2016 West Virginia State Report

July 2017

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Executive Summary

(July 2017)

- **Existing Capacity:** Natural gas represents approximately 8 percent of the total installed capacity in West Virginia while coal represents approximately 90 percent. This differs from PJM where natural gas and coal are relatively even at 35 and 34 percent respectively.
- **Interconnection Requests:** Natural gas represents nearly 90.5 percent of new interconnection requests in West Virginia.
- **Deactivations**: No generating units retired in West Virginia in 2016. This compares to the 392 MW that retired RTO-wide in 2016.
- **RTEP 2016:** West Virginia RTEP 2016 projects total more than $65 million in investment. Approximately 69 percent of that represents baseline projects.
- **Load Forecast:** West Virginia load growth is nearly flat, averaging between .3 and .5 percent per year over the next 10 years. This aligns with PJM RTO load growth projections.

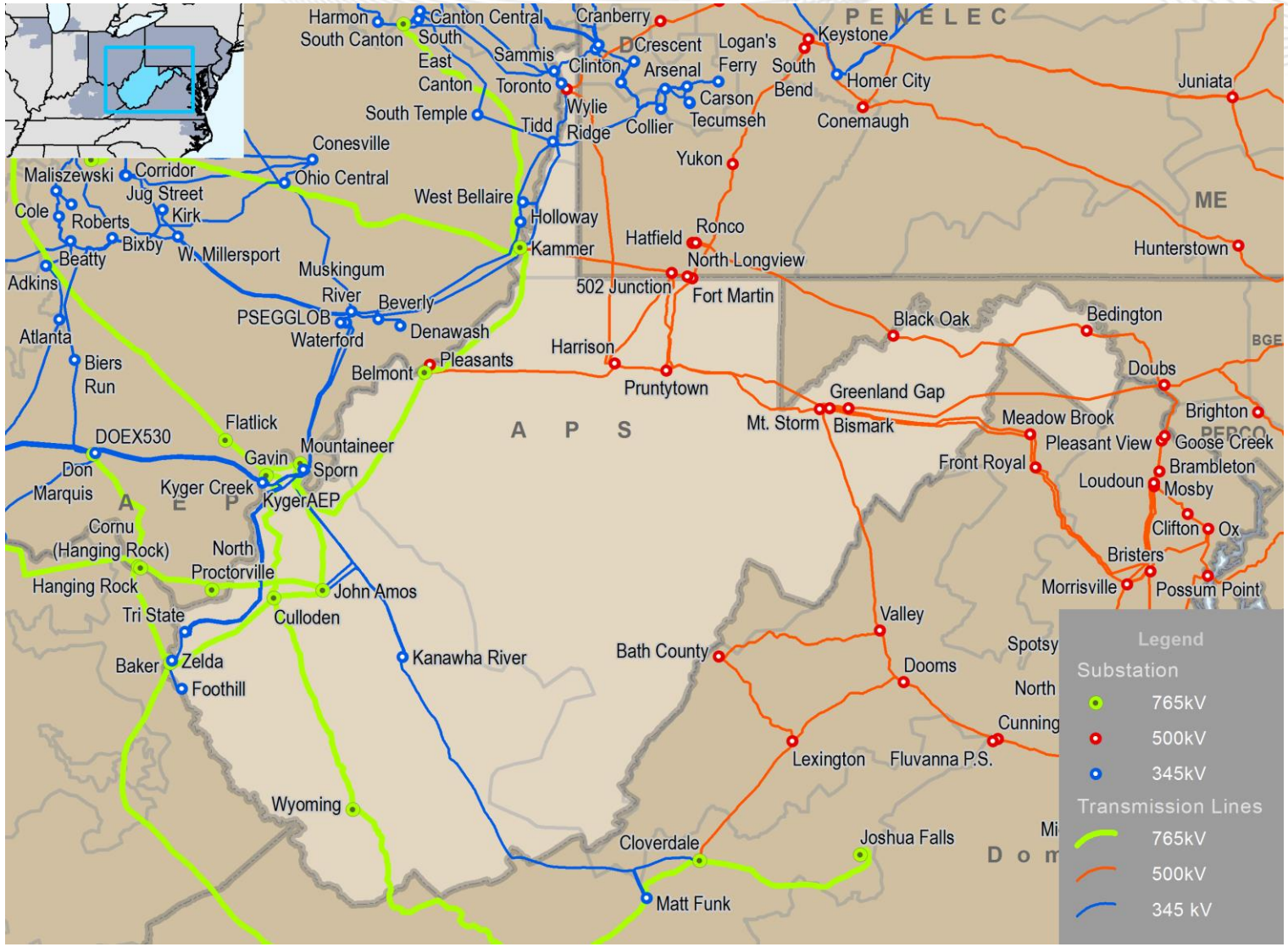
Executive Summary Cont.

(July 2017)

- **2020/21 Capacity Market:** Compared to the PJM footprint, West Virginia's distribution of generation, demand response and energy is similar.
- **6/1/14 – 5/31/17 Performance:** West Virginia's average daily locational marginal prices were consistent with PJM average daily LMPs. Coal resources represented 95 percent of generation produced in West Virginia while natural averaged 2 percent.
- **Emissions:** 2016 carbon dioxide emissions are slightly down from 2015; sulfur dioxides and nitrogen oxides continue to hold flat from 2015.

PJM Service Area – West Virginia

(December 31, 2016)



Planning

Generation Portfolio Analysis

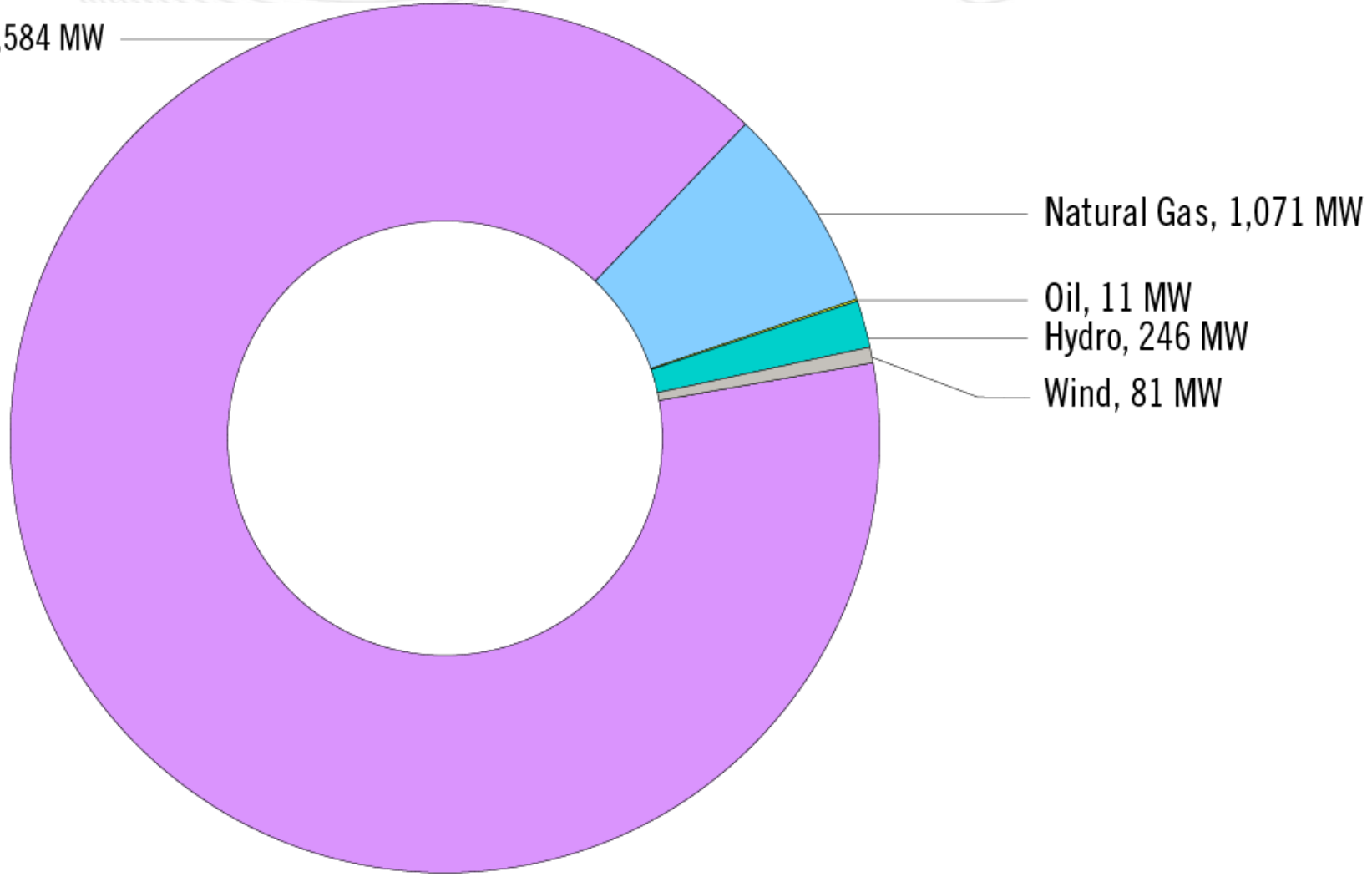
West Virginia – Existing Installed Capacity

(MW submitted to eRPM, December 31, 2016)

Summary:

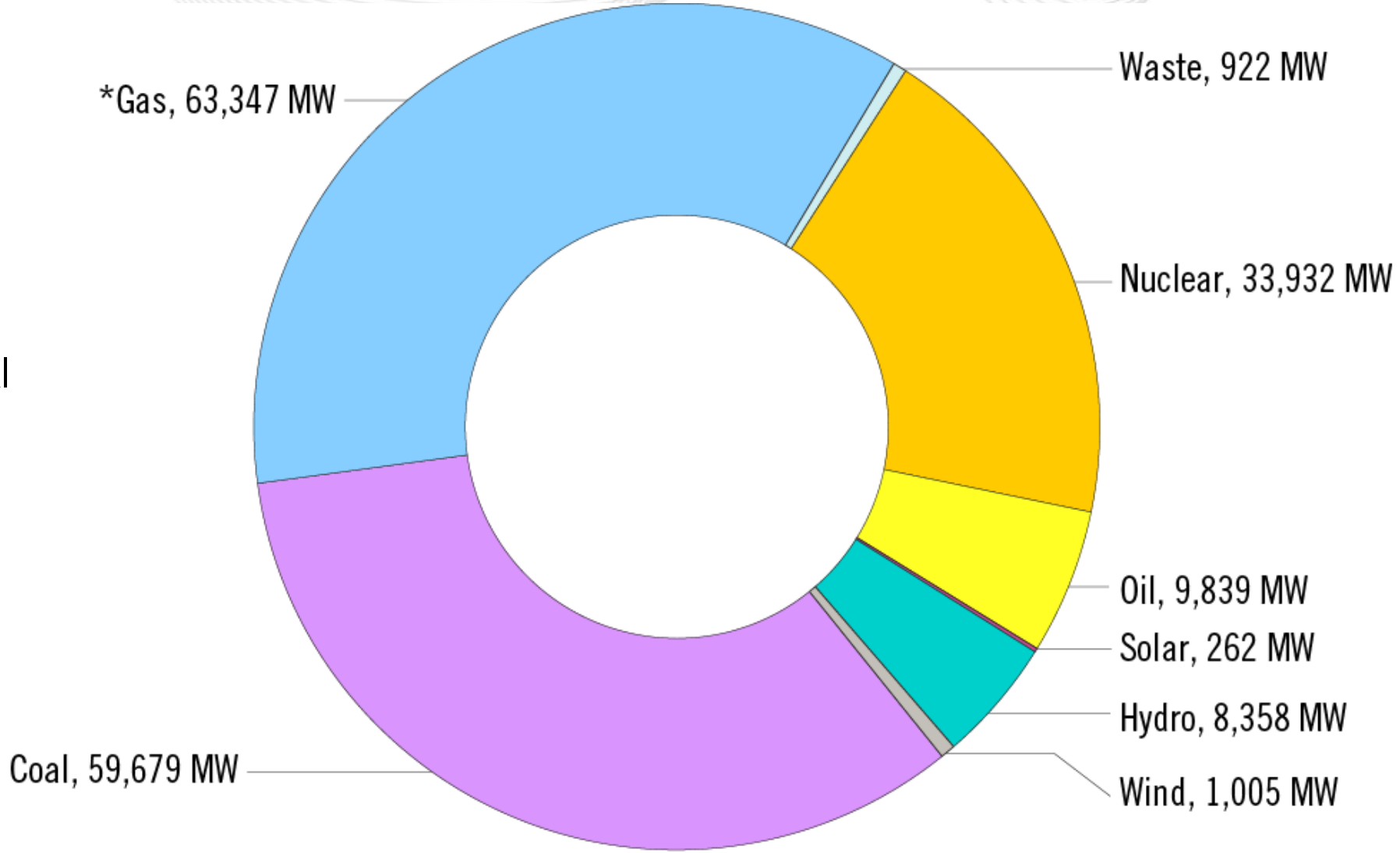
Natural gas represents approximately 8 percent of the total installed capacity in West Virginia while coal represents approximately 90 percent.

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



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

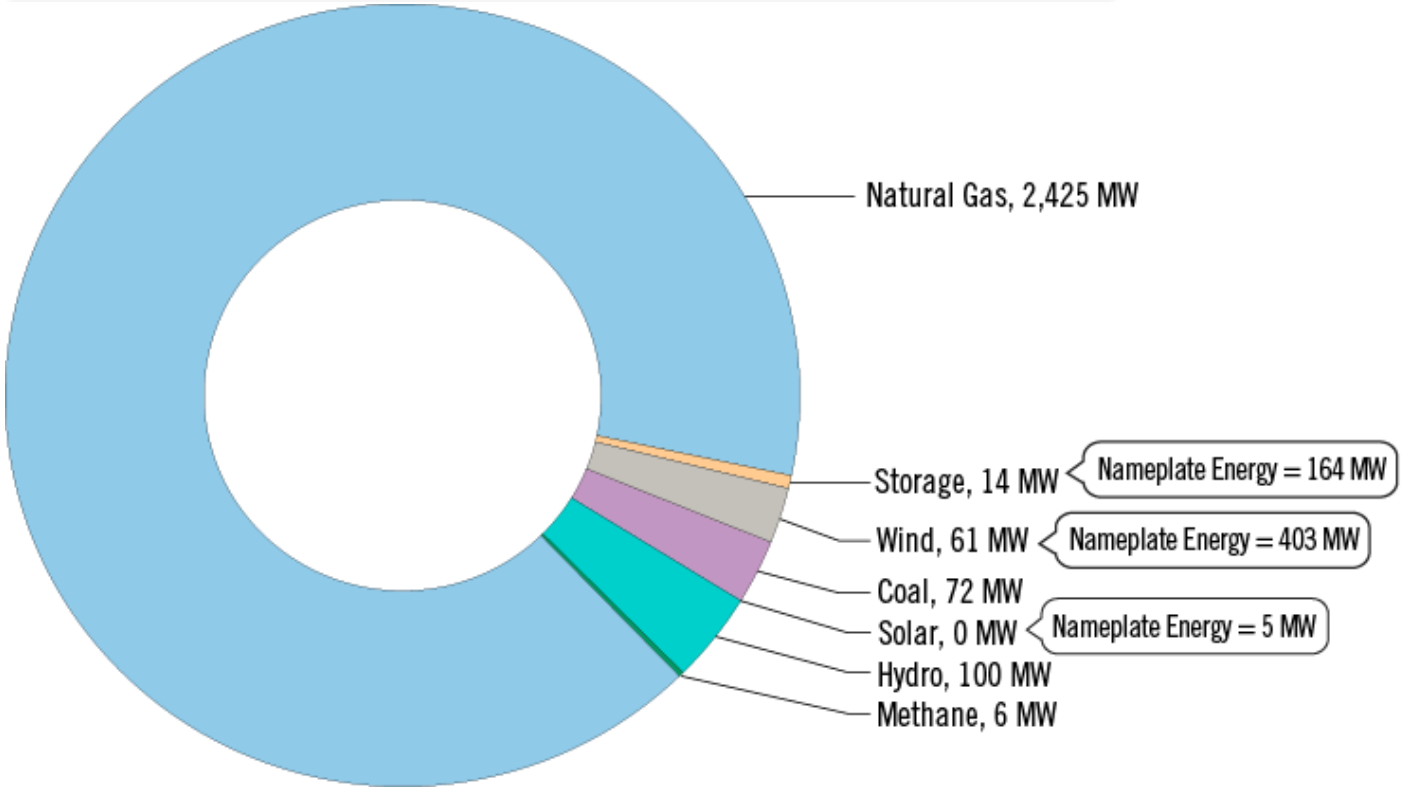
West Virginia – Interconnection Requests

(Requested Capacity Rights, December 31, 2016)

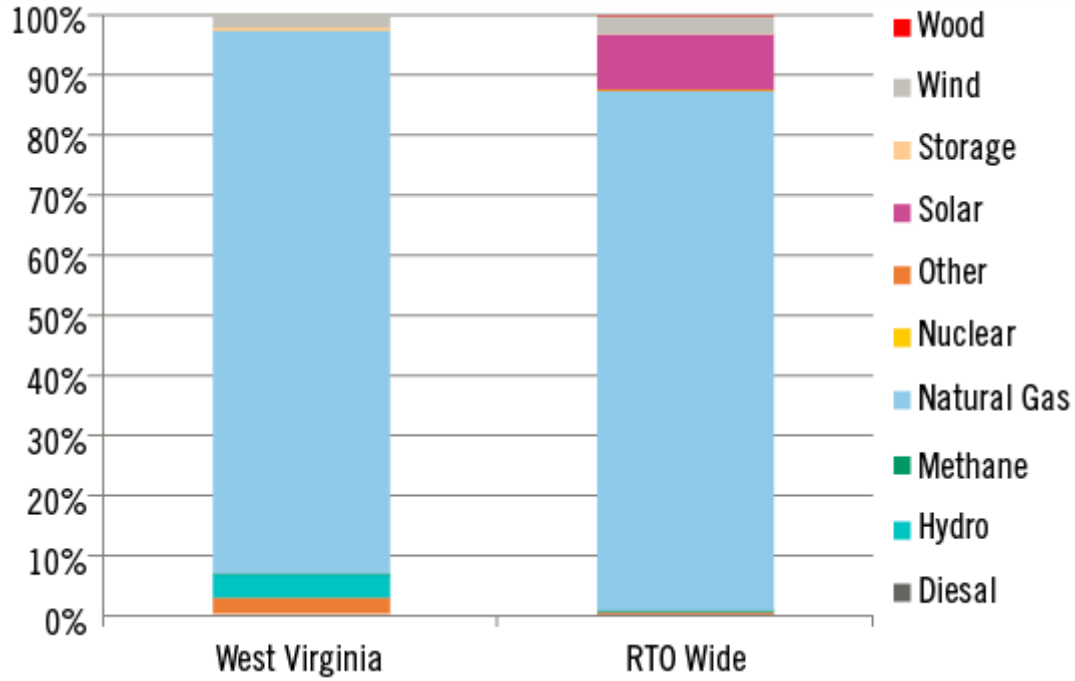
Natural gas represents nearly 90.5 percent of new interconnection requests in West Virginia.

	MW	# of projects
Active	1,930	15
Under Construction	203	9
Suspended	545	2
Total	2,678	26

Total MW Capacity by Fuel Type



Fuel as a Percentage of Projects in Queue



West Virginia - 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									48.0	2	48.0	2
Coal	36.0	1	815.0	8			36.0	1	2,023.0	7	2,910.0	17
Hydro			53.7	4			100.0	1	208.8	11	362.5	16
Methane			0.0	1			5.6	2	13.8	3	19.4	6
Natural Gas	1,879.6	11	391.7	5	545.0	2			11,893.0	27	14,709.3	45
Solar	0.0	1									0.0	1
Storage	14.3	2	0.0	1			0.0	2			14.3	5
Other									66.0	2	66.0	2
Wind			152.4	7			61.2	3	379.7	24	593.3	34
Total	**1,929.9**	**15**	**1,412.8**	**26**	**545.0**	**2**	**202.8**	**9**	**14,632.3**	**76**	**18,722.8**	**128**

West Virginia – Progression History Interconnection Requests

(Requested Capacity Rights, 2004 - 2016)

Following Final Agreement execution 108 MW of capacity withdrew from PJM's interconnection process. Another 622 MW have executed agreements but were not in service as of December 31, 2016 (*Suspended* or *Under Construction*). Overall, 9% of requested capacity in West Virginia reaches commercial operation.

West Virginia – 2016 Actual Generation Deactivations

Unit	MW Capacity	TO Zone	Age	Actual Deactivation Date

Summary:

- No generating units in WV deactivated in 2016
- Across PJM, 11 generating units totaling 392 MW of capacity deactivated in 2016

West Virginia – 2016 Projected Generation Deactivations (Deactivation Notifications Received in 2016)

Unit	MW Capacity	TO Zone	Age	Projected Deactivation Date

Summary:

- No generators in WV submitted generator deactivation notification in 2016
- Across PJM, 23 PJM generating units submitted deactivation notification to PJM, ranging in date from 2016 - 2020.

Planning

Transmission Infrastructure Analysis

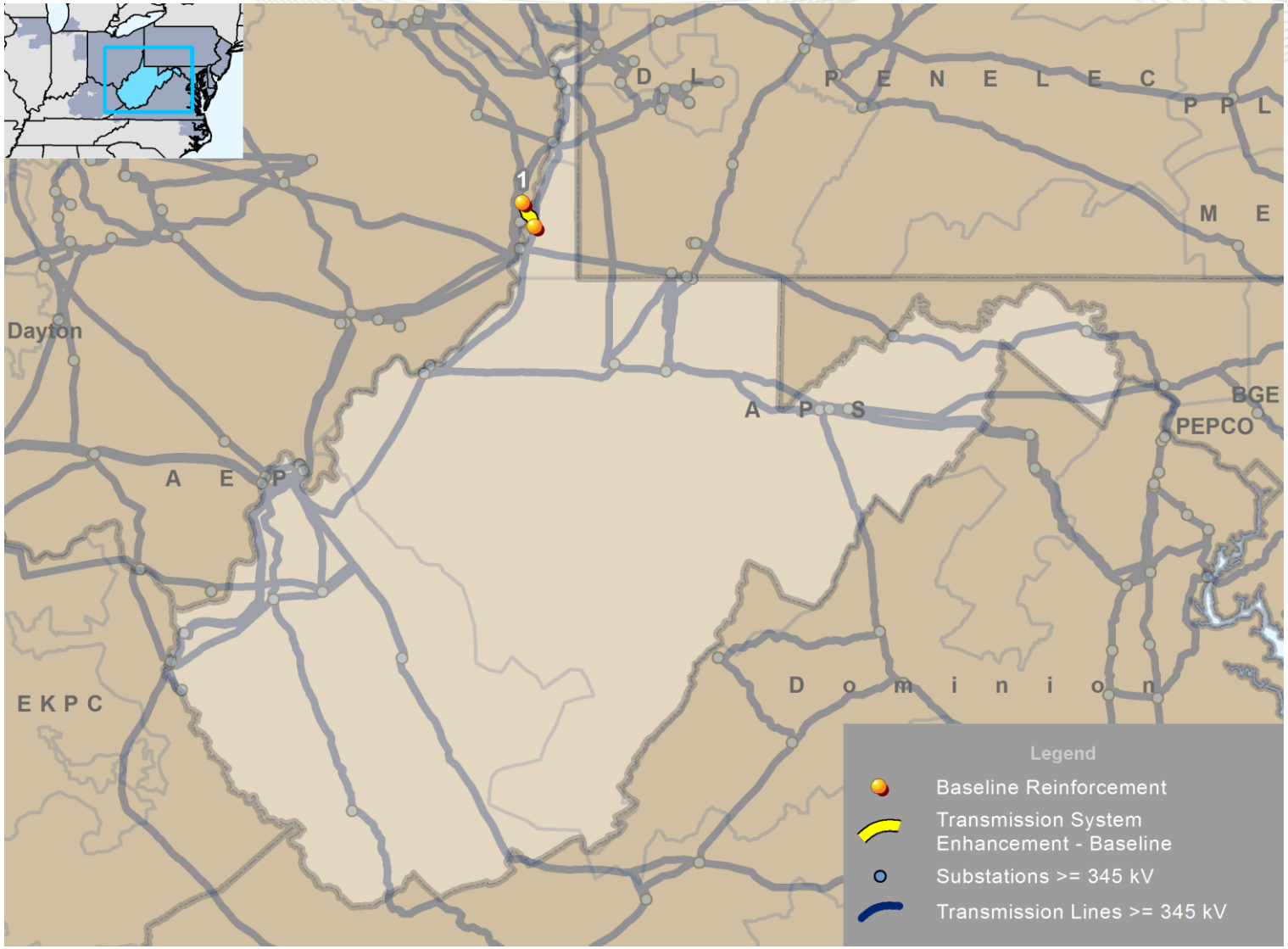
West Virginia – RTEP Baseline Projects

(Greater than $5 million)

Map ID	Project ID	Project	WV Baseline Project Driver: Baseline Load Growth/ Deliverability & Reliability	WV Baseline Project Driver: Congestion Relief - Economic	WV Baseline Project Driver: Operational Performance	WV Baseline Project Driver: Generator Deactivation	WV Baseline Project Driver: TO Criteria Violation	Required Date	Cost ($M)	Designated Entity*	2016 TEAC Review
1	b2743.7	Rebuild/Reconductor the Ringgold - Catoctin 138 kV circuit and upgrade terminal equipment on both ends		●				6/1/2020	$44.89	APS	6/9/2016

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

West Virginia - RTEP Baseline Projects



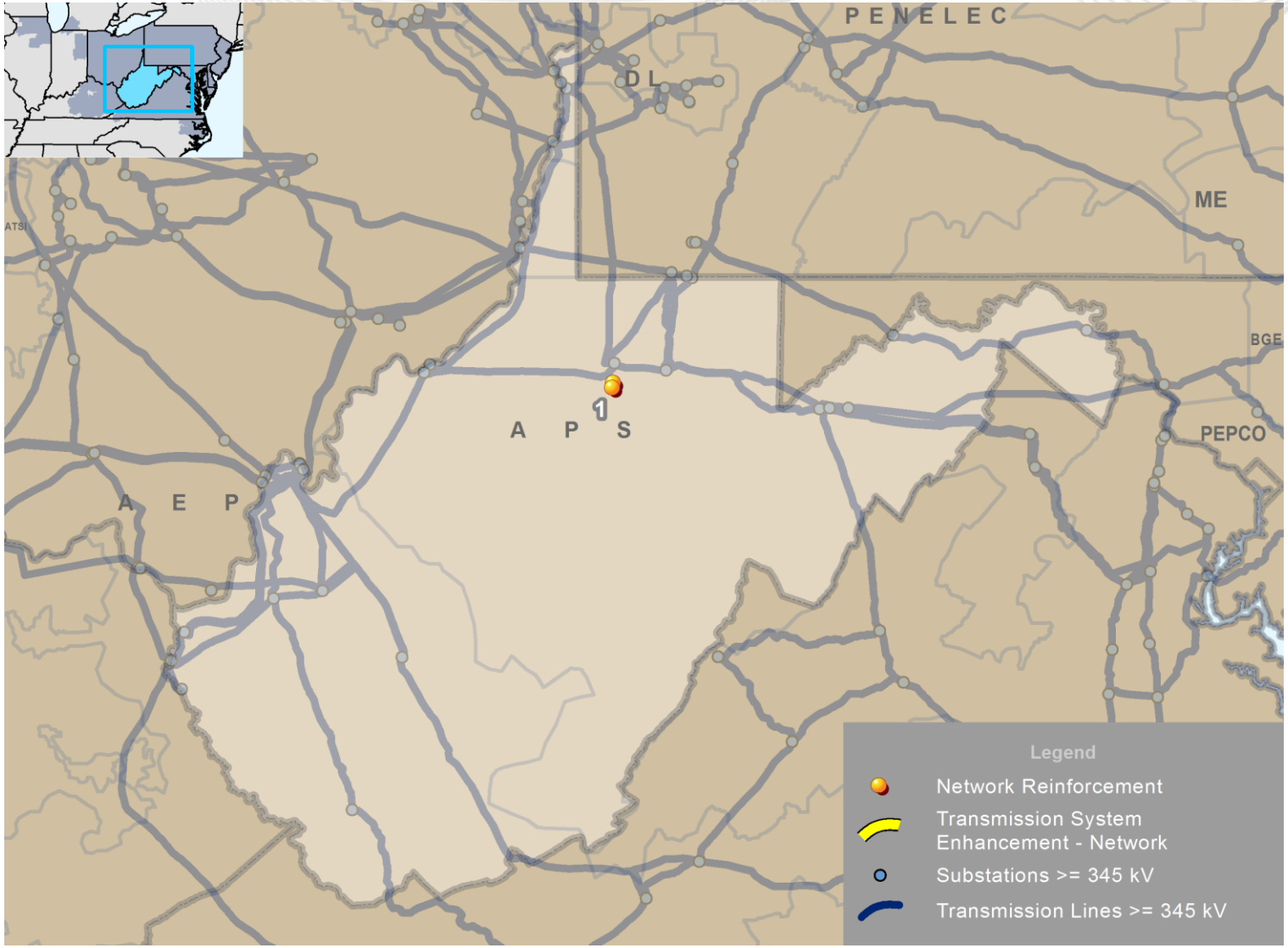
West Virginia – RTEP Network Projects

(Greater than $5 million)

Map ID	Project ID	Project	WV Network Project Drivers: Generation Interconnection	WV Network Project Drivers: Merchant Transmission Interconnection	WV Network Project Drivers: Long-term Firm Transmission Service	Required Date	Cost ($M)	TO Zone(s)	2016 TEAC Review
1	n4656	Reconductor the Rockwood – Somerset 115 kV line and upgrade terminal equipment at Rockwood and Somerset.	AA1-062			9/25/2017	$10.89	APS	10/6/2016
2	n4855	Rebuild 2.5 miles of the Glen Falls-Oak Mound 138 kV line and upgrade terminal equipment at both Glen Falls & Oak Mound substations.	AA2-119			6/1/2020	$9.48	APS	10/6/2016

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.

West Virginia – RTEP Network Projects



West Virginia – 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.

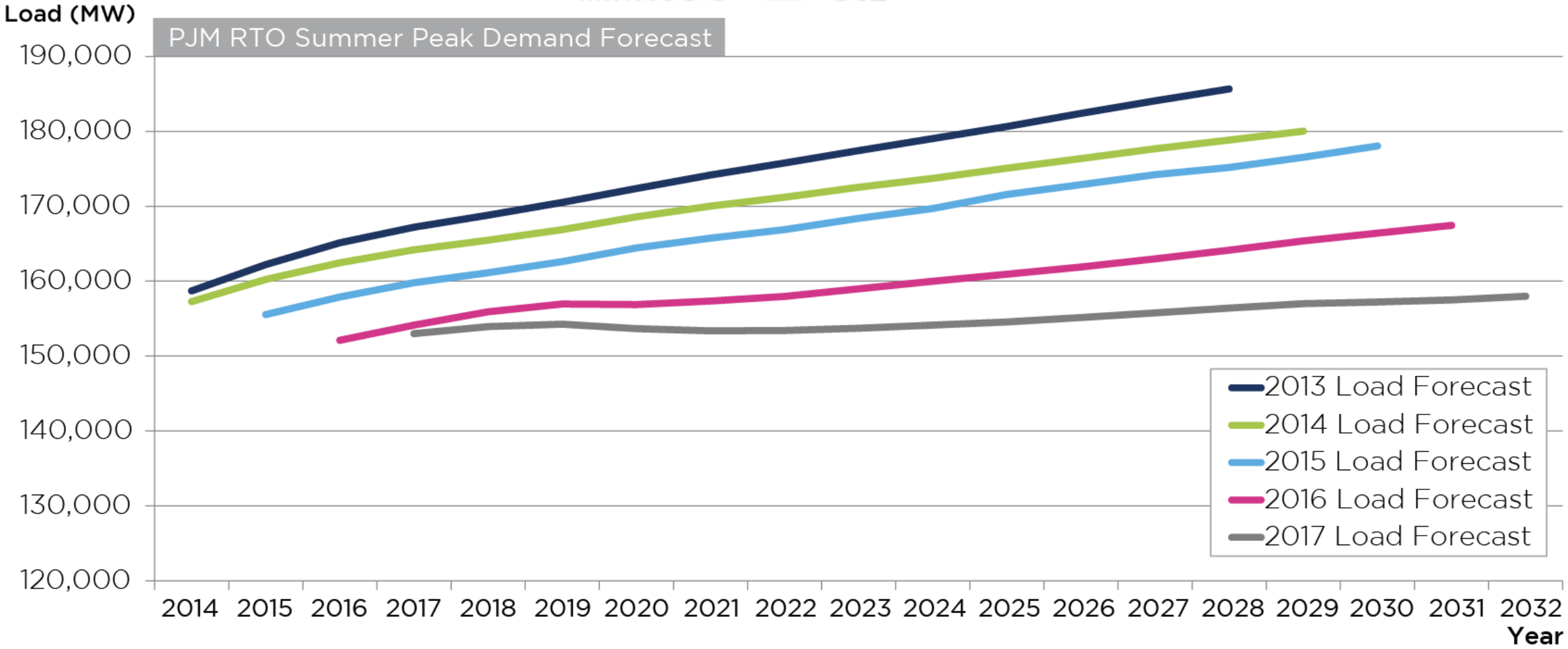
West Virginia – Merchant Transmission Project Requests

Queue	Project Name	MFO	Status	In Service Date	TO
	None				

Planning
Load Forecast

PJM Annual Load Forecasts

(January 9, 2017)



West Virginia – 2017 Load Forecast Report

	Summer Peak (MW)			Winter Peak (MW)		
Transmission Owner	2017	2027	Growth Rate (%)	2016/17	2026/27	Growth Rate (%)
American Electric Power Company *	3,050	3,175	0.4%	3,627	3,823	0.5%
Allegheny Power *	2,842	2,934	0.3%	2,875	3,018	0.5%
PJM RTO	152,999	155,773	0.2%	131,391	134,915	0.3%

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

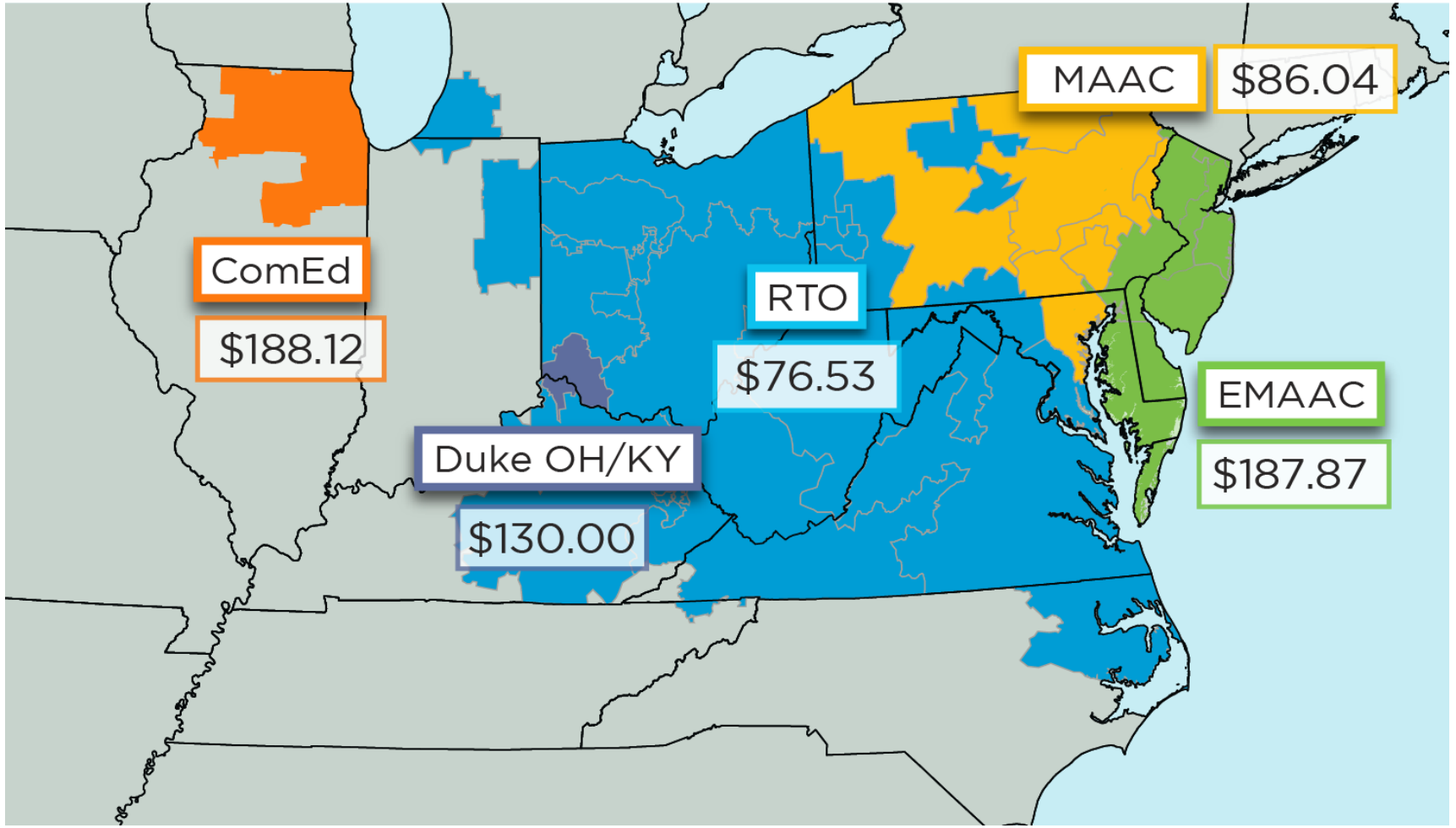
***Note:** PJM's 2017 forecast reflects methodology improvements implemented in 2016: variables to account for equipment and appliance saturation and efficiency, distributed solar generation adjustments and more refined treatment of weather data.

Markets

Capacity Market Results

PJM 2020/21 Auction Clearing Prices

(May 23, 2017)



West Virginia - Cleared Resources in 2020/21 Auction

(May 23, 2017)

	Cleared MW (Unforced Capacity)	Change from 2019/20 Auction
Generation	7,074	88
Demand Response	402	(49)
Energy Efficiency	30	13
Total	7,506	52

RTO Locational Clearing Price
$76.53

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)

West Virginia – Offered and Cleared Resources in 2020/21 Auction

(May 23, 2017)

		Unforced Capacity
Generation	Offered MW	7,263
	Cleared MW	7,074
Demand Response	Offered MW	452
	Cleared MW	402
Energy Efficiency	Offered MW	38
	Cleared MW	30
Total Offered MW		7,752
Total Cleared MW		7,506

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.

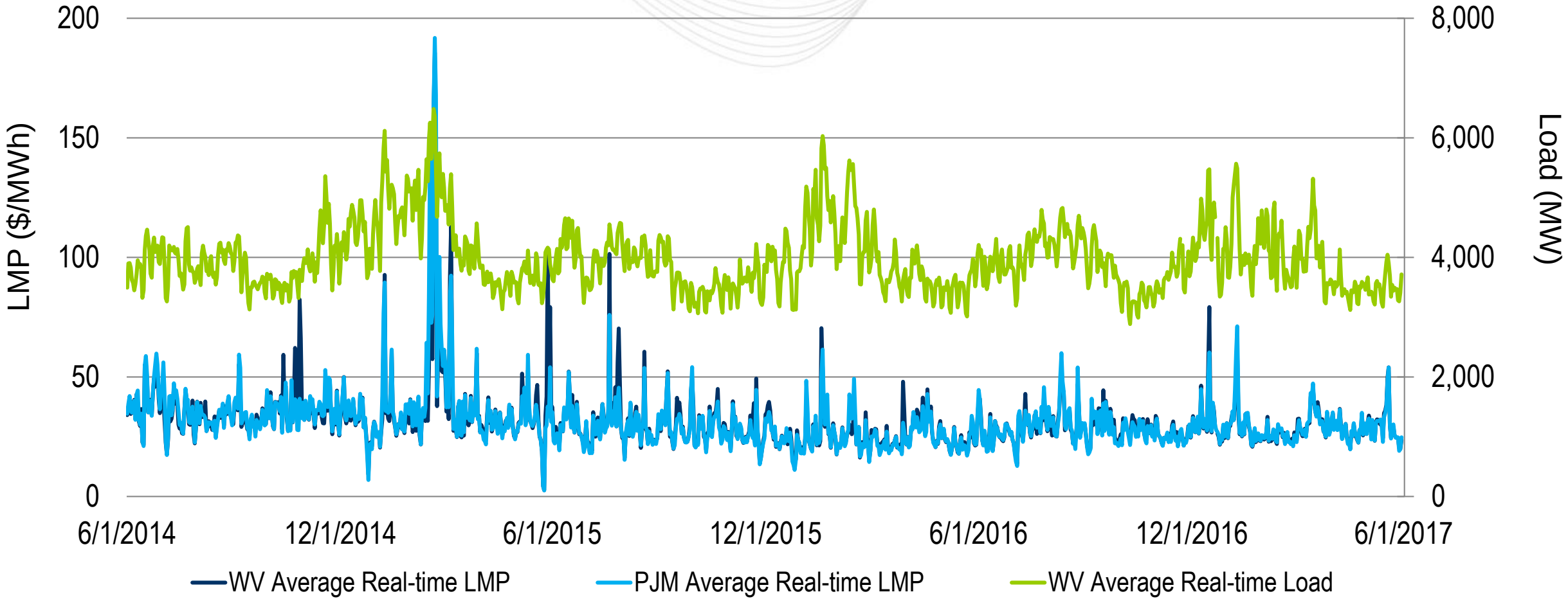
Markets

Market Analysis

West Virginia - Average Daily Load and LMP

(June 1, 2014 - May 31, 2017)

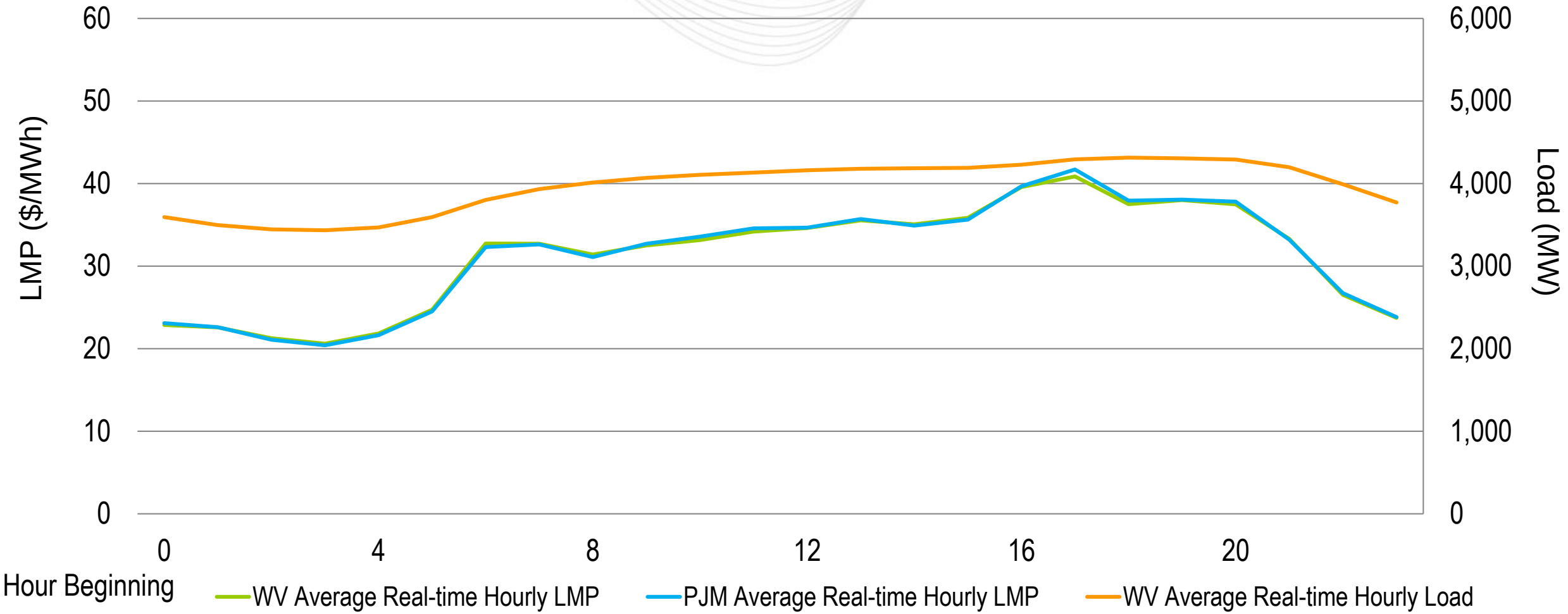
West Virginia's average daily LMPs generally align with the PJM average daily LMP



West Virginia – Hourly Average LMP and Load

(June 1, 2014 – May 31, 2017)

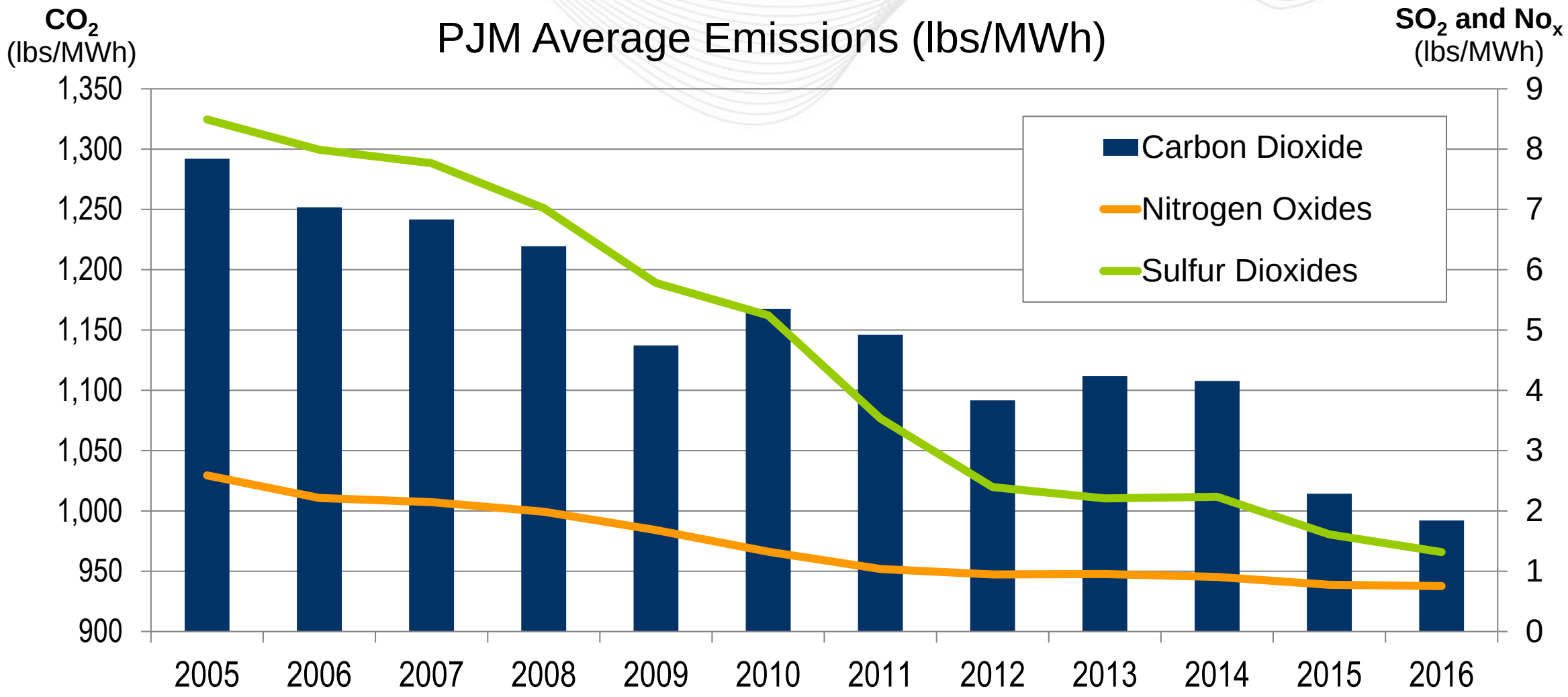
West Virginia's hourly LMPs were relatively the same as the PJM average.



Operations
Emissions Data

PJM - Average Emissions (lbs/MWh)

(December 31, 2016)



West Virginia - Average Emissions (lbs/MWh)

(December 31, 2016)