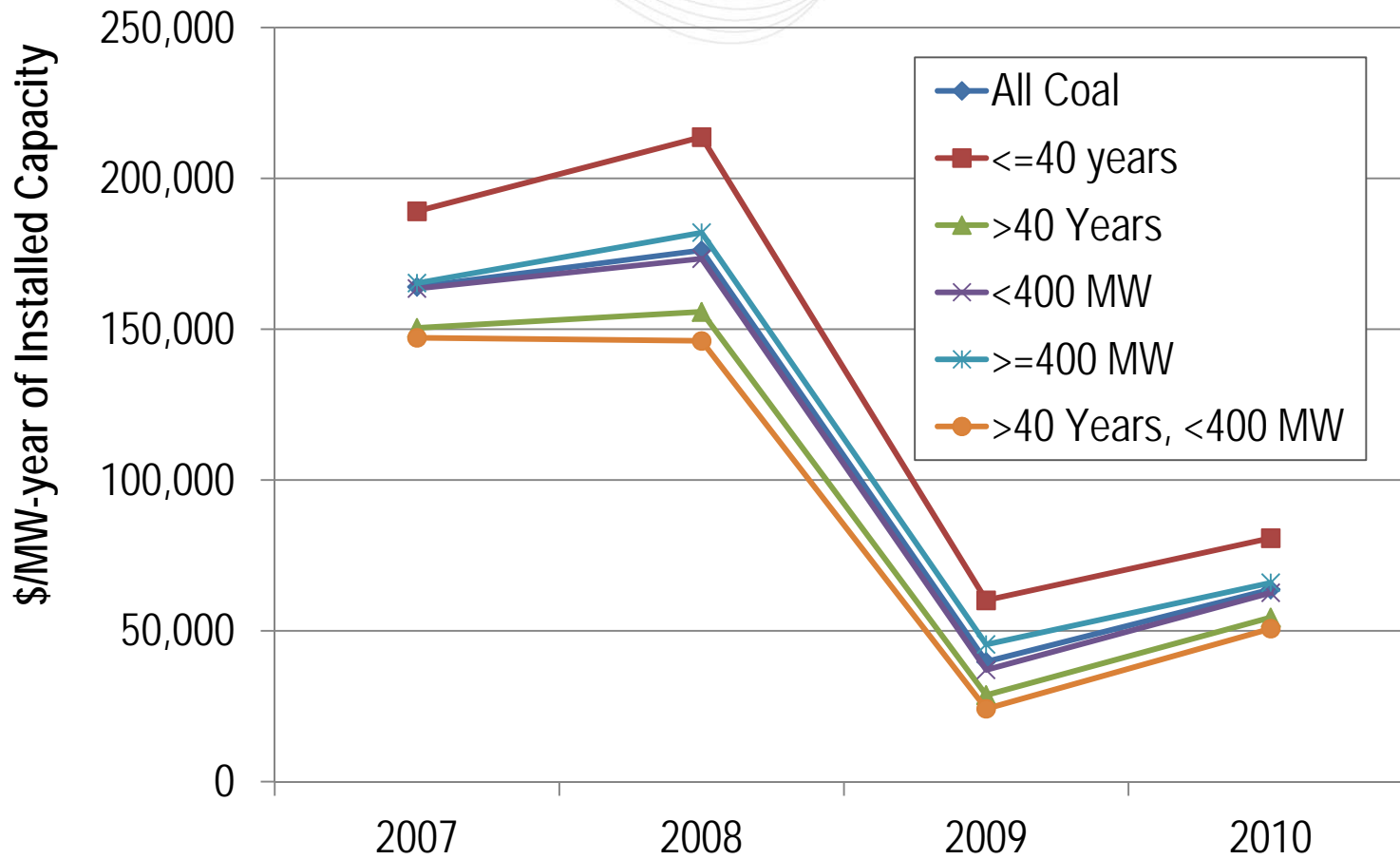




National Average Annual Delivered Price of Coal and Natural Gas 2006-2010



Coal Net Energy Market Revenues by Age and Size, 2007-2010



- Retrofits to comply with air rules are very costly putting pressure on fixed costs
 - Economies of scale to retrofit costs...cost/MW is higher for smaller units
- Significantly reduced gas-coal spreads and demand are adding pressure on the revenue side of the equation
 - Some controls also have significant variable costs and add to this pressure
 - Smaller, older units have lower revenues per MW
- Conjecture:
 - Older, smaller units will be at greater risk for retirement if they require retrofits

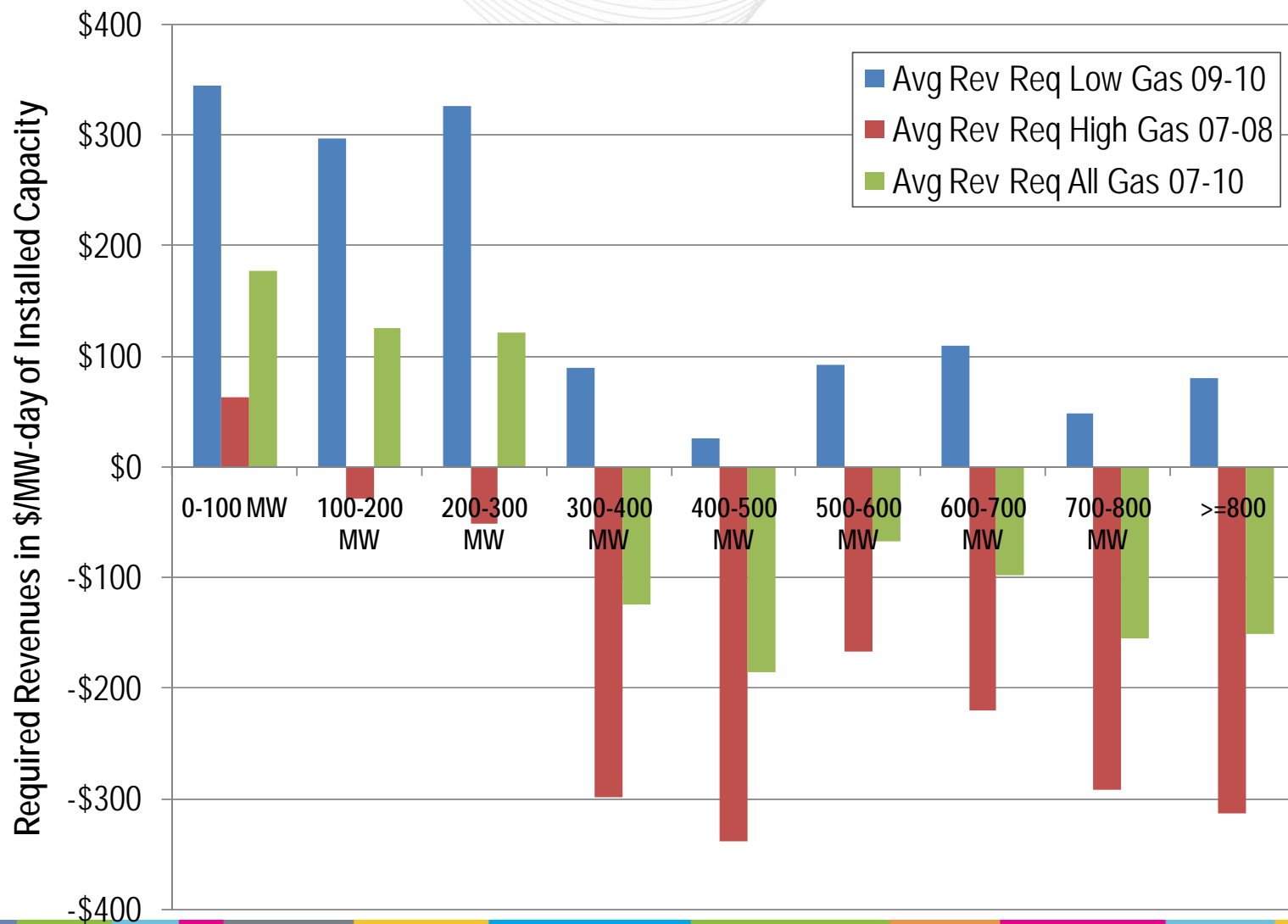


Unit Characteristics Screen: Key Takeaways

Units More than 40 Years Old and Less than 400 MW

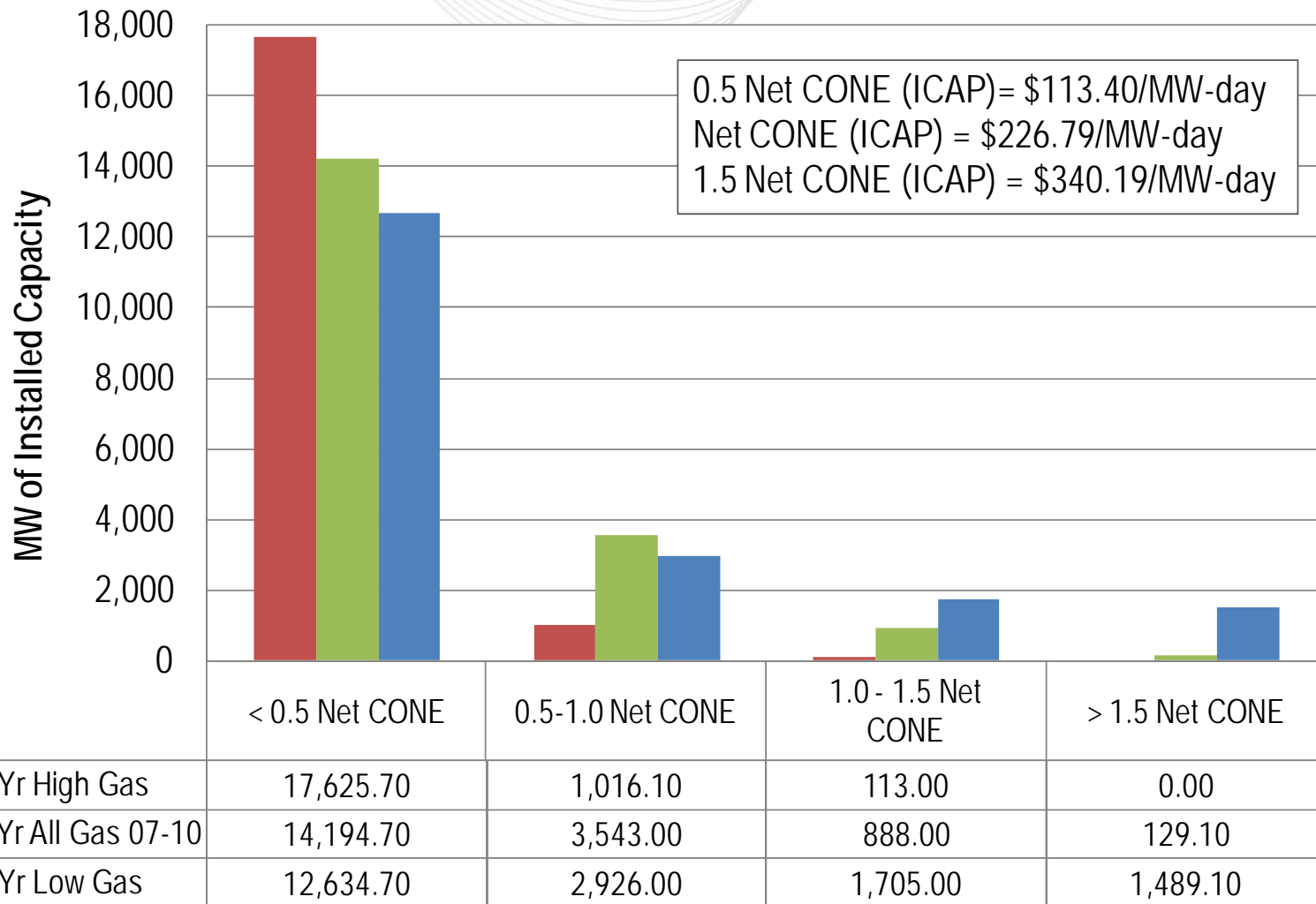
	PJM	MAAC	Rest of PJM
Total	22,907	5,769	17,138
No SO ₂ Controls	17,387	2,560	14,827
No Fabric Filter	20,104	3,729	16,375
No SO ₂ Control and No Baghouse	16,775	2,035	14,740
No SCR	18,762	4,456	14,306
No SO ₂ Control and No SCR	14,541	2,236	12,305

Necessary Revenue to Continue Operating under CSAPR and NESHAP



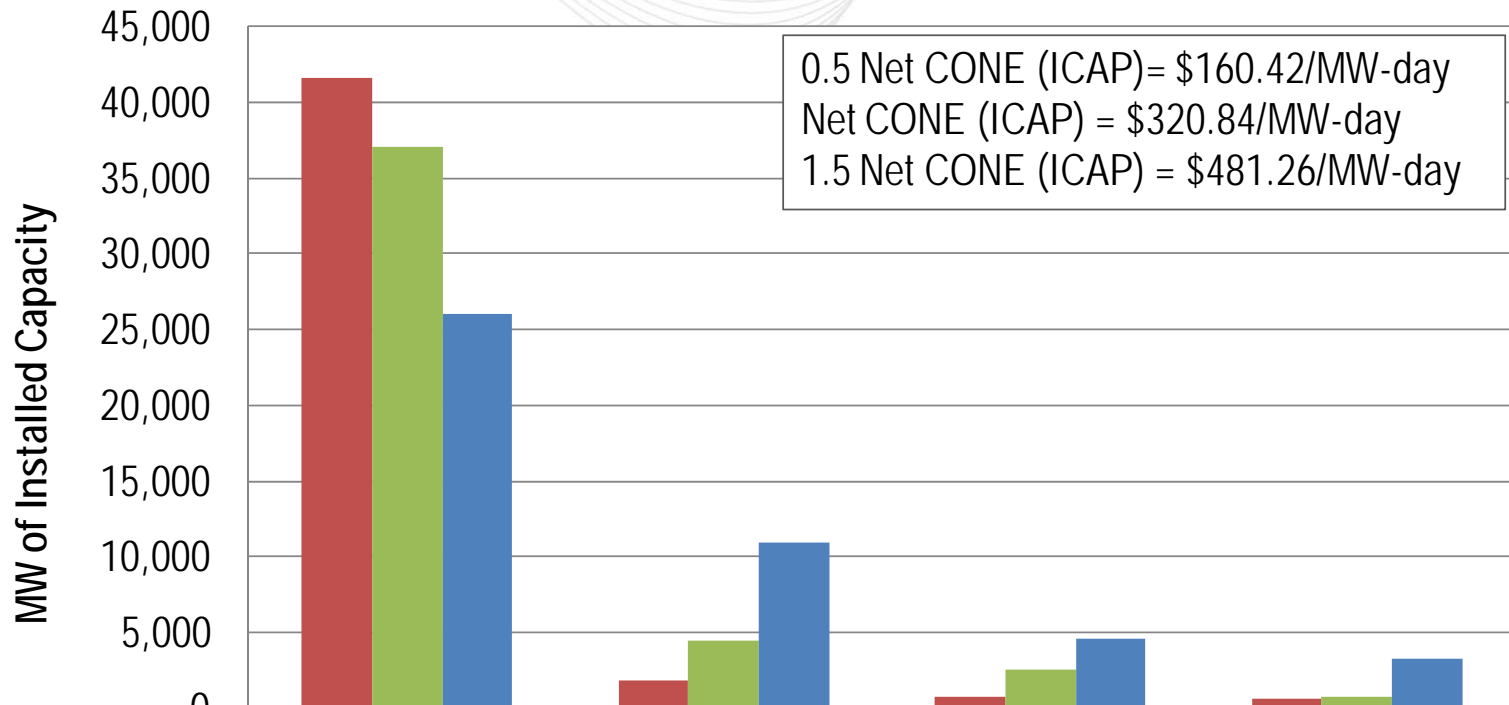


Capacity with Needed Revenues under CSAPR and NESHAP Benchmarked against Net CONE in MAAC





Capacity with Needed Revenues under CSAPR and NESHAP Benchmarked against Net CONE in Rest of RTO



	< 0.5 Net CONE	0.5-1.0 Net CONE	1.0 - 1.5 Net CONE	> 1.5 Net CONE
20 Yr High Gas	41,654.40	1,801.00	696.00	645.00
20 Yr All Gas 07-10	37,065.40	4,409.00	2,554.00	768.00
20 Yr Low Gas	26,010.40	10,929.00	4,595.00	3,262.00



Summary of Additional Revenues Needed Relative to Net CONE with 20 Yr Recovery—Low Gas

Additional Revenue Needed	PJM	MAAC	Rest of PJM
< 0.5 Net CONE	38,334	12,634	25,700
0.5 Net CONE – 1.0 Net CONE	14,147	2,908	11,239
> 1.0 Net CONE	11,051	3,194	7,857

- For the 11,051 MW at “high” or “very high risk”, the average age is more than 50, average size less than 200 MW.
- For the 14,147 “at risk” the average age is 37, average size almost 400 MW
- For the remaining capacity “at low risk”, average age is 34, average size almost 500 MW

- 6,985 MW UCAP (7,350 MW ICAP) less coal capacity cleared in the 2014/15 BRA than in the 2013/2014 BRA
- Approximately 7,000 MW of FRR coal capacity (outside RPM) has been announced as retiring by 2015
 - Most of this capacity falls into the high or very high risk categories
- Reserve margin for 2014/2015 is projected at 19.6%, even with less coal capacity clearing
- Accounting for FRR announcements still leaves PJM above the 15.3% target

- Large volume of likely retirements increases the probability of the need for some transmission upgrades to allow units to retire reliably
- PJM request in its NESHAP comments to EPA:
 - Allow for at least a 1 year extension to 2016 for units deemed critical for reliability to allow transmission upgrades to be built to allow a unit to retire
 - Unit must provide advance notice (2 years prior to effective compliance date) to provide sufficient lead time to construct transmission upgrades
 - Possibility of extension beyond 2016 on a case-by-case basis through consent decrees