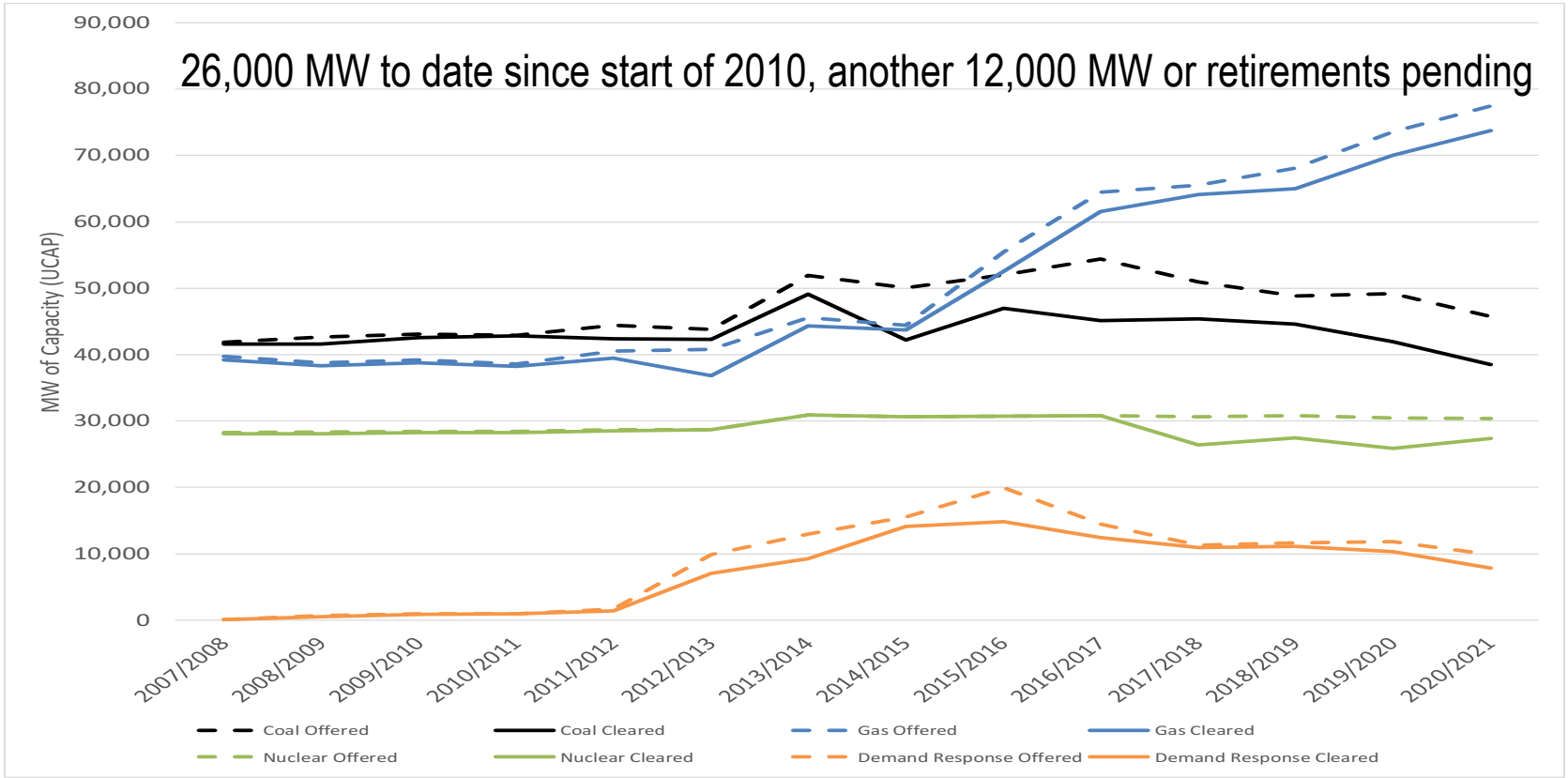
DOE NOPR: Examining Market and Reliability Implications

Paul M. Sotkiewicz, Ph.D
President
E-Cubed Policy Associates, LLC
October 19, 2017

Offered and Cleared Installed Capacity in PJM



E-Cubed Policy Associates, LLC

Source: PJM Interconnection, LLC

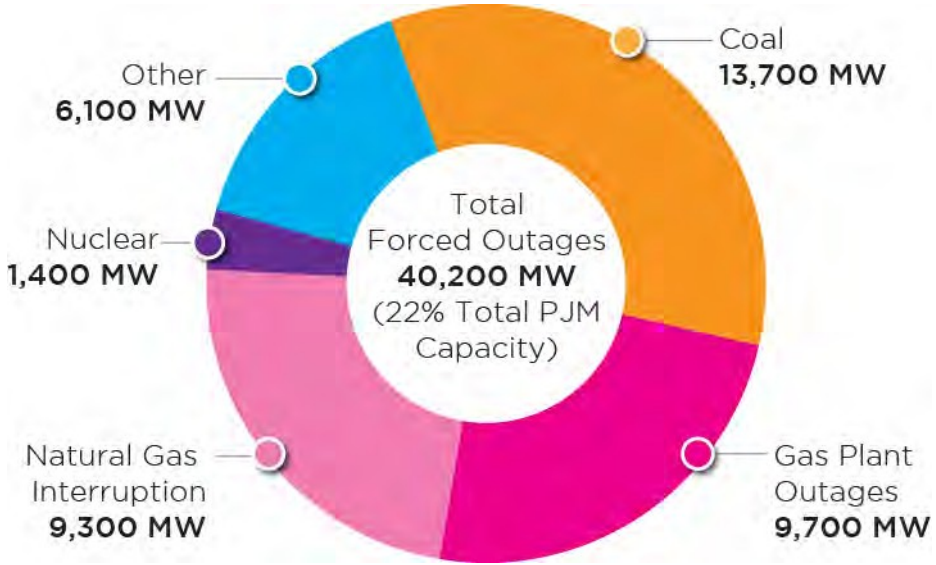
Reliability in the Context of Retirements is Already Addressed in the PJM Tariff

- Part V of the PJM Tariff outlines how retirements and reliability are handled.
  - Reliability Study
  - If there is a problem and it will take more time than the advance notice provided to solve it, then an RMR is possible to keep the unit is service until the solution is operational
  - In the alternative to an RMR, special operating procedures can and have been utilized
  - Issues are transmission overloads and voltage conditions
  - Average notice of units retired….20 months, average of pending retirements...30 months

Is There Really a Reliability Problem? Short Answer is NO!

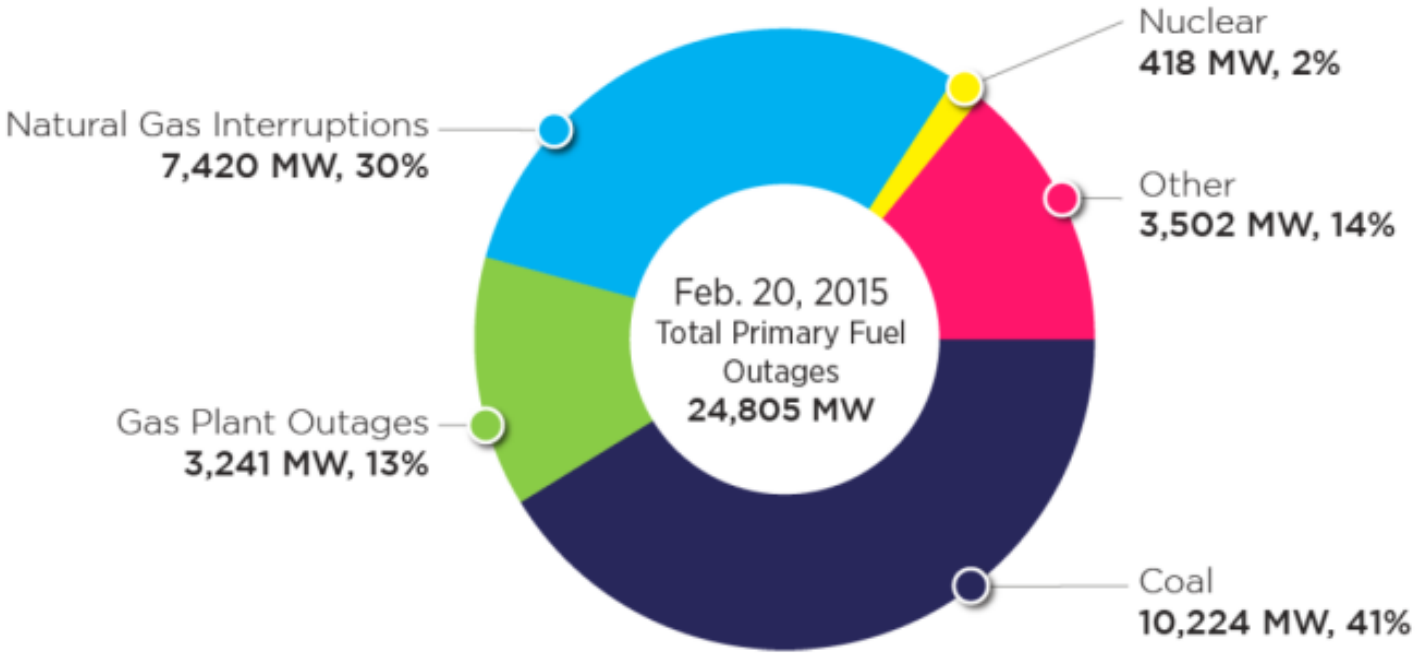
- PJM is at an all time cleared installed reserve margin with 23.2%, nearly 6% above the target of 16.6%
- Winter performance improving
- Overall fleet performance improving since CP was proposed and implemented
- Coal and nuclear are only small sources of reserves and regulation…all generation provides voltage support

The Polar Vortex Revisited…Outages in PJM



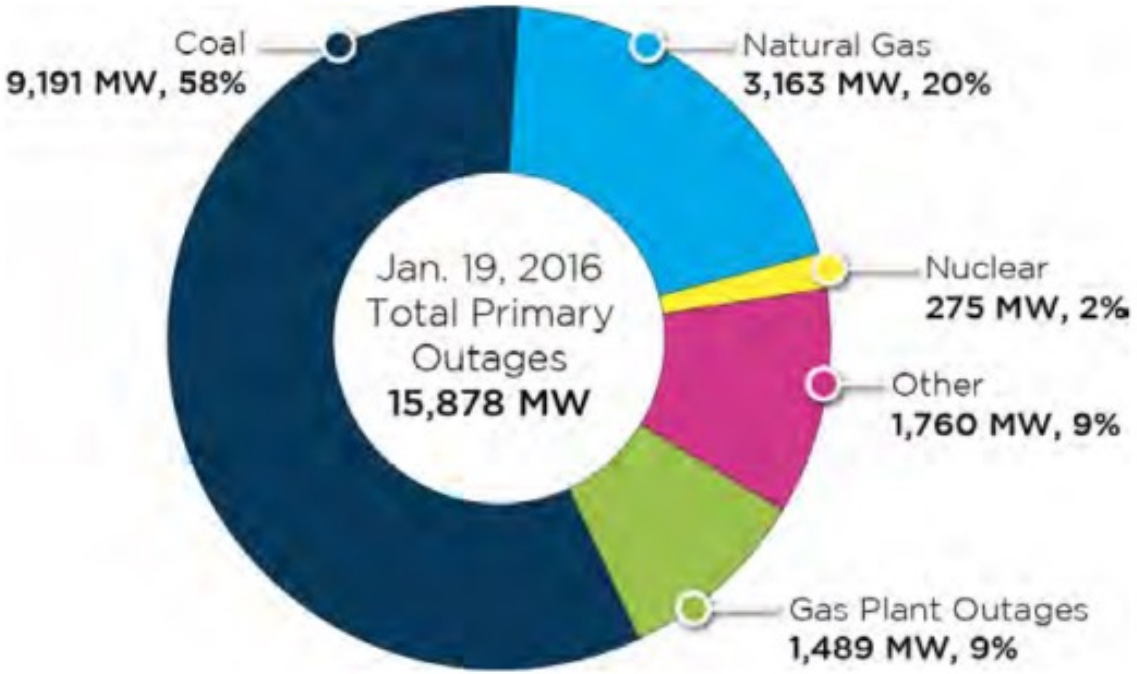
Source: PJM Interconnection, LLC, *Analysis of Operational Events and Market Impacts During the January 2014 Cold Weather Events*

Winter 2015 Performance



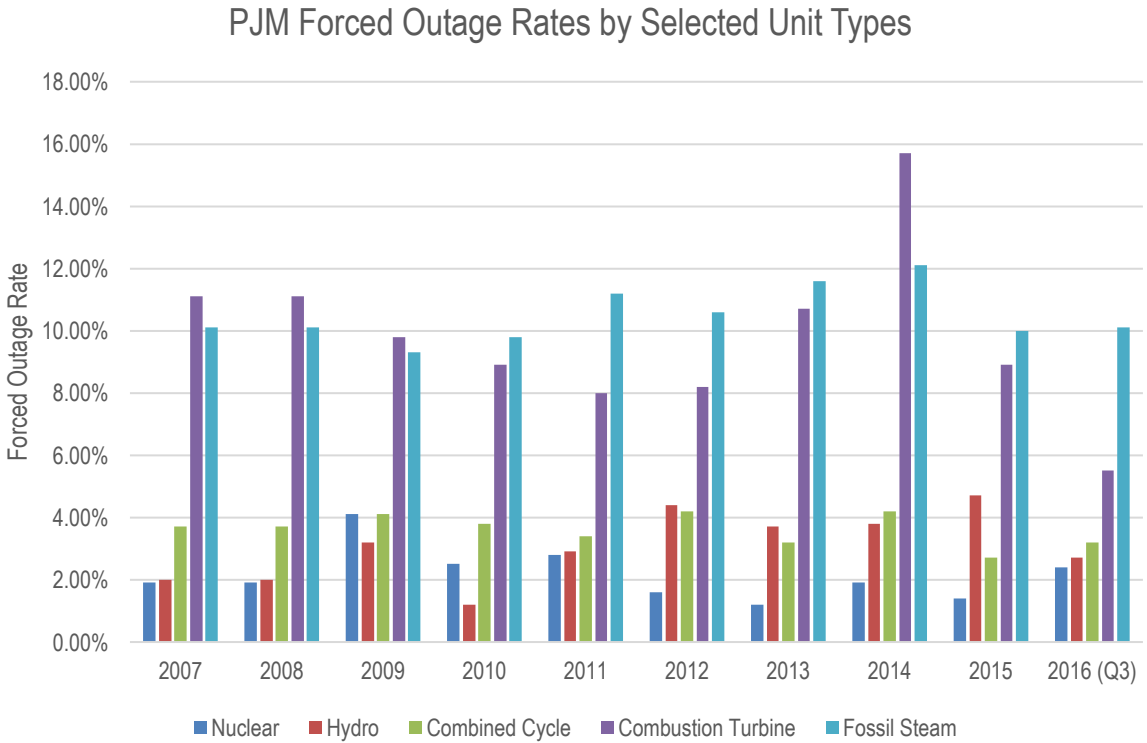
Source: PJM Interconnection, LLC, *2015 Winter Report*

Winter 2016 Performance



Source: PJM Interconnection, LLC, *2016 Winter Report*

History of Generator Performance in PJM

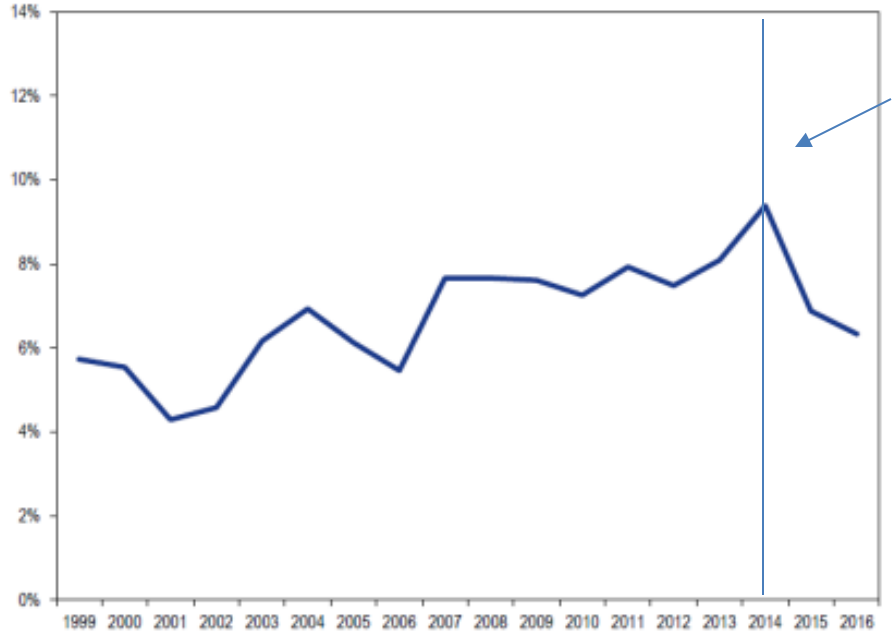


Source: Monitoring Analytics, LLC, *2015 State of the Market Report for PJM: Volume 2 Detailed Analysis* and *2016 Q3 State of the Market Report: January through September*

PJM Overall Trend in EFORd

Lack of fuel accounts for only 0.7% of all generator outages in PJM

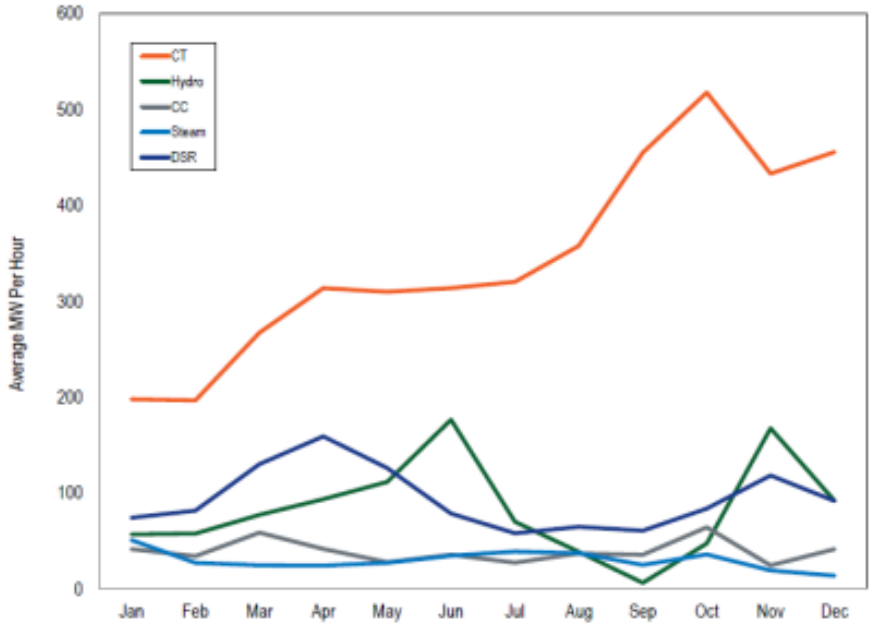
Figure 5-11 Trends in the PJM equivalent demand forced outage rate (EFORd): 1999 through 2016



Capacity Performance Proposal And Approval after Polar Vortex

Tier 2 Synchronized Reserve Sources in PJM

Figure 10-7 Cleared tier 2 synchronized reserve average hourly MW per hour by unit type, RTO Zone: 2016



In contrast to what has been stated by NERC and others, Steam (coal) does not account for a large share of reserves needed beyond what is on-line

Sources of Regulation and Frequency Response in PJM

Table 10-32 PJM regulation by source: 2015 and 2016[56]

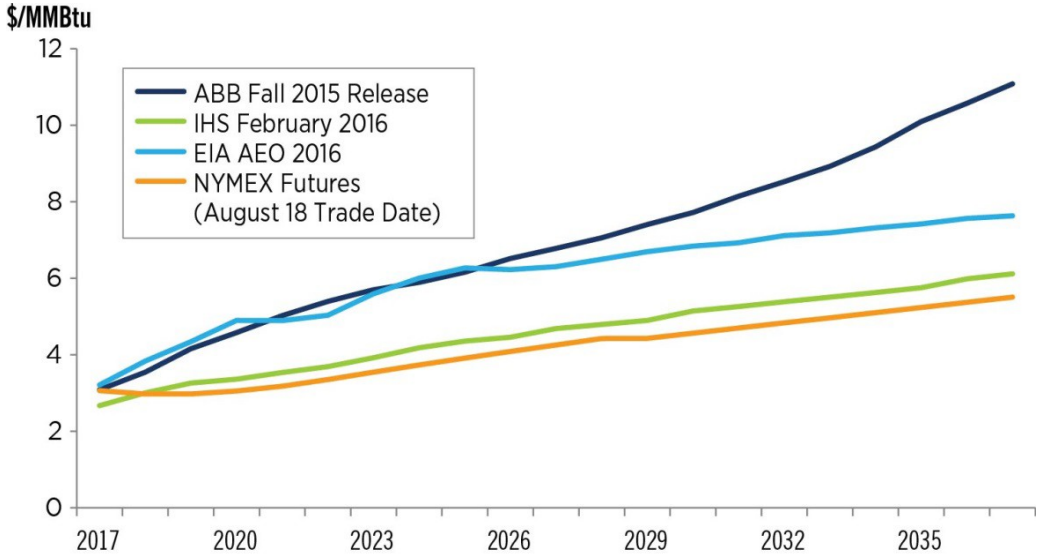
	2015				2016			
Source	Number of Units	Adjusted Settled Regulation (MW)	Percent of Scheduled Regulation	Total Regulation Credits	Number of Units	Adjusted Settled Regulation (MW)	Percent of Scheduled Regulation	Total Regulation Credits
Battery	18	1,384,058.6	27.6%	$37,460,009	21	2,020,532.8	41.0%	$31,108,011
Coal	101	590,903.6	11.8%	$32,877,595	49	427,069.7	8.7%	$9,604,454
Hydro	40	936,094.4	18.6%	$37,607,500	39	926,915.3	18.8%	$18,261,418
Natural Gas	150	2,076,097.3	41.3%	$71,188,567	152	1,488,563.1	30.2%	$24,266,943
DR	38	35,731.5	0.7%	$1,047,198	35	70,795.6	1.4%	$1,090,169
Total	347	5,022,885.5	100.0%	$180,180,868	296	4,933,876.5	100.0%	$84,330,994

Coal Steam Units only account for at most 12% of regulation and frequency response. Batteries and gas account for 70% of regulation service

Market Distortions/Inefficiency Abound with Higher Costs

- No clarity on how this is implemented
- Two possible options:
  - $/MWh adder like a PTC or REC or ZEC
  - Additional capacity payment
- Either way, distorts both energy and capacity market outcomes
  - Makes price formation non-transparent
  - Leads to more expensive resources being dispatched and committed, while lower cost resources may be forced to exit
  - Market prices artificially suppressed while costs to customers are higher.
- Only increases costs for customers

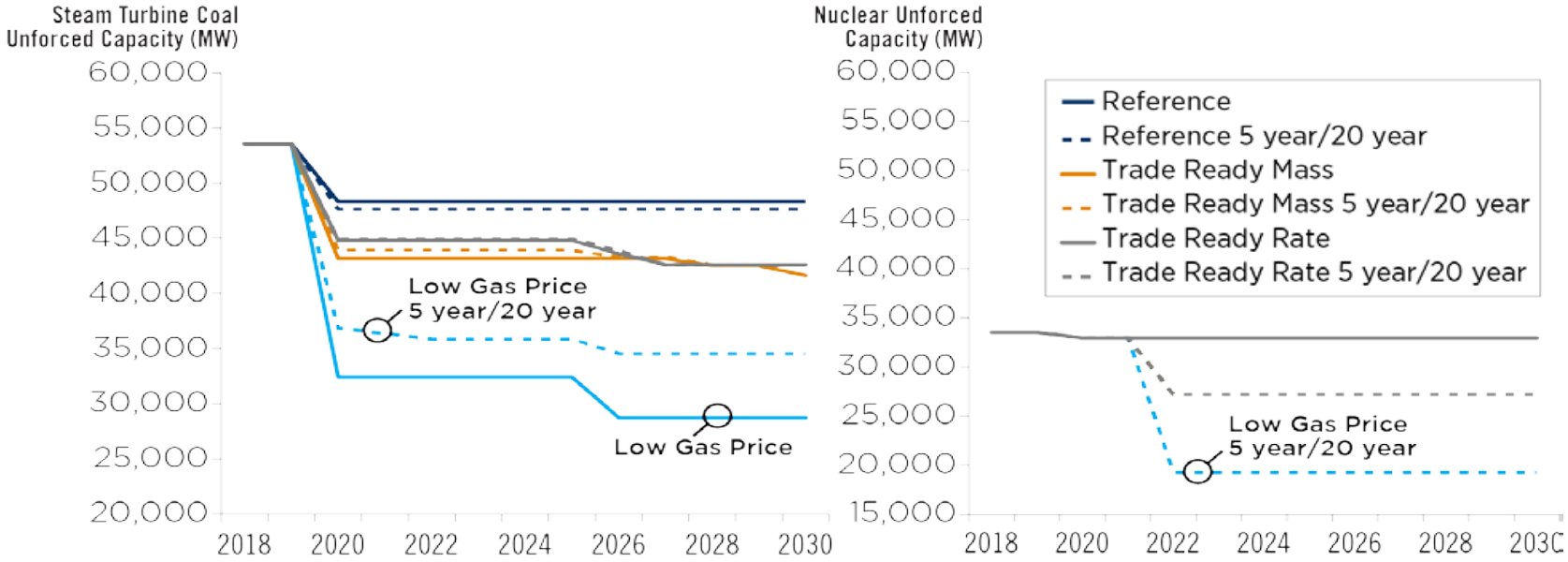
Gas Price Assumptions from the PJM Clean Power Plan Study



Source: IHS Inc.

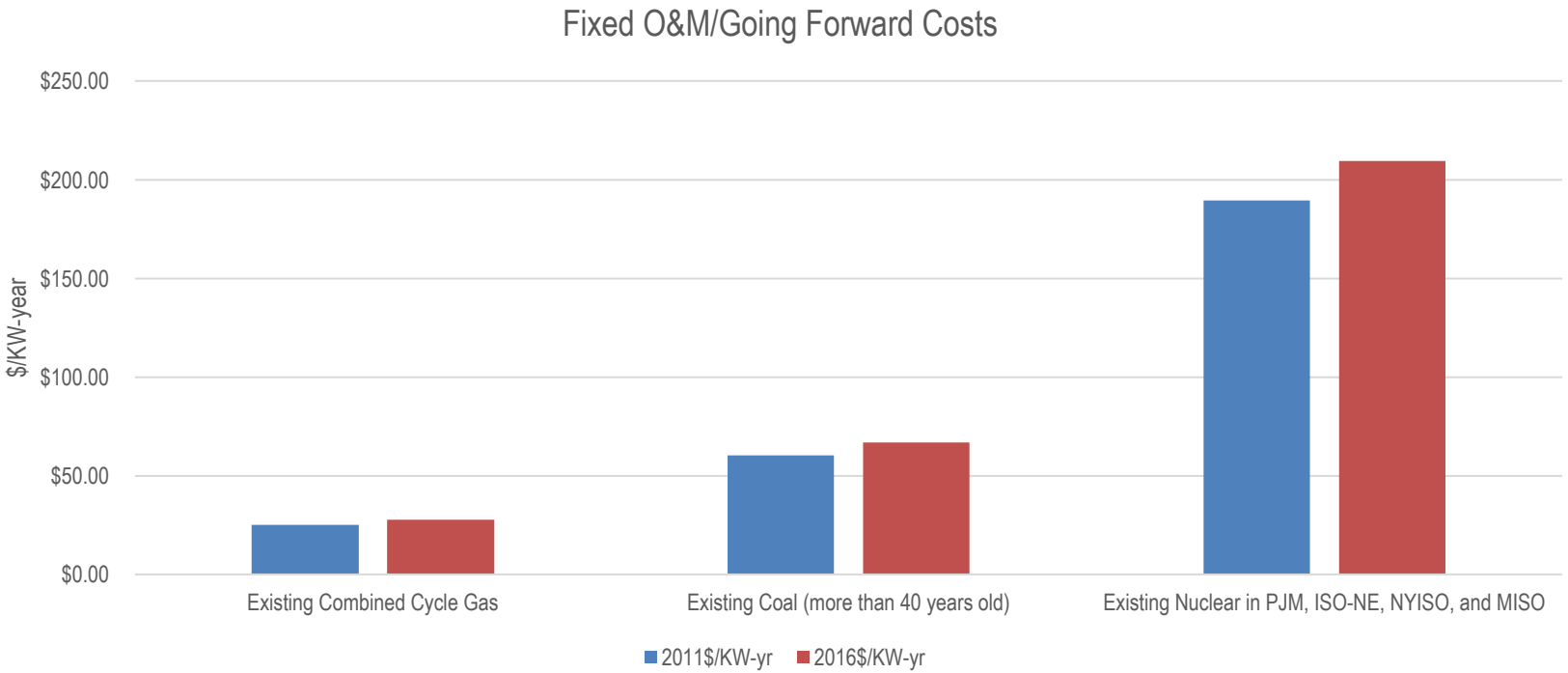
Source: PJM Interconnection, LLC, *EPA's Final Clean Power Plan Compliance Pathways and Reliability Analysis*, September 1, 2016, Figure 2.
The low gas price scenarios used the green series and these are higher than the Henry Hub forward curve from August 2016 and higher than the end of February 2017.

Low Gas Prices Lead to More Coal Retirements…and Combined with Short-term Decisions Lead to 14 GW of Nuclear Retirements



Source: PJM Interconnection, LLC, *EPA's Final Clean Power Plan Compliance Pathways and Reliability Analysis*, September 1, 2016, Figure 28.
The Blue dashed series has 14 GW of nuclear retirements…but additional combined cycle new entry and coal retirements due to the low gas prices.

Gas Dominates Going Forward Costs for Existing Resources

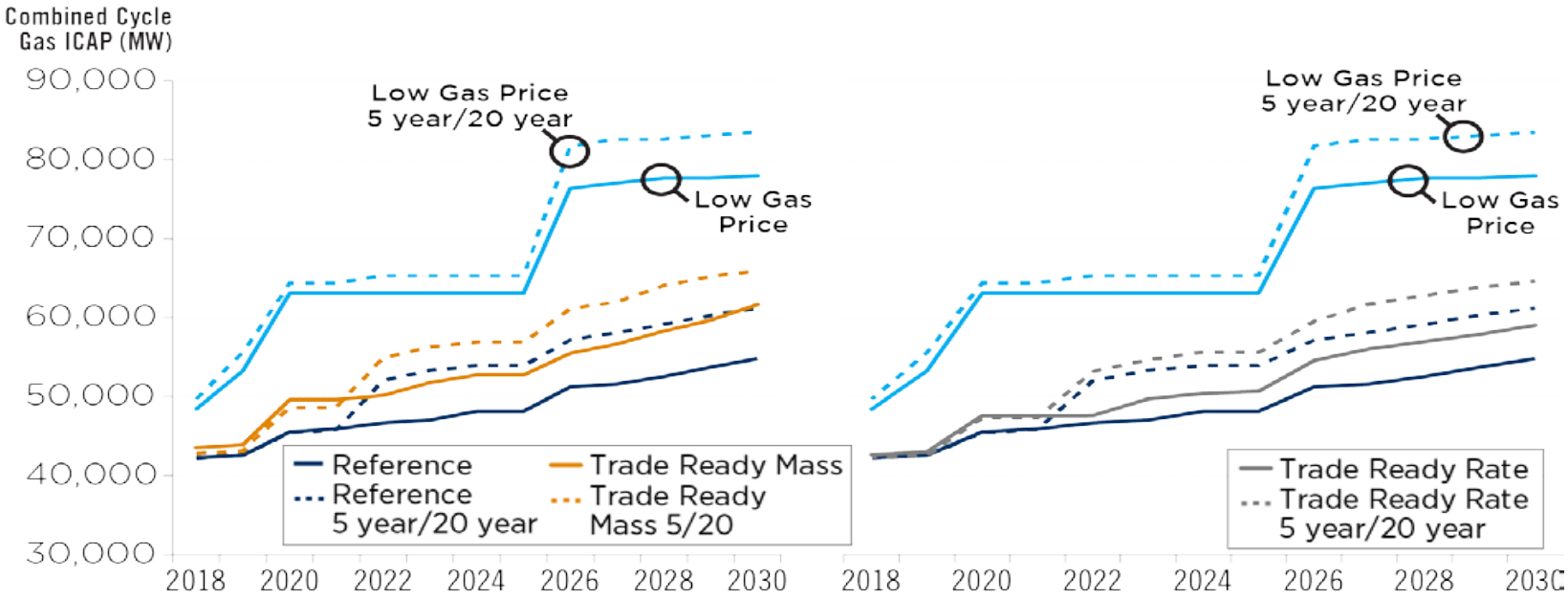


Source: EPA IPM Modeling Base Case v.5.13 Documentation

Lower Bound Cost of NOPR Based on PJM Low Gas Scenarios

- With 14 GW of nuclear retirements, $4.5 billion per year and this just accounts for going forward costs. Impact is $5.70/MWh estimated
- With just low gas prices and long-term view, few nuclear retirements, $1.75 billion per year and only covering going forward costs
- This does not account for the costs of new investments need for environmental compliance, rates of return, or costs of units coming out of retirement to capture returns.
- Cost allocation is not even addressed!

Low Gas Prices Lead to Additional Combined Cycle New Entry



Source: PJM Interconnection, LLC, *EPA's Final Clean Power Plan Compliance Pathways and Reliability Analysis*, September 1, 2016, Figure 23.
The Blue dashed series has 14 GW of nuclear retirements…but additional combined cycle new entry and coal retirements due to the low gas prices.

Questions?

Paul M. Sotkiewicz, Ph.D

drpaulg8r@gmail.com

610-955-2411

352-244-8800