



Maryland and Washington, D.C. Infrastructure Report

July 2017



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- Load Forecast

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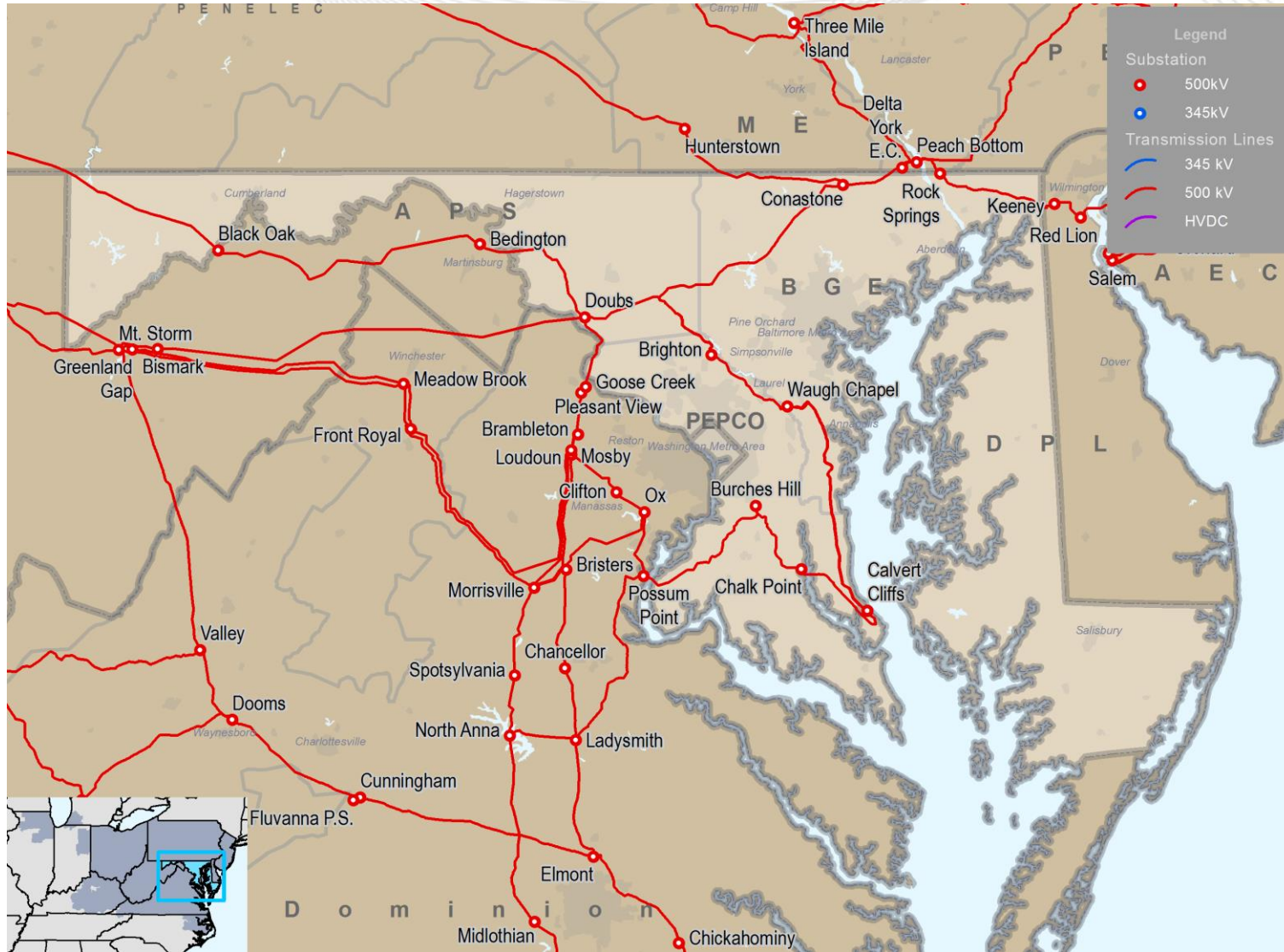
- **Existing Capacity:** Natural gas represents approximately 27 percent of the total installed capacity in Maryland and Washington, D.C. while coal represents approximately 39 percent. This differs from PJM where natural gas and coal are relatively even at 35 and 34 percent respectively.
- **Interconnection Requests:** Natural gas represents more than 76 percent of new interconnection requests in Maryland.
- **Deactivations:** Approximately 127 MW of capacity in Maryland retired in 2016. This represents more than 32 percent of the 392 MW that retired RTO-wide in 2016.
- **RTEP 2016:** Maryland and Washington, D.C. RTEP 2016 projects total greater than \$137 million in investment, all of which represents baseline projects.
- **Load Forecast:** Maryland and Washington, D.C. load growth is nearly flat, averaging between -.1 and .5 percent per year over the next 10 years. This aligns with PJM RTO load growth projections.

- **2020/21 Capacity Market:** Compared to the PJM footprint, Maryland's distribution of generation, demand response and energy efficiency in both base and capacity performance is similar. Washington, D.C. does not generate energy, but does contribute to the capacity market through demand response and energy efficiency.
- **6/1/14 – 5/31/17 Performance:** Maryland and Washington, D.C.'s average daily locational marginal prices were consistently above PJM average daily LMPs. Imported resources represented 48 percent of generation produced in Maryland while nuclear averaged 23 percent. 100 percent of generation in District Columbia is imported.
- **Emissions:** 2016 carbon dioxide emissions in Maryland are slightly up from 2015, while sulfur dioxides and nitrogen oxides continue to hold flat from 2015. All 2016 emissions in Washington, D.C. hold flat from 2015.



PJM Service Area – Maryland and Washington, D.C.

(December 31, 2016)



Planning

Generation Portfolio Analysis



Maryland & Washington, D.C. – Existing Installed Capacity

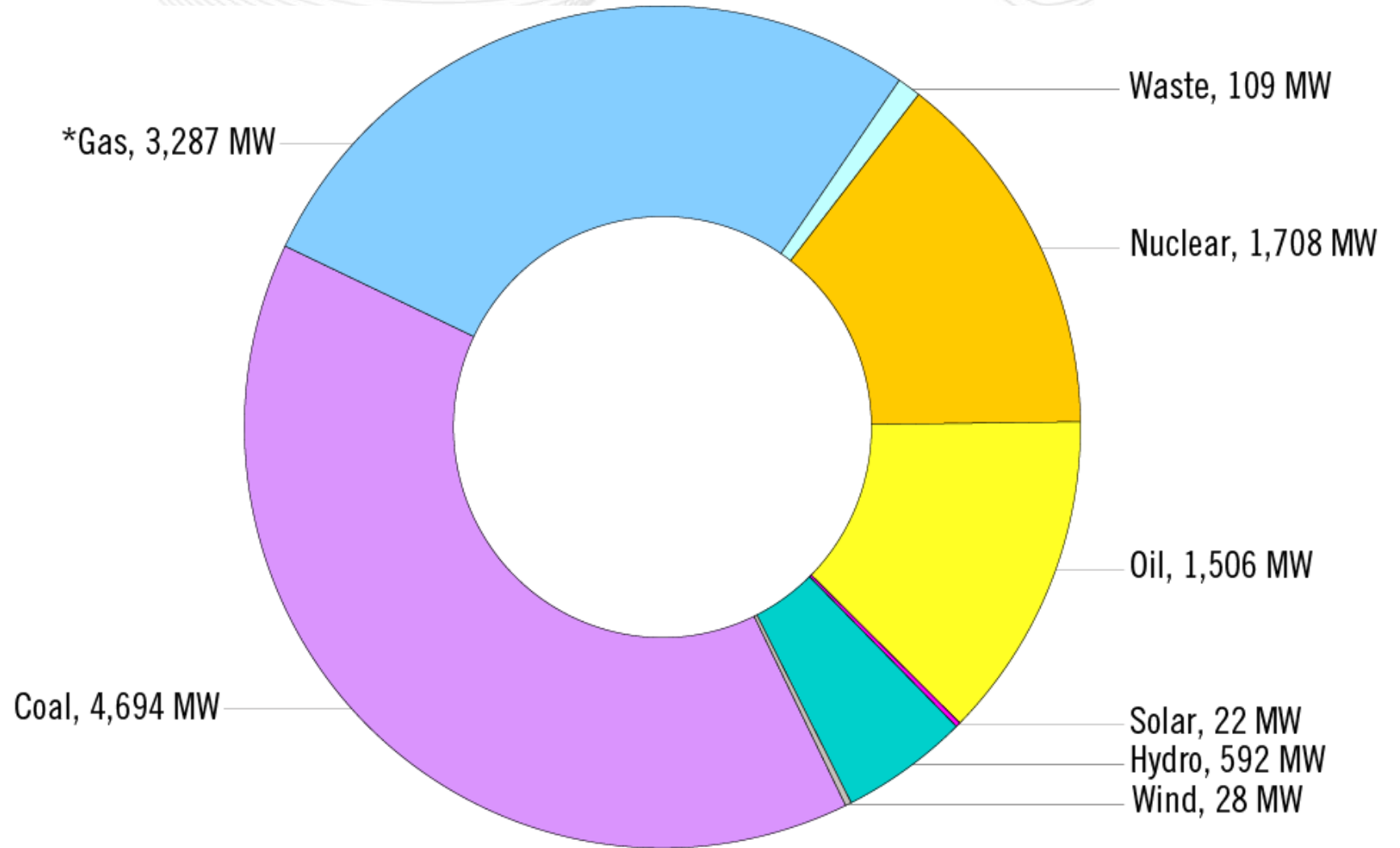
(MW submitted to eRPM, December 31, 2016)

Summary:

Natural gas represents approximately 28 percent of the total installed capacity in Maryland while coal represents approximately 39 percent.

Overall in PJM, natural gas and coal are relatively even at 35 percent and 34 percent respectively.

* Gas Contains	
Natural Gas	3,269.8 MW
Other Gas	17.3 MW

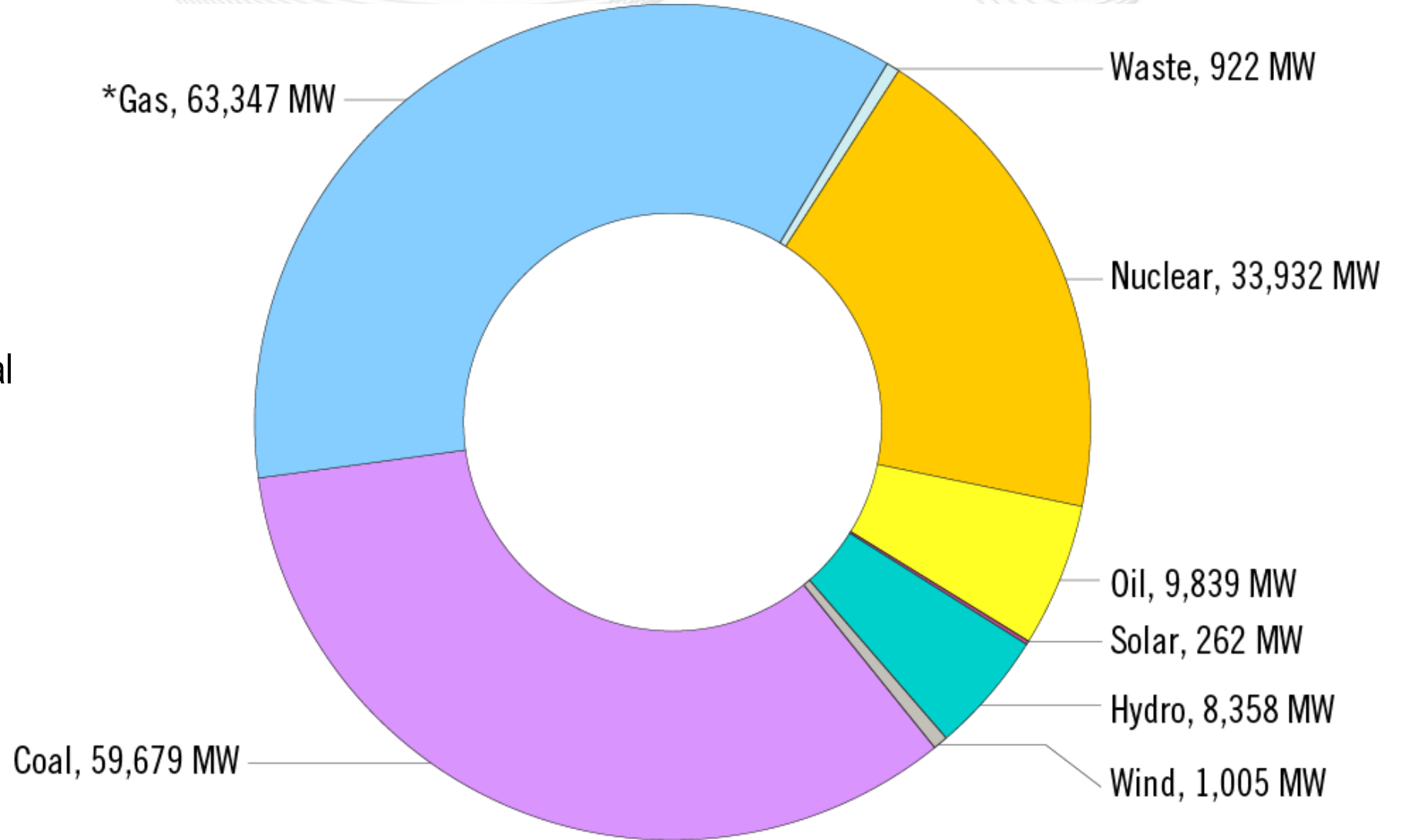


PJM – Existing Installed Capacity

(MW submitted to eRPM, December 31, 2016)

In PJM, natural gas and coal make up nearly 70 percent total installed capacity.

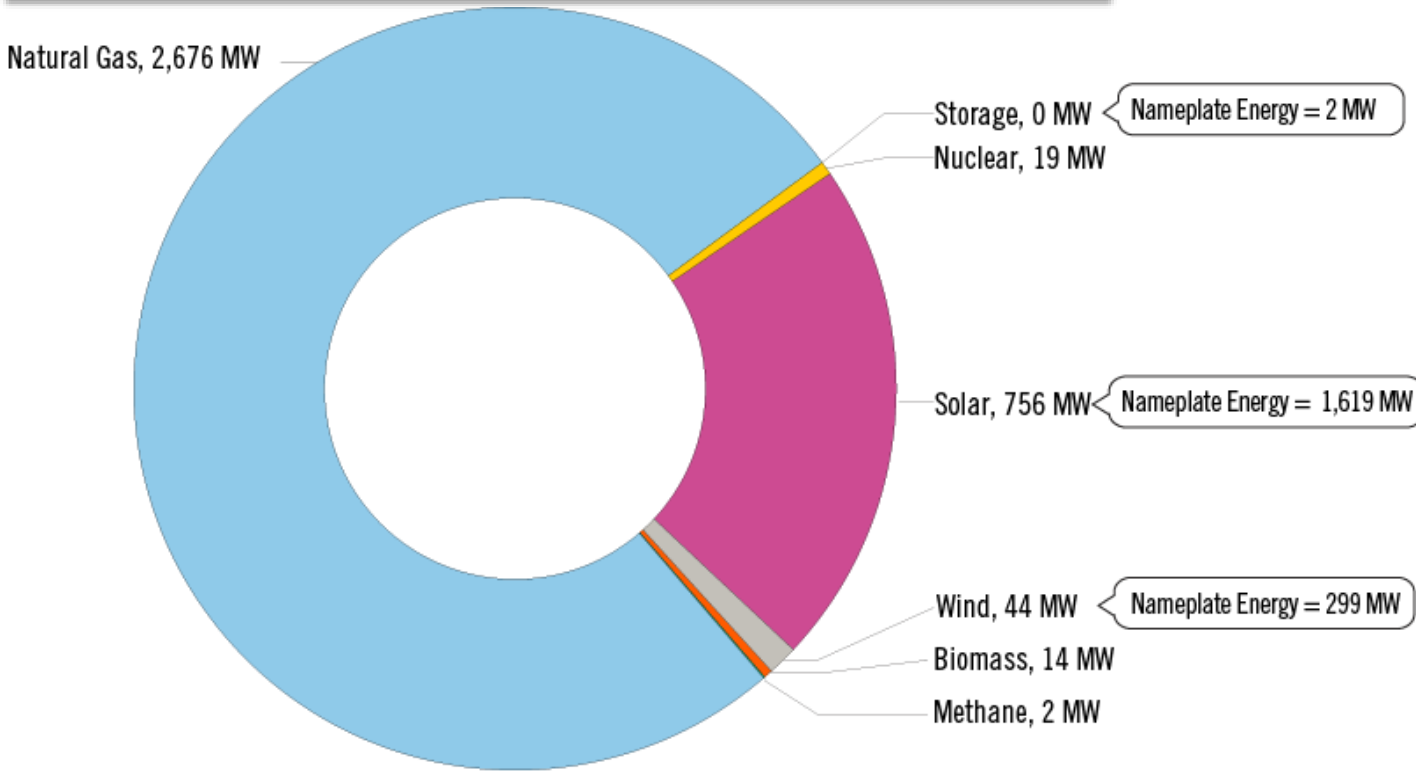
* Gas Contains	
Natural Gas	62,941 MW
Other Gas	405 MW



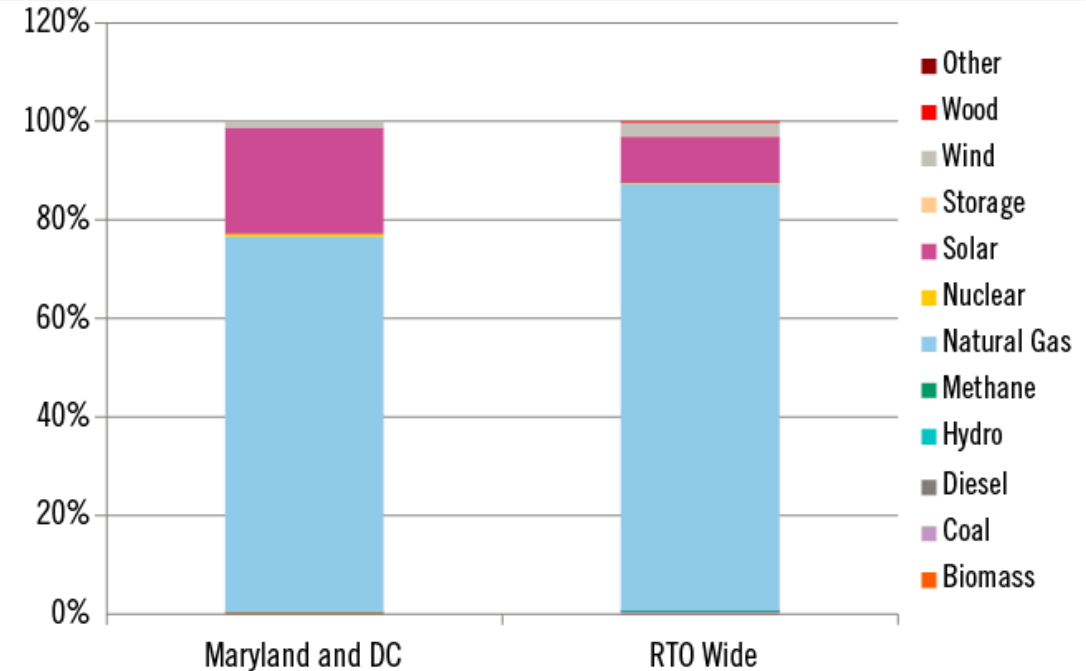
Natural gas represents nearly 76 percent of new interconnection requests in Maryland.

	MW	# of projects
Active	645	57
Under Construction	2,806	49
Suspended	62	12
Total	3,512	118

Total MW Capacity by Fuel Type



Fuel as a Percentage of Projects in Queue

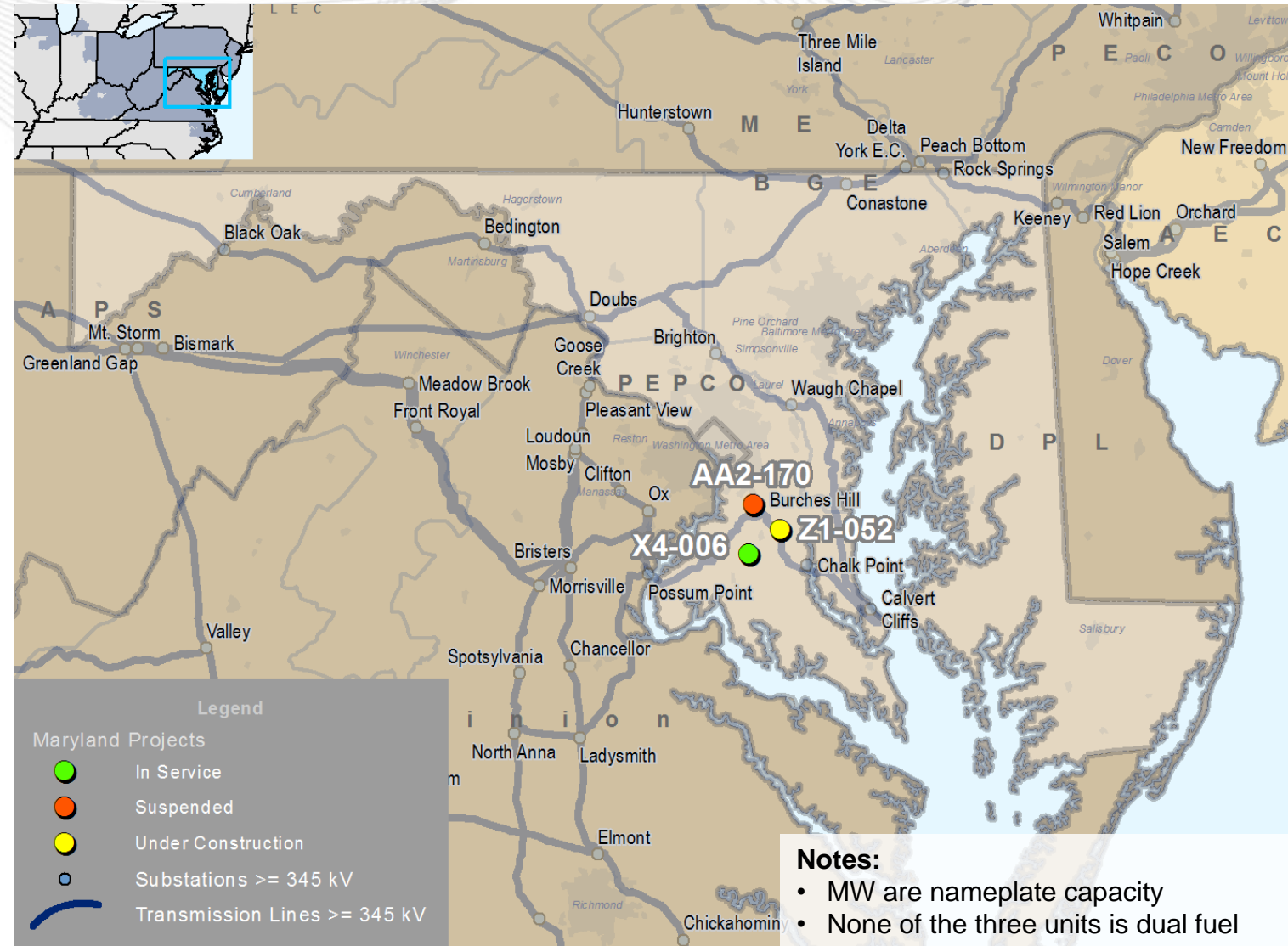




Maryland & Washington, D.C. – Interconnection Requests

	Active		In Service		Suspended		Under Construction		Withdrawn		Total Sum	
	MW	# of Projects	MW	# of Projects	MW	# of Projects	MW	# of Projects	MW	# of Projects	MW	# of Projects
Biomass	13.8	3							188.8	8	202.6	11
Coal			10.0	1							10.0	1
Diesel			0.0	1					5.0	1	5.0	2
Hydro			60.0	2			0.0	1	73.4	3	133.4	6
Methane	2.0	1	21.5	9					4.0	3	27.5	13
Natural Gas			1,232.2	26	4.4	1	2,672.0	9	31,295.1	58	35,203.7	94
Nuclear	19.2	1	0.0	1					4,955.0	4	4,974.2	6
Oil			5.0	2					2.0	1	7.0	3
Solar	601.8	49	26.0	8	48.1	10	106.2	17	525.7	100	1,307.8	184
Storage	0.0	1					0.0	20	60.0	7	60.0	28
Other									157.0	5	157.0	5
Wind	7.9	2	32.5	4	9.1	1	27.3	2	167.0	7	243.8	16
Total	644.7	57	1,387.2	54	61.5	12	2,805.5	49	37,433.0	197	42,331.9	369

Combined Cycle Natural Gas Generation Project	St. Charles	<ul style="list-style-type: none"> • 785 MW, Charles County • Owned by CPV; Queue Position V3-017 / X4-006 • Fully in service and operating (early 2017)
	Keys	<ul style="list-style-type: none"> • 800 MW, Prince Georges County • Owned by PS Power; Queue Position X4-035 / Z1-052 • Under construction; initial operation expected 1Q18; new interconnect sub — Cheltenham — expected to be operational June 2017
	Mattawoman	<ul style="list-style-type: none"> • 1000 MW, Prince Georges County • Owned by Panda Power; Queue Position X3-087 / Z2-060 / AA2-170 • Recently went into suspension; will need to develop new schedule once out of suspension.



Maryland and Washington, D.C. – Progression History Interconnection Requests

(Requested Capacity Rights, 2004 - 2016)



Following Final Agreement execution 4,602 MW of capacity withdrew from PJM's interconnection process. Another 2,859 MW have executed agreements but were not in service as of December 31, 2016 (*Suspended or Under Construction*). Overall, 3% of requested capacity in Maryland and Washington, D.C. reaches commercial operation.

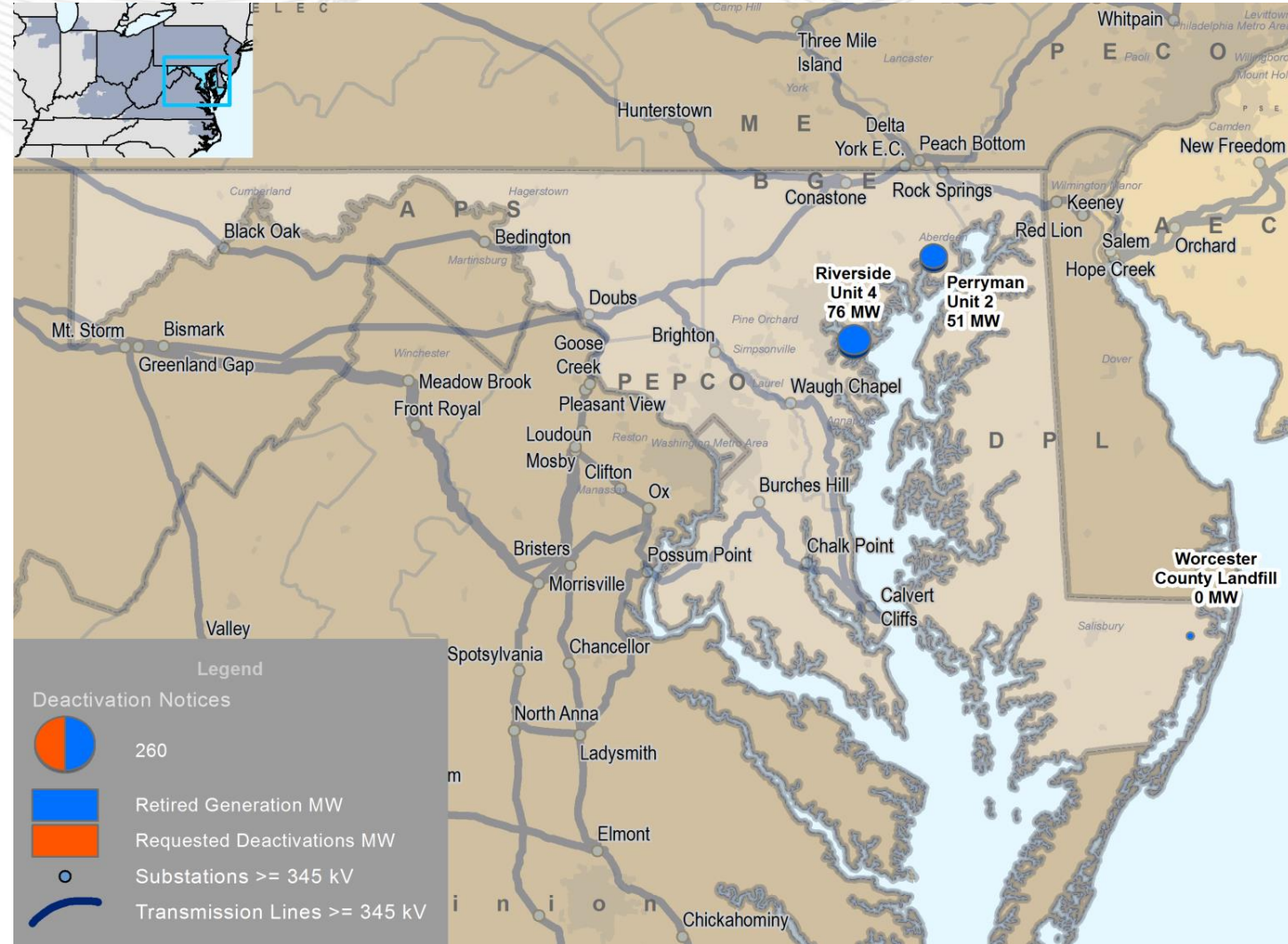


Maryland and Washington, D.C. – 2016 Actual Generation Deactivations

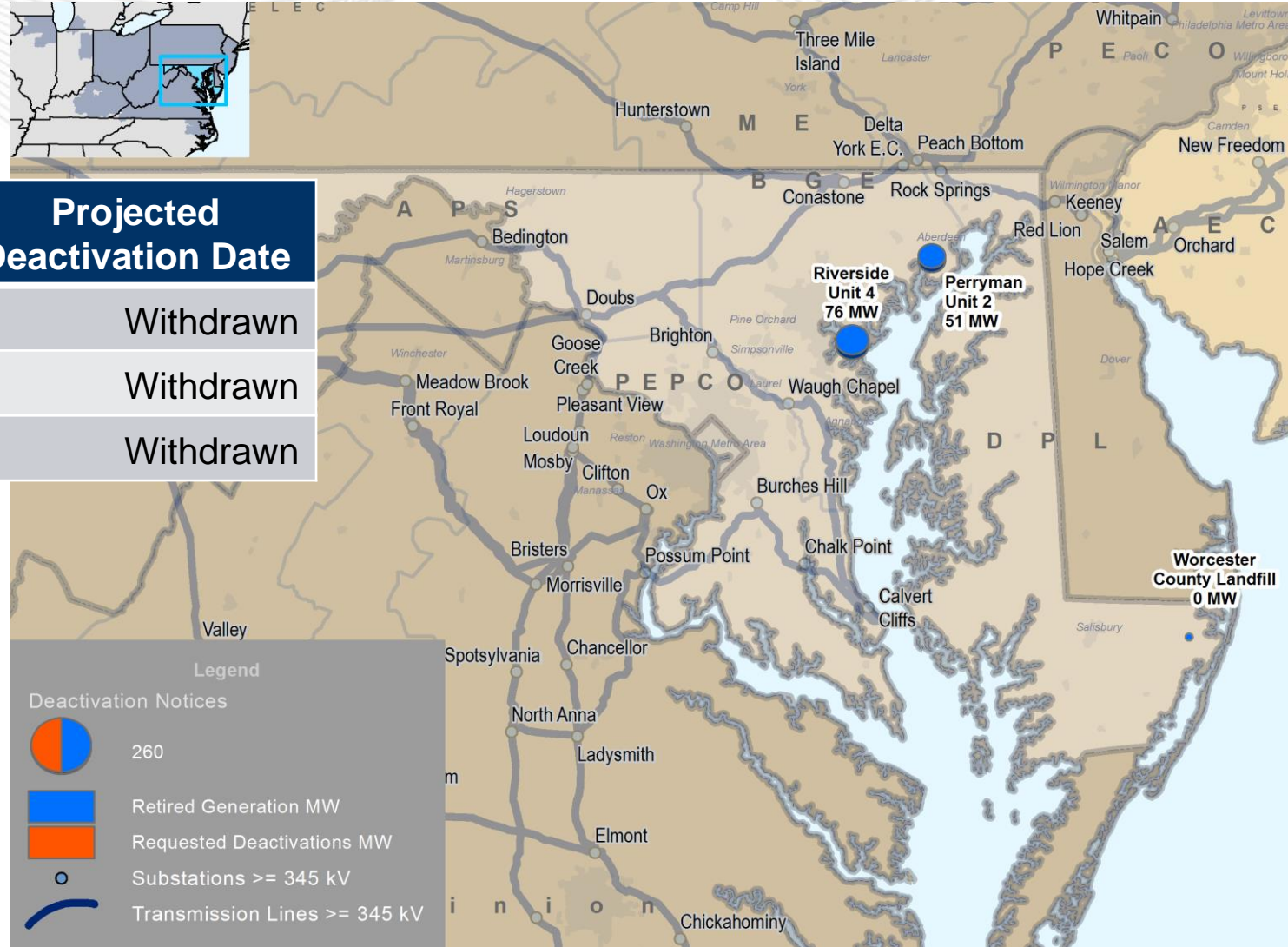
Summary:

- 3 generating units in MD deactivated in 2016
- Worcester County Landfill comprised 0 MW capacity and 2 MW energy
- 11 generating units across PJM totaling 392 MW of capacity deactivated in 2016

Unit	MW Capacity	TO Zone	Age	Actual Deactivation Date
Perryman 2	51	BGE	43	2/1/2016
Riverside 4	76	BGE	62	6/1/2016
Worcester County Landfill	0	DPL	8	12/23/2016



Maryland and Washington, D.C.– 2016 Projected Generation Deactivations (Deactivation Notifications Received in 2016)



Unit	MW Capacity	TO Zone	Age	Projected Deactivation Date
Crane 1*	190	BGE	55	Withdrawn
Crane 2*	195	BGE	54	Withdrawn
Crane GT*	14	BGE	50	Withdrawn

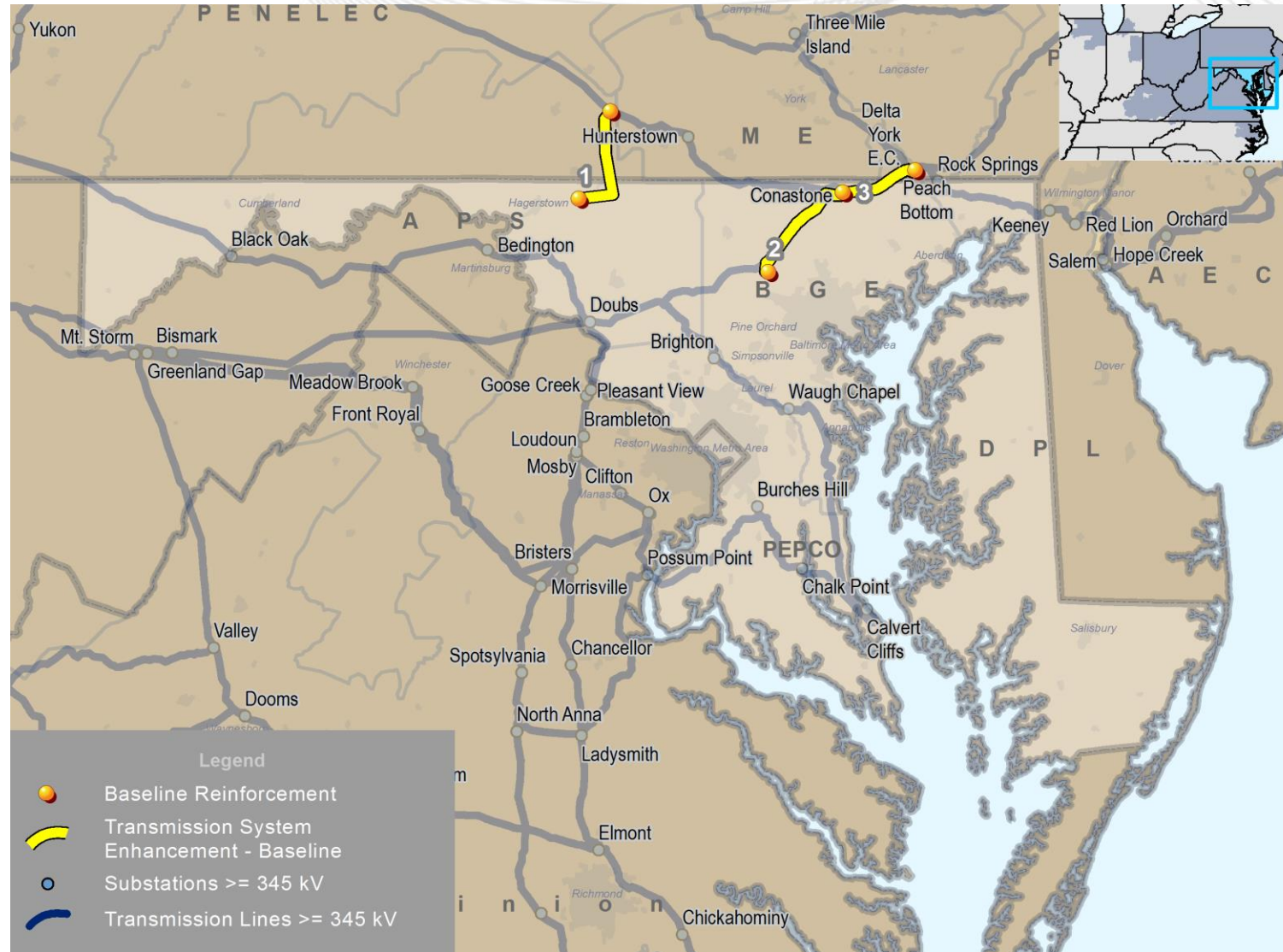
Summary:

- Crane units 1, 2 and GT submitted a deactivation notice then withdrew it
- 23 generating units across PJM announced their intent to deactivate, ranging in date from 2016 - 2020.

Planning

Transmission Infrastructure Analysis

Maryland & Washington, D.C. – RTEP Baseline Projects





Maryland & Washington, D.C. – RTEP Baseline Projects

(Greater than \$5 million)

Maryland & DC Baseline Project Driver

Map ID	Project ID	Project	Baseline Load Growth/ Deliverability & Reliability	Congestion Relief - Economic	Operational Performance	Generator Deactivation	TO Criteria Violation	Required Date	Cost (\$M)	Designated Entity*	2016 TEAC Review
1	b2743.5	Build new 230 kV double circuit line between Rice and Ringgold 230 kV, operated as a single circuit.		•				6/1/2020	\$72.88	Transource	6/9/2016
	b2743.6	Reconfigure the Ringgold 230 kV substation to double bus double breaker scheme		•				6/1/2020	\$7.87	APS	6/9/2016

Note: Baseline upgrades are those that resolve a system reliability criteria violation.



Maryland & Washington, D.C. – RTEP Baseline Projects

(Greater than \$5 million)

Maryland & DC Baseline Project Driver

Map ID	Project ID	Project	Baseline Load Growth/Deliverability & Reliability	Congestion Relief - Economic	Operational Performance	Generator Deactivation	TO Criteria Violation	Required Date	Cost (\$M)	Designated Entity*	2016 TEAC Review
1	b2743.6.1	Replace the two Ringgold 230/138 kV transformers		•				6/1/2020	\$6.26	APS	6/9/2016
2	b2752.6	Conastone 230 kV substation tie-in work (install a new circuit breaker at Conastone 230 kV and upgrade any required terminal equipment to terminate the new circuit)		•				6/1/2020	\$4.12	BGE	6/9/2016

Note: Baseline upgrades are those that resolve a system reliability criteria violation.



Maryland & Washington, D.C. – RTEP Baseline Projects

(Greater than \$5 million)

Maryland & DC Baseline Project Driver

Map ID	Project ID	Project	Baseline Load Growth/ Deliverability & Reliability	Congestion Relief - Economic	Operational Performance	Generator Deactivation	TO Criteria Violation	Required Date	Cost (\$M)	Designated Entity*	2016 TEAC Review
2	b2752.7	Reconductor/Rebuild the two Conastone - Northwest 230 kV lines and upgrade terminal equipment on both ends		•				6/1/2020	\$45.88	BGE	6/9/2016

Note: Baseline upgrades are those that resolve a system reliability criteria violation.



Maryland & Washington, D.C. – RTEP Baseline Projects

(Greater than \$5 million)

			MD and DC Baseline Project Driver								
Map ID	Project ID	Project	Baseline Load Growth/ Deliverability & Reliability	Congestion Relief - Economic	Operational Performance	Generator Deactivation	TO Criteria Violation	Required Date	Cost (\$M)	Designated Entity*	2016 TEAC Review
3	b2766.1	Upgrade substation equipment at Conastone 500 kV (on the Peach Bottom – Conastone 500 kV circuit) to increase facility rating to 2826 MVA normal and 3525 MVA emergency	●					6/1/2021	\$2.70	BGE	10/6/2016

Note: Baseline upgrades are those that resolve a system reliability criteria violation.



Maryland & Washington, D.C. – RTEP Network Projects

(Greater than \$5 million)

			MD and DC Network Project Drivers			Required Date	Cost (\$M)	TO Zone(s)	2016 TEAC Review
Map ID	Project ID	Project	Generation Interconnection	Merchant Transmission Interconnection	Long-term Firm Transmission Service				
		none							

Note: Network upgrades are new or upgraded facilities required primarily to eliminate reliability criteria violations caused by proposed generation, merchant transmission or long term firm transmission service requests.



Maryland & Washington, D.C. – TO Supplemental Projects

(Greater than \$5 million)

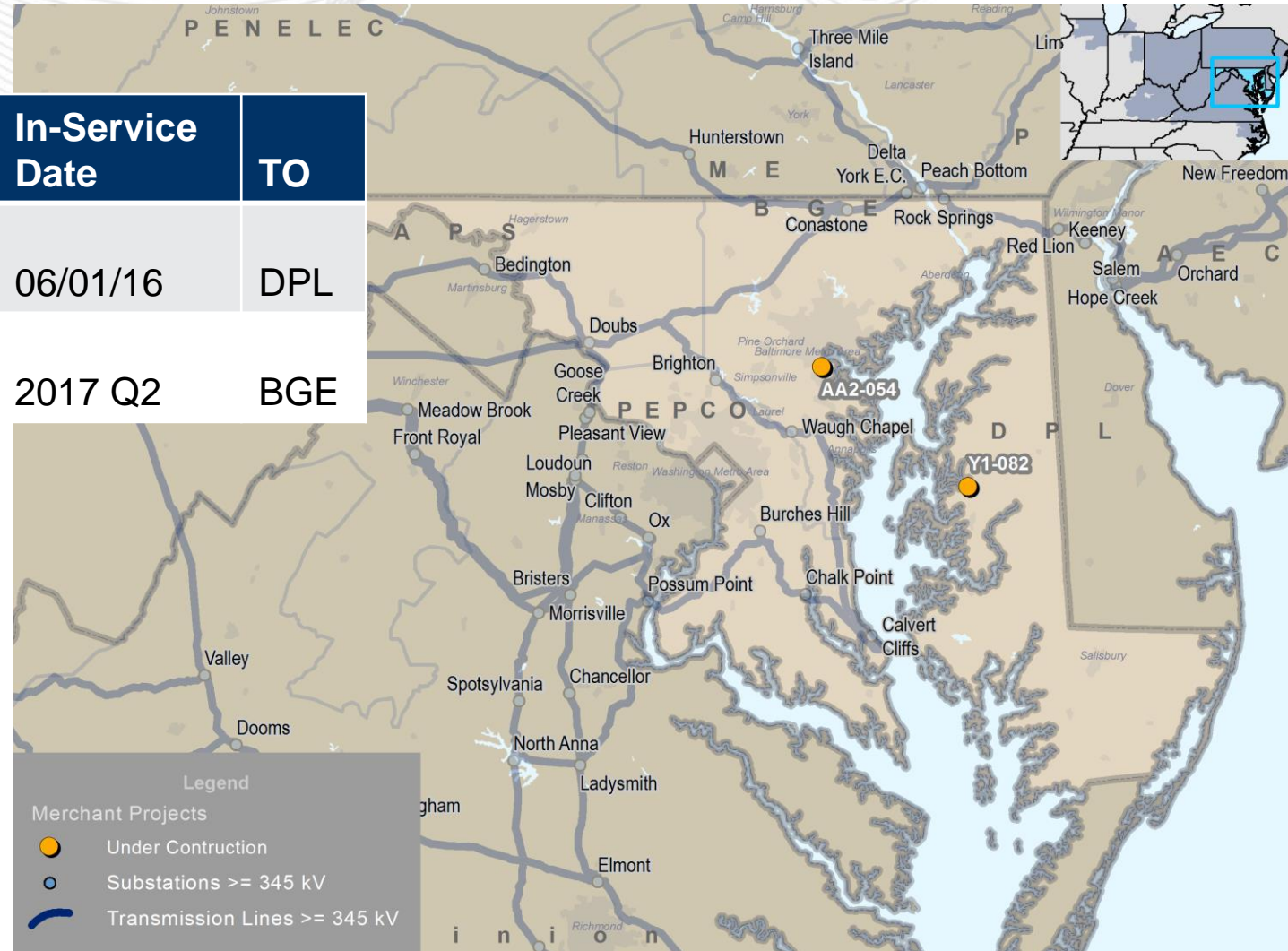
Map ID	Project ID	Project	Required Date	Cost (\$M)	TO Zone(s)	2016 TEAC Review
		None				

Note: Supplemental projects are transmission expansions or enhancements that are used as inputs to RTEP models, but are not required for reliability, economic efficiency or operational performance criteria, as determined by PJM.



Maryland & Washington, D.C. – Merchant Transmission Project Requests

Queue	Project Name	MFO	Status	In-Service Date	TO
Y1-082	Longwood-Wye Mills 69kV	63	In Service	06/01/16	DPL
AA2-054	Pumphrey 230kV	155	Under Construction	2017 Q2	BGE



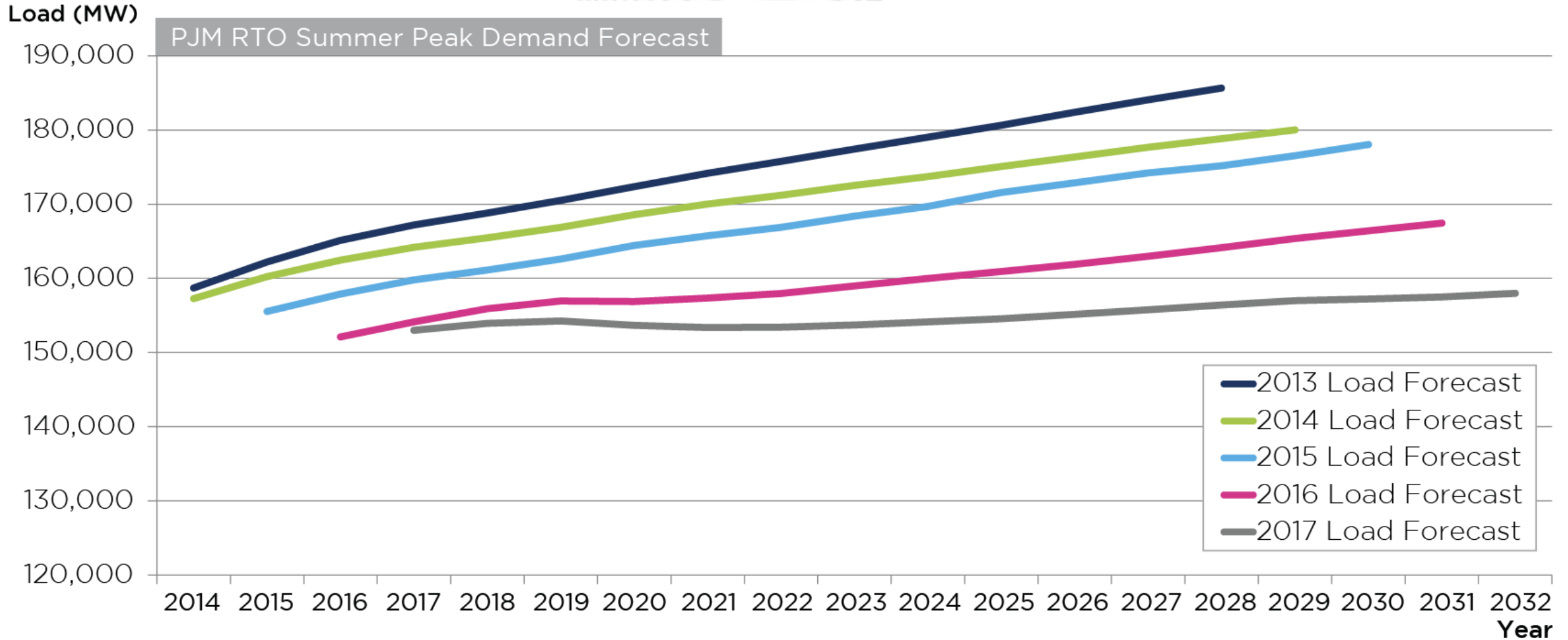
Planning

Load Forecast



PJM Annual Load Forecasts

(January 9, 2017)





Washington, D.C. – 2017 Load Forecast Report

Transmission Owner	Summer Peak (MW)			Winter Peak (MW)		
	2017	2027	Growth Rate (%)	2016/17	2026/27	Growth Rate (%)
Potomac Electric Power Company*	2,063	2,041	-0.1%	1,603	1,630	0.2%
PJM RTO	152,999	155,773	0.2%	131,391	134,915	0.3%

***Note:** Potomac Electric Power serves load other than in the District of Columbia. The Summer peak and Winter Peak MW values in this table each reflect the estimated amount of forecasted load to be served by Potomac Electric Power solely in DC. Estimated amounts were calculated based on the average share of each transmission owner's real-time summer and winter peak load located in DC over the past five years.

PJM's 2017 forecast reflects methodology improvements implemented in 2016: variables to account for equipment and appliance saturation and efficiency, distributed solar generation adjustments and more refined treatment of weather data.



Maryland – 2017 Load Forecast Report

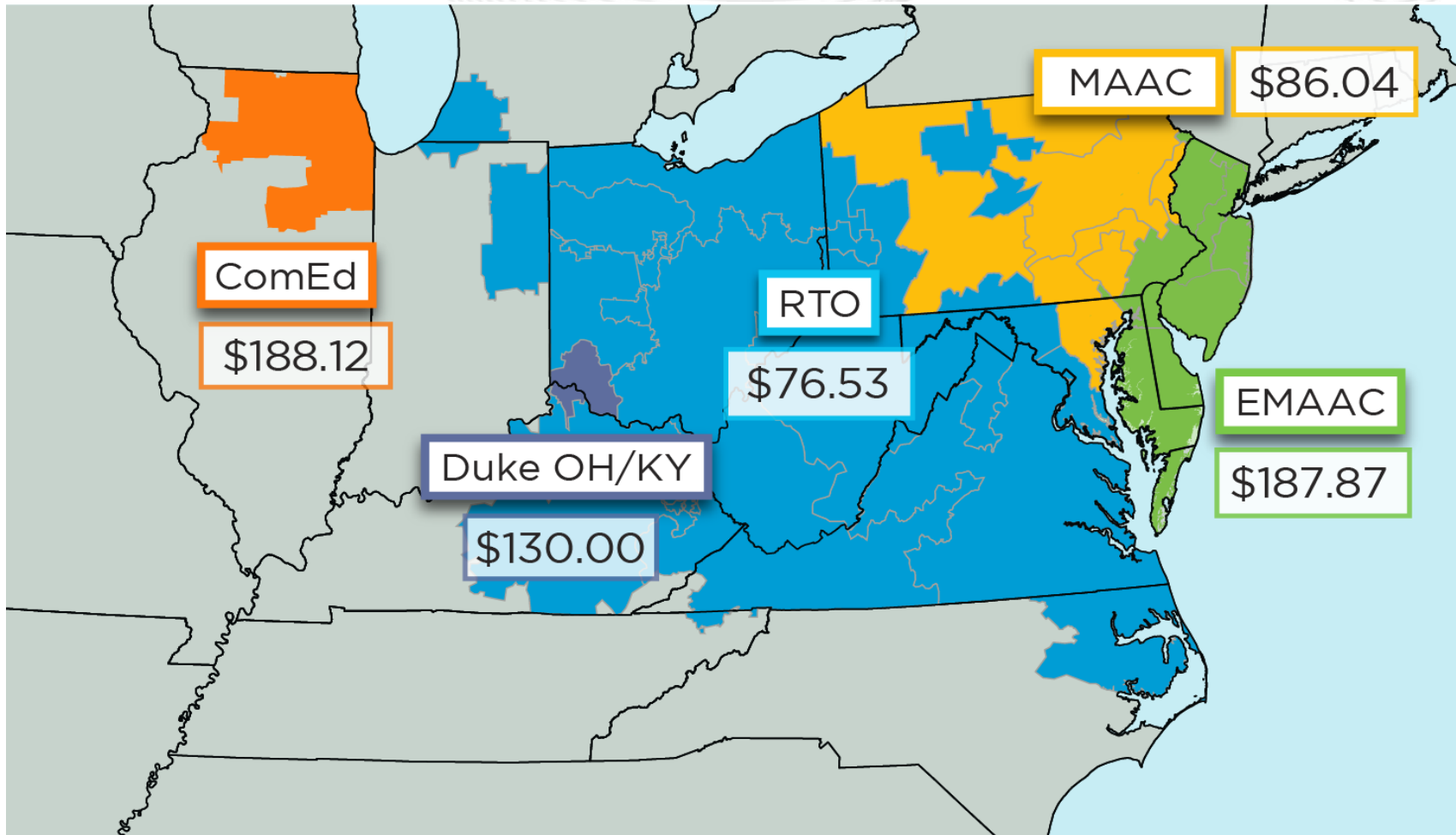
Transmission Owner	Summer Peak (MW)			Winter Peak (MW)		
	2017	2027	Growth Rate (%)	2016/17	2026/27	Growth Rate (%)
Allegheny Power*	1,328	1,371	0.3%	1,356	1,424	0.5%
Baltimore Gas and Electric Company	6,889	6,911	0.0%	5,883	5,920	0.1%
Delmarva Power and Light*	1,202	1,189	-0.1%	1,177	1,201	0.2%
Potomac Electric Power Company*	4,551	4,502	-0.1%	3,749	3,814	0.2%
PJM RTO	152,999	155,773	0.2%	131,391	134,915	0.3%

***Note:** Allegheny Power, Delmarva Power and Light, and Potomac Electric Power each serve load other than in Maryland. The Summer peak and Winter peak MW values in this table reflect the estimated amount of forecasted load to be served by each PJM transmission owner in Maryland. Estimated amounts were calculated based on the average share of each transmission owner's real-time summer and winter peak load located in Maryland over the past five years.

PJM's 2017 forecast reflects methodology improvements implemented in 2016: variables to account for equipment and appliance saturation and efficiency, distributed solar generation adjustments and more refined treatment of weather data.

Markets

Capacity Market Results





Maryland - Cleared Resources in 2020/21 Auction

(May 23, 2017)

	Cleared MW (Unforced Capacity)	Change from 2019/20 Auction
Generation	11,784	(1,236)
Demand Response	127	(660)
Energy Efficiency	40	(117)
Total	11,951	(2,013)

RTO Locational Clearing Price

\$76.53

MAAC Locational Clearing Price

\$86.04

NOTE: Demand Response and Energy Efficiency are reported to PJM by Transmission Zone. The numbers above reflect the state's pro-rata share of cross-state zones for illustrative purposes.



Washington, D.C. - Cleared Resources in 2020/21 Auction

(May 23, 2017)

	Cleared MW (Unforced Capacity)	Change from 2019/20 Auction
Generation	-	-
Demand Response	85	(109)
Energy Efficiency	27	(5)
Total	112	(114)

RTO Locational Clearing Price

\$76.53

MAAC Locational Clearing Price

\$86.04

NOTE: Demand Response and Energy Efficiency are reported to PJM by Transmission Zone. The numbers above reflect the state's pro-rata share of cross-state zones for illustrative purposes.



PJM - Cleared Resources in 2020/21 Auction

(May 23, 2017)

	Cleared MW (Unforced Capacity)	Change from 2019/20 Auction
Generation	155,976	882
Demand Response	7,820	(2,528)
Energy Efficiency	1,710	195
Total	165,506	(1,450)



Maryland – Offered and Cleared Resources in 2020/21 Auction

(May 23, 2017)

		Unforced Capacity
Generation	Offered MW	13,950
	Cleared MW	11,784
Demand Response	Offered MW	208
	Cleared MW	127
Energy Efficiency	Offered MW	60
	Cleared MW	40
Total Offered MW		14,218
Total Cleared MW		11,951

NOTE: Demand Response and Energy Efficiency are reported to PJM by Transmission Zone. The numbers above reflect the state's pro-rata share of cross-state zones for illustrative purposes.



Washington, D.C. - Cleared Resources in 2020/21 Auction

(May 23, 2017)

		Unforced Capacity
Generation	Offered MW	-
	Cleared MW	-
Demand Response	Offered MW	139
	Cleared MW	85
Energy Efficiency	Offered MW	36
	Cleared MW	27
Total Offered MW		174
Total Cleared MW		112

NOTE: Demand Response and Energy Efficiency are reported to PJM by Transmission Zone. The numbers above reflect the state's pro-rata share of cross-state zones for illustrative purposes.

Markets

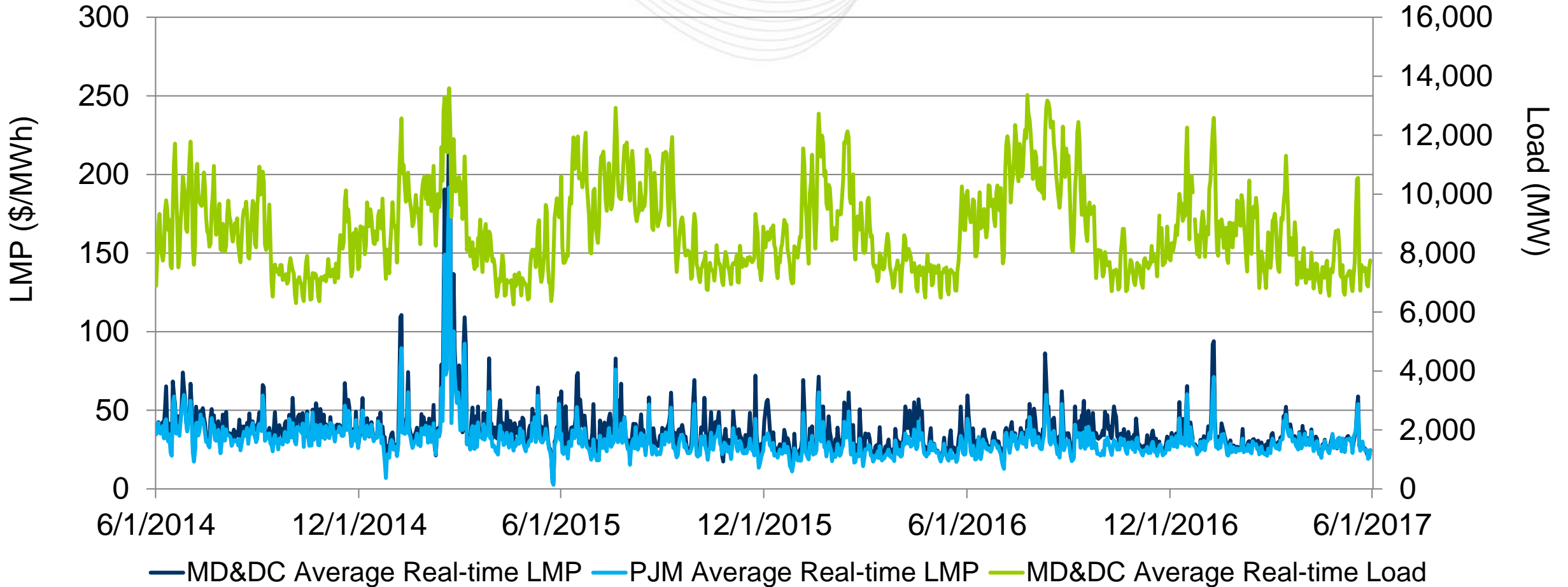
Market Analysis



Maryland and D.C. - Average Daily Load and LMP

(June 1, 2014 - May 31, 2017)

Maryland and D.C.'s average daily LMPs were generally higher than the PJM average daily LMP
(The graphs for each individual district are comparable; LMP's are the load-weighted average for Maryland and Washington, D.C.)



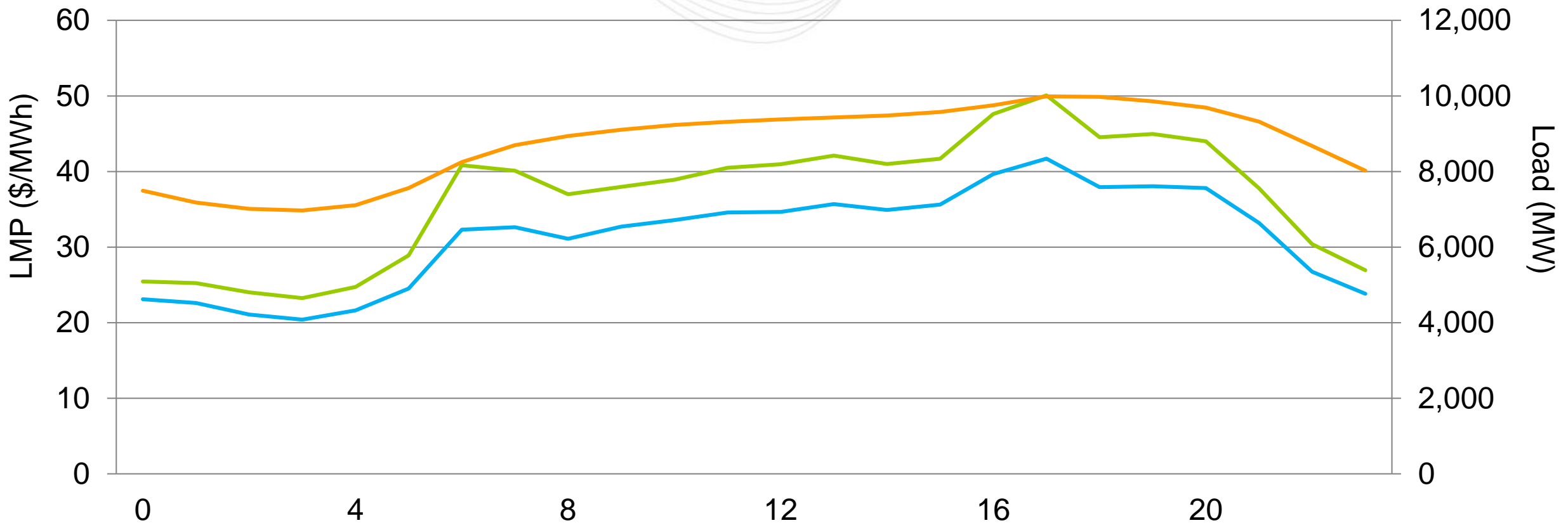


Maryland and D.C. – Hourly Average LMP and Load

(June 1, 2014 – May 31, 2017)

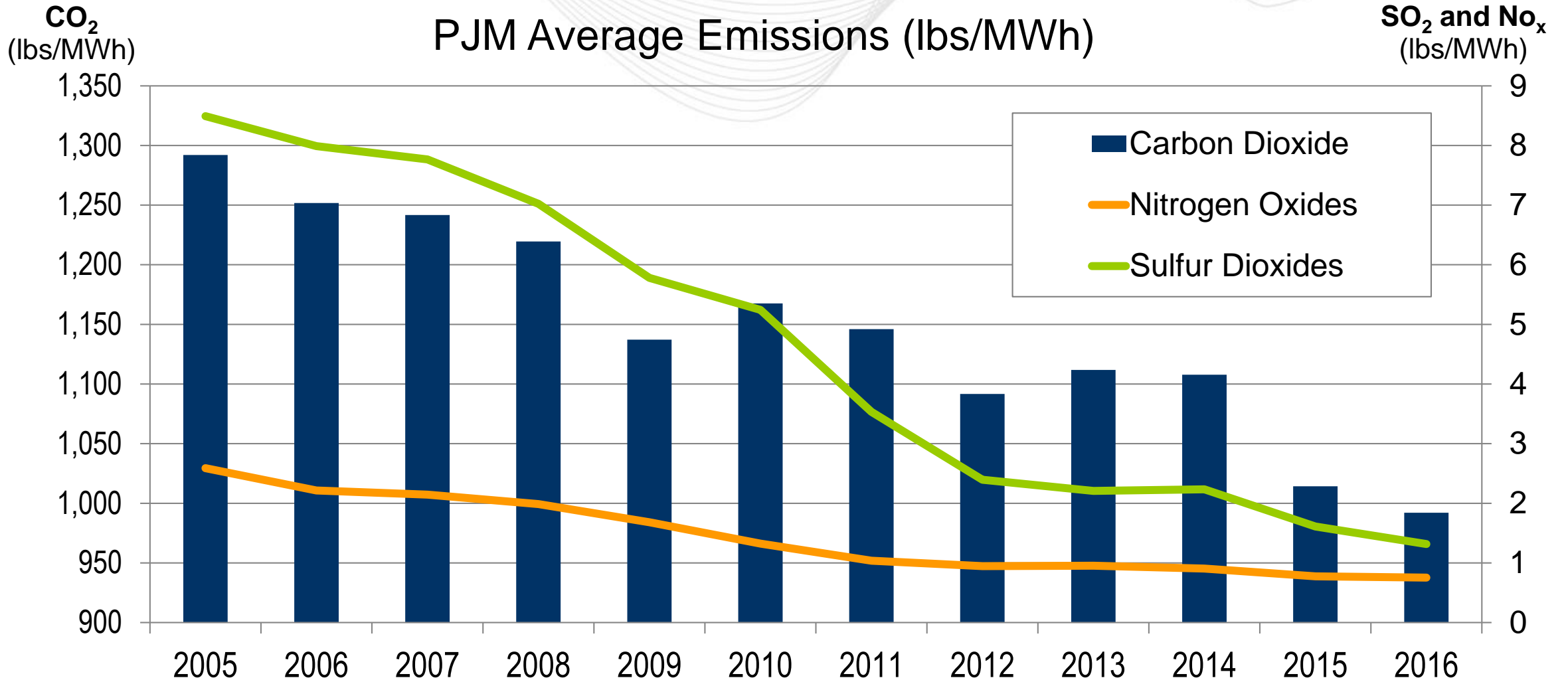
Maryland and Washington, D.C.'s hourly LMPs were above the PJM average.

(The graphs for each individual district are comparable; LMP's are the load-weighted average for Maryland and Washington, D.C.)



Hour Beginning — MD&DC Average RT Hourly LMP — PJM Average RT Hourly LMP — MD&DC Average RT Hourly Load

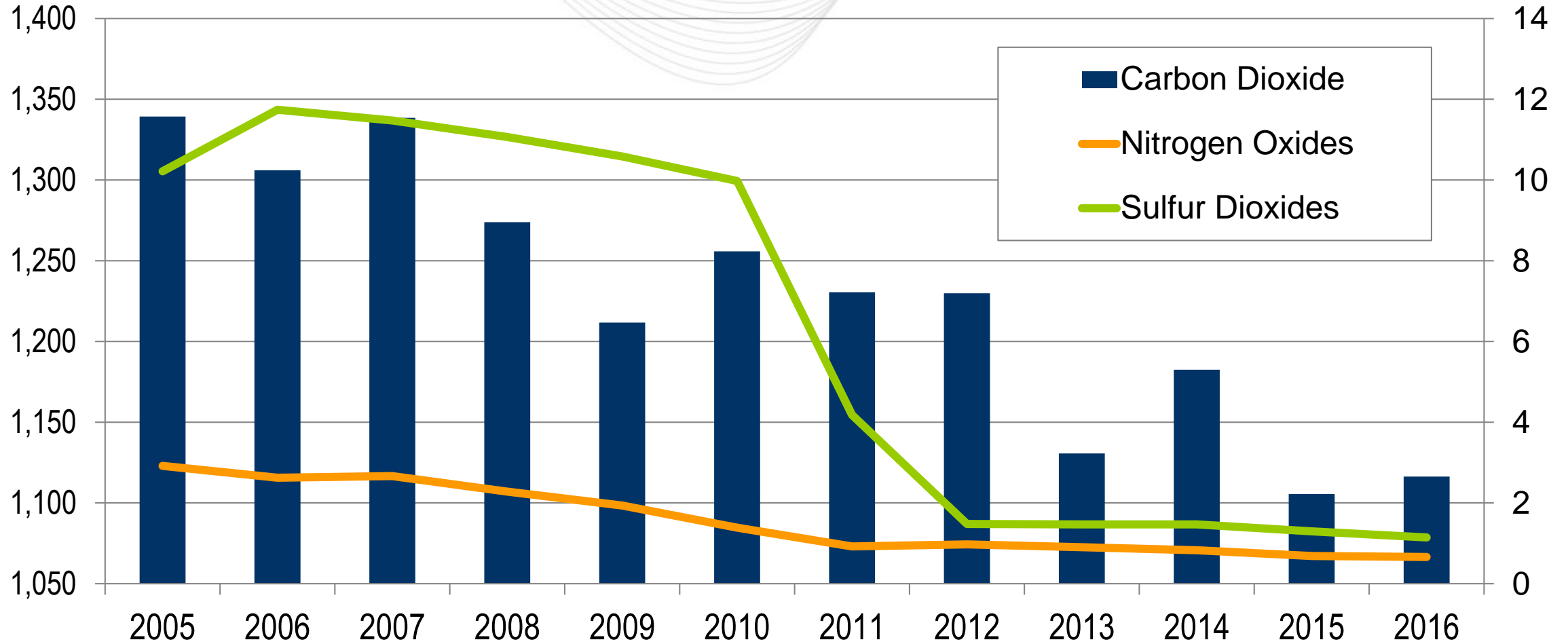
Operations Emissions Data



CO₂
(lbs/MWh)

Maryland Average Emissions (lbs/MWh)

SO₂ and NO_x
(lbs/MWh)



District of Columbia Average Emissions (lbs/MWh)

CO₂
(lbs/MWh)

SO₂ and No_x
(lbs/MWh)

