



2020 West Virginia Infrastructure Report

(January 1, 2020 – December 31, 2020)

April 2021

1. Planning

- Generation Portfolio Analysis
- Transmission Analysis
- Load Forecast

2. Markets

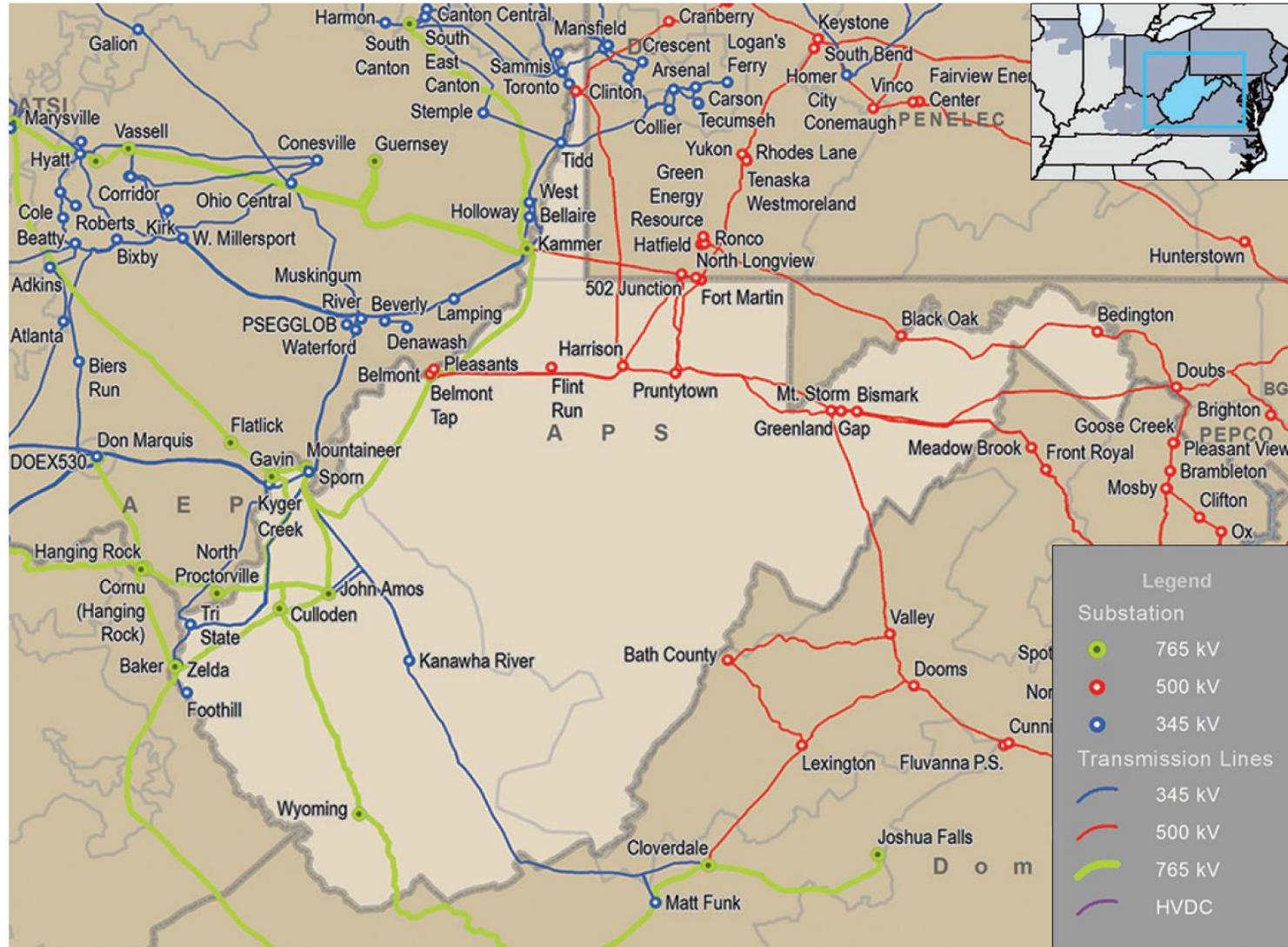
- Market Analysis
- Net Energy Import/Export Trend

3. Operations

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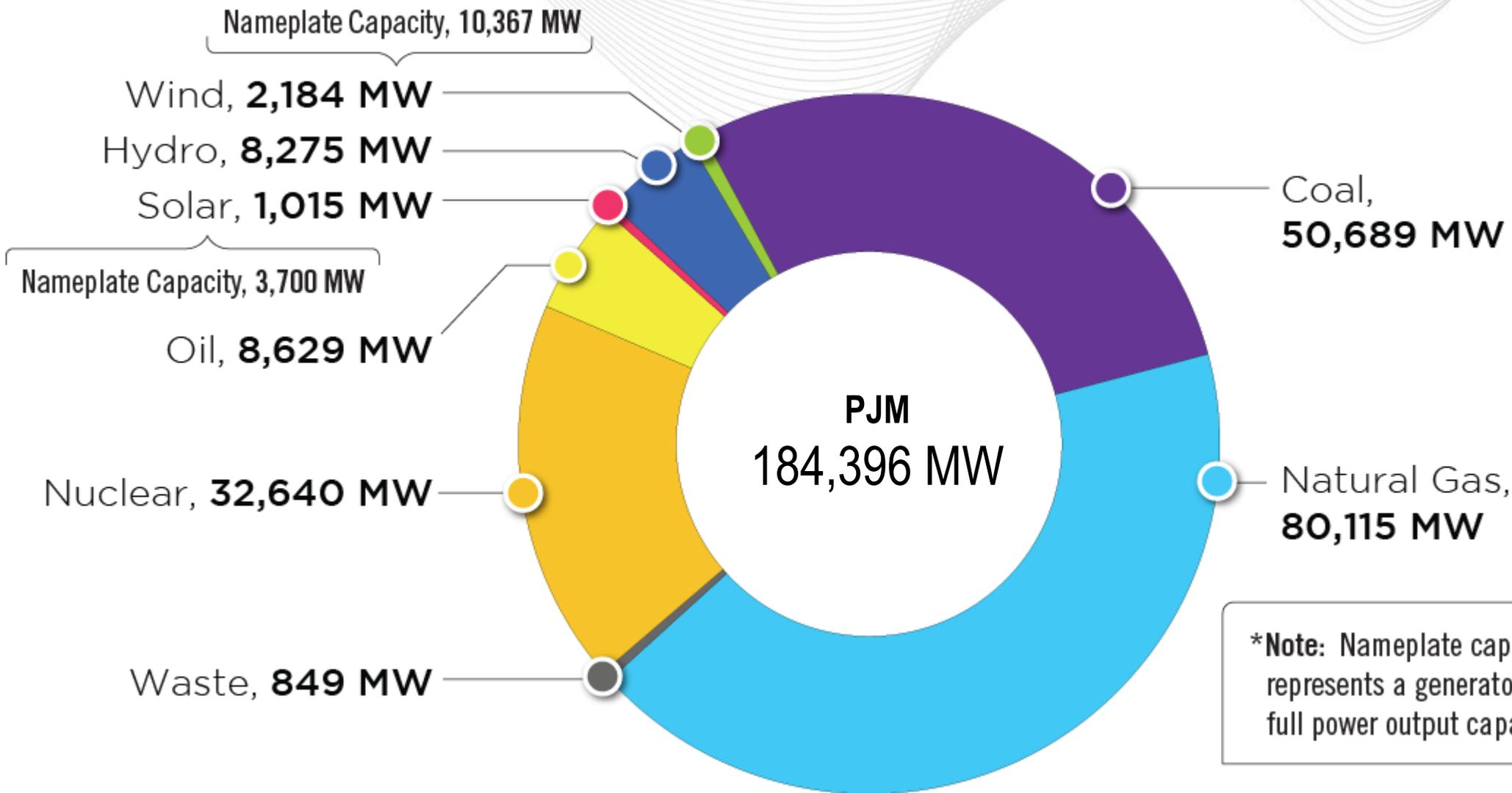
- **Existing Capacity:** Coal represents approximately 89.5 percent of the total installed capacity in the West Virginia service territory while natural gas represents approximately 7.8 percent. Across PJM, natural gas and coal account respectively for 43.4 and 27.5 percent of total installed capacity.
- **Interconnection Requests:** Natural gas represents 56 percent of new interconnection requests in West Virginia, while solar represents approximately 39.1 percent of new requests
- **Deactivations:** No generation in West Virginia gave notification of deactivation in 2020.
- **RTEP 2020:** West Virginia's 2020 RTEP projects total approximately \$560.9 million in investment. Approximately 95.1 percent of that represents supplemental projects. These investment figures only represent RTEP projects that cost at least \$5 million.

- **Load Forecast:** West Virginia's peak load within the PJM footprint is projected to grow between 0.1 and 0.2 percent annually over the next ten years. Comparatively, the overall PJM RTO projected load growth rate is 0.3 percent.
- **2022/23 Capacity Market:** No Base Residual Auction was conducted in 2020. For the most recent auction results, please see the 2018 West Virginia State Infrastructure Report.
- **1/1/20 – 12/31/20 Market Performance:** West Virginia's average hourly LMPs aligned with the PJM average hourly LMP.
- **Emissions:** 2020 carbon dioxide emissions are down from 2019 levels, while sulfur dioxide and nitrogen oxide emissions have remained nearly flat.



Planning

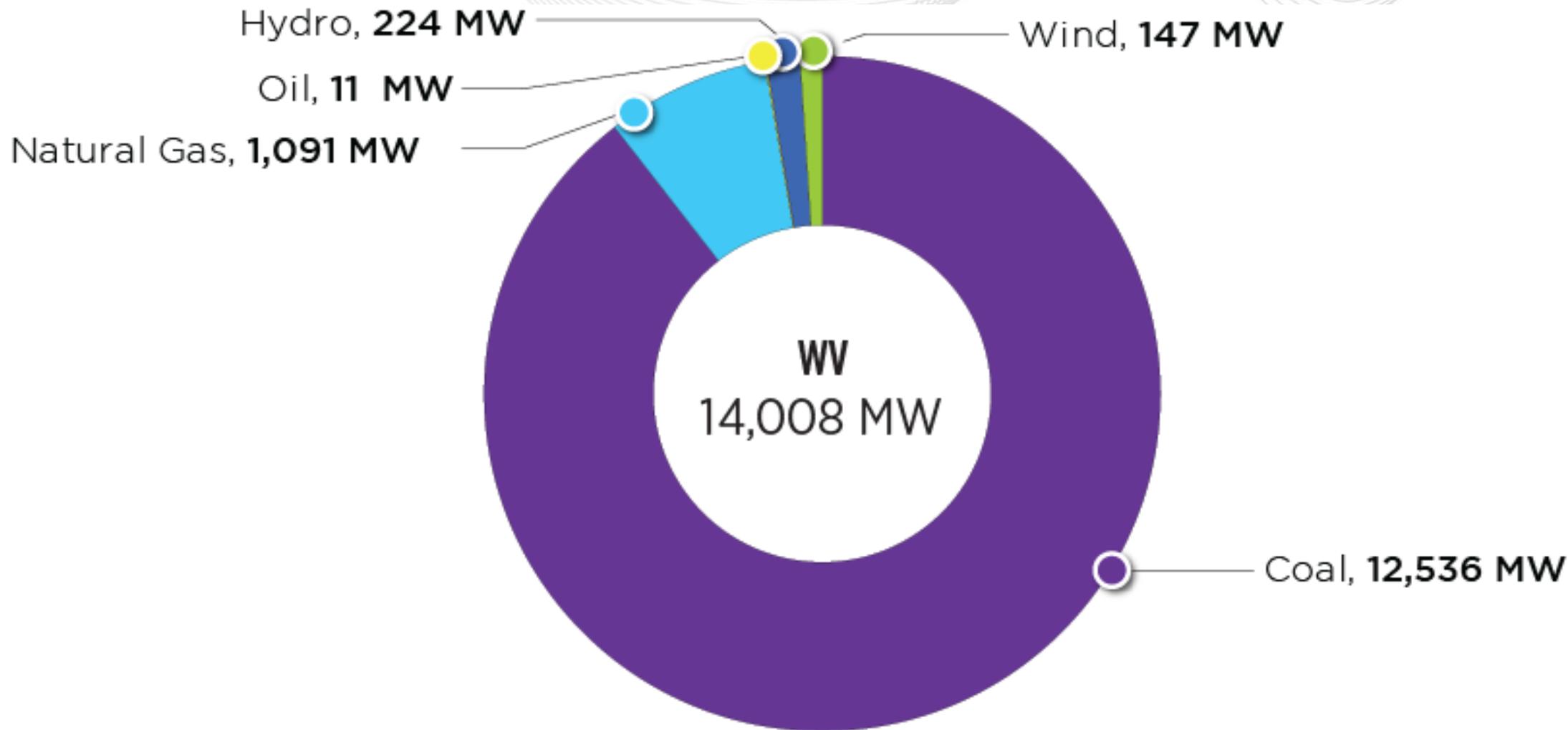
Generation Portfolio Analysis

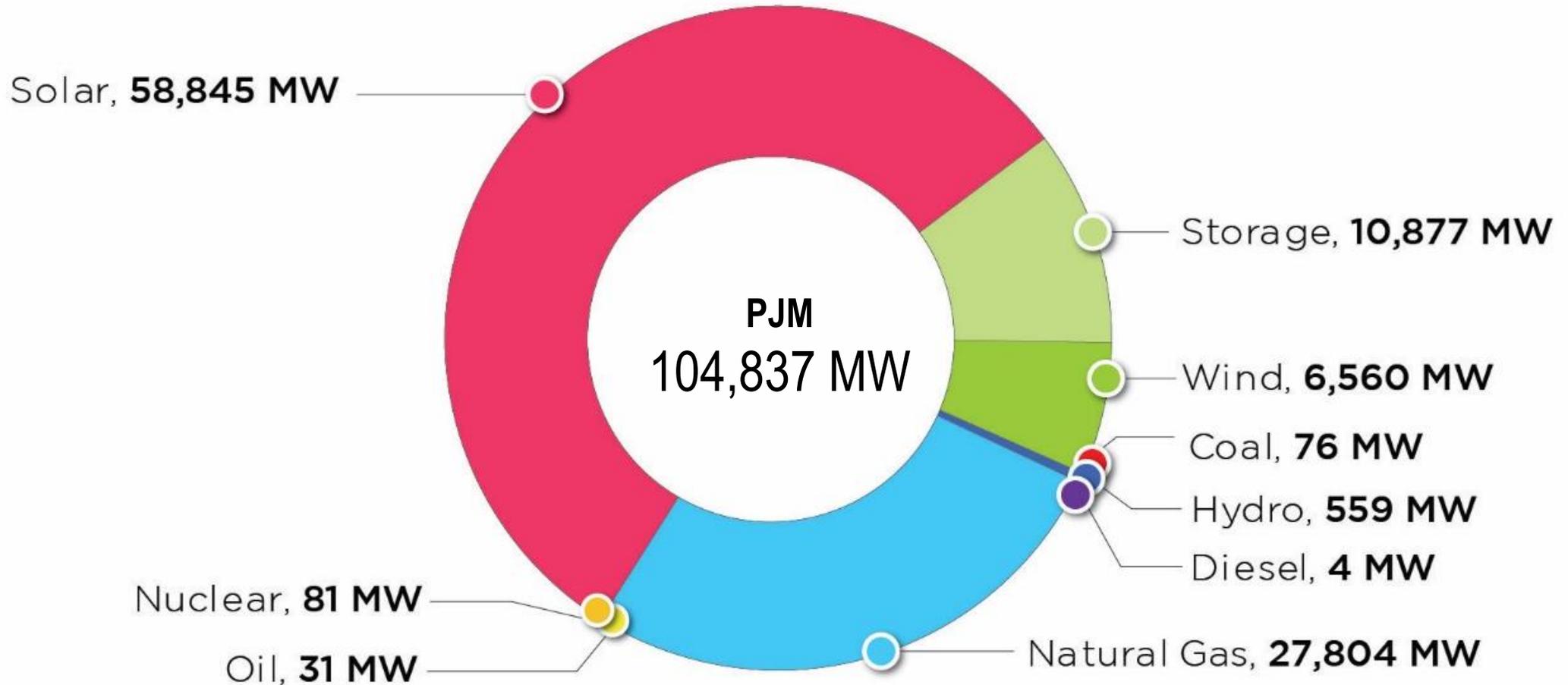


***Note:** Nameplate capacity represents a generator's rated full power output capability.

West Virginia – Existing Installed Capacity

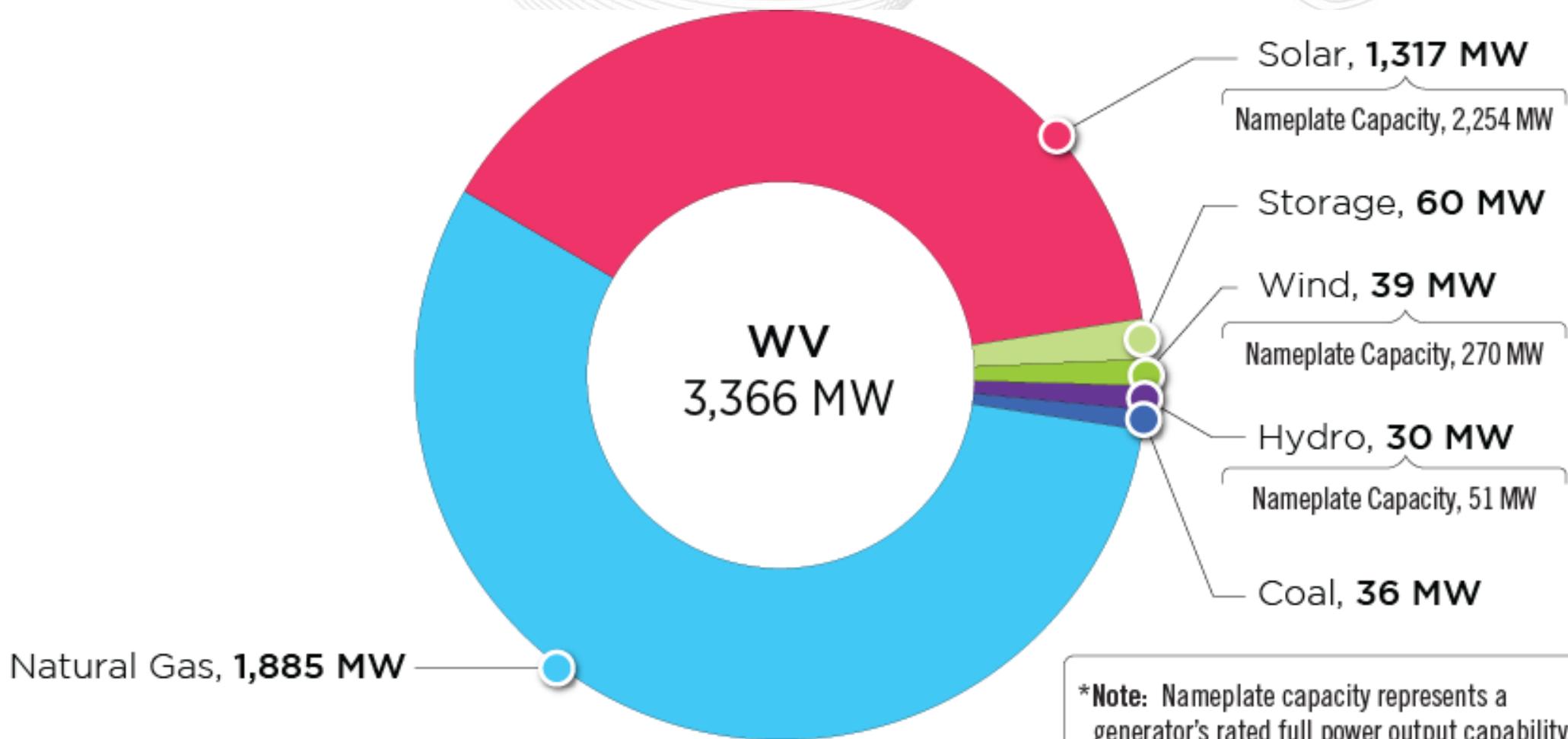
(CIRs – as of Dec. 31, 2020)





West Virginia – Queued Capacity (MW) by Fuel Type

(Requested CIRs – as of Dec. 31, 2020)



***Note:** Nameplate capacity represents a generator's rated full power output capability.



West Virginia – Interconnection Requests by Fuel Type

(Unforced Capacity – as of Dec. 31, 2020)

		In Queue					Complete					Grand Total	
		Active		Suspended		Under Construction		In Service		Withdrawn		Projects	Capacity (MW)
		Projects	Capacity (MW)	Projects	Capacity (MW)	Projects	Capacity (MW)	Projects	Capacity (MW)	Projects	Capacity (MW)	Projects	Capacity (MW)
Non-Renewable	Coal	0	0.0	0	0.0	1	36.0	10	861.0	7	2,023.0	18	2,920.0
	Natural Gas	2	1,285.0	3	600.0	0	0.0	6	409.7	43	16,140.8	54	18,435.5
	Nuclear	0	0.0	0	0.0	0	0.0	0	0.0	2	66.0	2	66.0
	Other	3	54.2	1	5.8	1	0.0	2	0.0	3	18.0	10	78.0
	Storage	0	0.0	0	0.0	0	0.0	0	0.0	2	48.0	2	48.0
Renewable	Biomass	1	30.0	0	0.0	0	0.0	5	59.2	12	208.8	18	298.0
	Hydro	0	0.0	0	0.0	0	0.0	3	5.6	3	13.8	6	19.4
	Methane	23	1,316.7	0	0.0	0	0.0	0	0.0	4	44.2	27	1,360.9
	Solar	2	23.5	0	0.0	1	15.1	10	197.5	26	414.8	39	650.9
	Wind	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Grand Total		31	2,709.4	4	605.8	3	51.1	36	1,533.0	102	18,977.4	176	23,876.7

Note: The "Under Construction" column includes both "Engineering and Procurement" and "Under Construction" project statuses.

West Virginia – Progression History of Interconnection Requests



Projects withdrawn after final agreement

		Nameplate Capacity
12	Interconnection Service Agreements	1,499 MW
2	Wholesale Market Participation Agreements	11 MW

Percentage of planned capacity and projects that have reached commercial operation	7%	25%
	Requested capacity megawatts	Requested projects

This graphic shows the final state of generation submitted to the PJM queue that completed the study phase as of Dec. 31, 2020, meaning the generation reached in-service operation, began construction, or was suspended or withdrawn. It does not include projects considered active in the queue as of Dec. 31, 2020.



West Virginia – Generation Deactivation Notifications Received in 2020

West Virginia had no generation deactivation notifications in 2020.

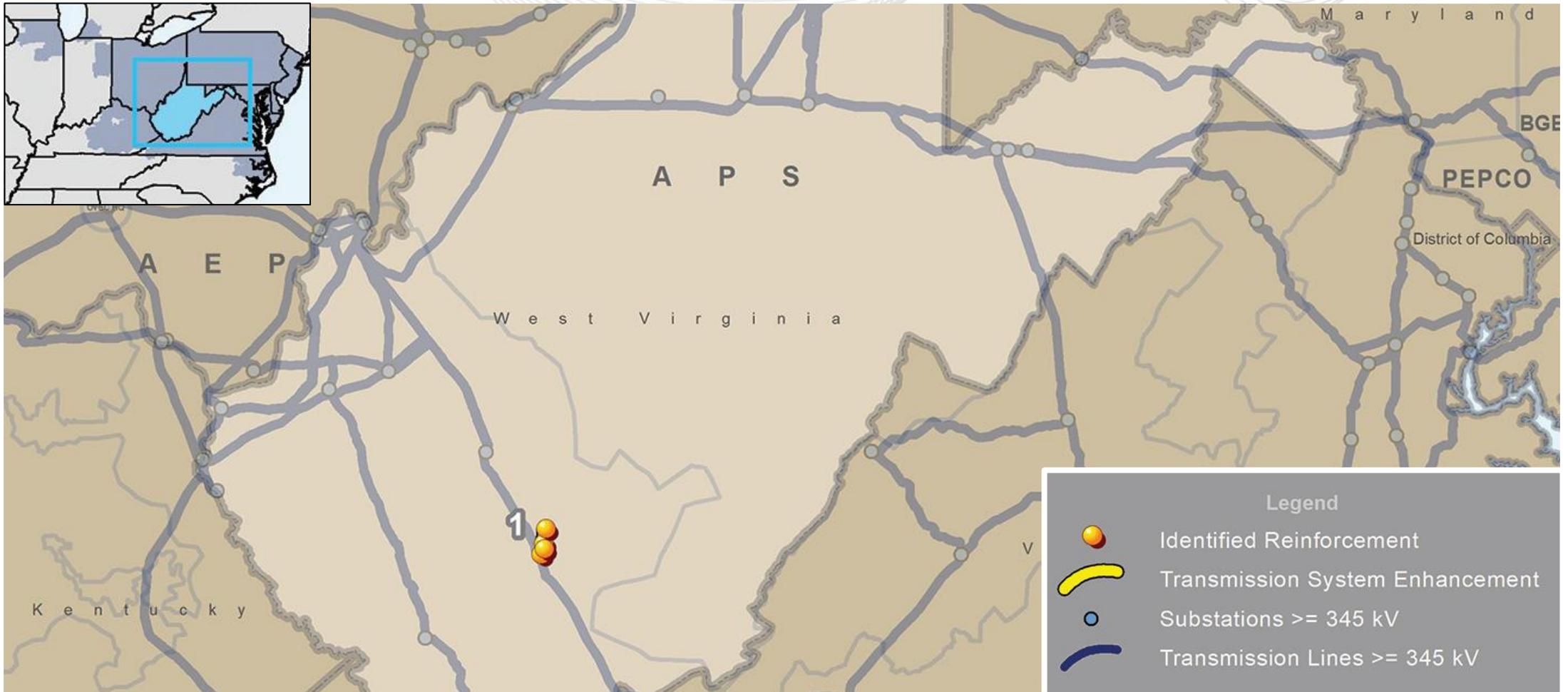
Planning

Transmission Infrastructure Analysis

Please note that PJM historically used \$5 million as the threshold for listing projects in the RTEP report. Beginning in 2018, it was decided to increase this cutoff to \$10 million. All RTEP projects with costs totaling at least \$5 million are included in this state report. However, only projects that are \$10 million and above are displayed on the project maps.

For a complete list of all RTEP projects, please visit the “RTEP Upgrades & Status – Transmission Construction Status” page on [pjm.com](https://www.pjm.com).

<https://www.pjm.com/planning/project-construction>



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



West Virginia – RTEP Baseline Projects

(Greater than \$5 million)

Map ID	Project	Description	Required In-Service Date	Project Cost (\$M)	TO Zone	TEAC Date
1	b3148	Rebuild the 46 kV Bradley-Scarbro line to 96 kV standards using 795 ACSR to achieve a minimum rater of 120 MVA. Rebuild the new line adjacent to the existing one leaving the old line in service until the work is completed.	12/1/2021	\$27.70	AEP	10/25/2019
		Bradley remote-end station work, replace 46 kV bus, install new 12 MVAR capacitor bank.				
		Replace the existing switch at Sun substation with a two-way SCADA-controlled MOAB switch.				
		Remote end work and associated equipment at Scarbro station.				
		Retire Mt. Hope station and transfer load to existing Sun station.				

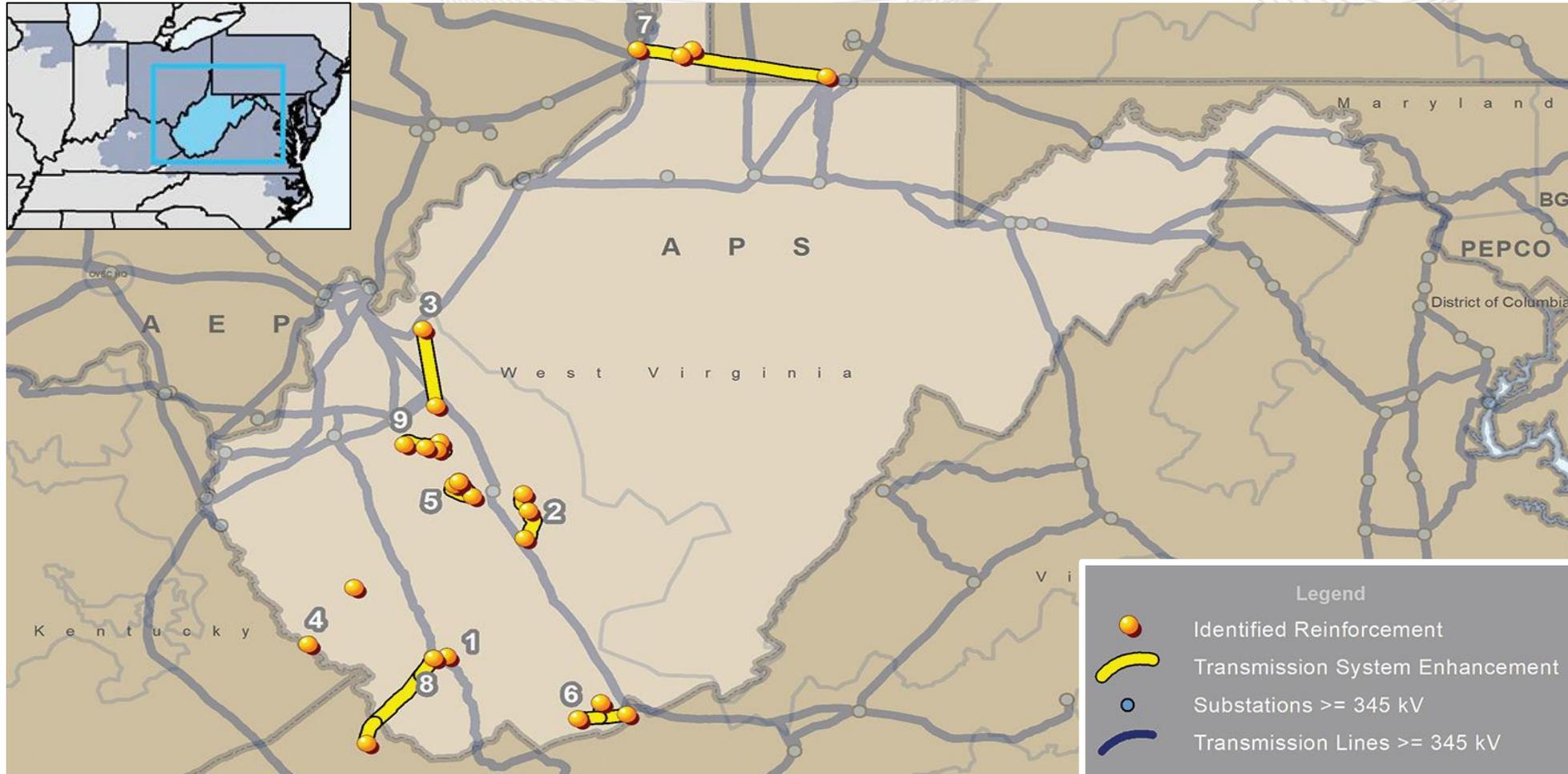


West Virginia – RTEP Network Projects

(Greater than \$5 million)

West Virginia had no network project upgrades in 2020.

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, as well as certain direct connection facilities required to interconnect proposed generation projects.



Note: Supplemental projects are transmission expansions or enhancements that are not required for compliance with PJM criteria and are not state public policy projects according to the PJM Operating Agreement. These projects 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 – TO Supplemental Projects

(Greater than \$5 million)

Map ID	Project	Description	Projected In-Service Date	Project Cost (\$M)	TO Zone	TEAC Date
1	s1497	Expand Guyandotte 138 kV station, install new 138 kV switch, circuit switcher and 138/12 kV transformer to allow for retirement of Marianna station.	6/1/2021	\$78.50	AEP	11/20/2020
2	s2177	Rebuild the Carbondale-Kincaid 46 kV line as a single-circuit 46 kV line (~16.3 miles).	6/1/2023	\$76.50		1/17/2020
		Retire the Carbondale-Kincaid No. 1/No. 2 double-circuit 46 kV line.				
		Alloy station: Install a two-way switch to address hard tap.				
		Page substation: Replace existing switch to accommodate new line.				
		Raynes Meter station: Remove/retire station.				
		Boomer station: Remove/retire station.				
Carbondale station: Replace existing circuit breakers A and G with two new 69 kV circuit breakers. Replace existing 46 kV circuit breakers B, C and F. Retire 46 kV circuit breaker D. Install two new 138 kV circuit breakers and a high-side circuit switcher. Replace existing 138/69/46 kV, 115 MVA transformer with a new 138/69/46 kV, 130 MVA transformer. 138 kV line work needed to accommodate the station work.						
Kincaid station: Replace existing circuit breakers A and B with two new 46 kV circuit breakers. Retire circuit breaker J. Replace existing ground transformer bank with a new ground transformer bank. Install a new high side circuit switcher to replace the existing ground switch. MOAB on the high side of the transformer.						
3	s2178	Construct a new 138 kV line (~11.5 mi.) from Kenna to the existing Ripley 138 kV station.	11/17/2023	\$61.70	2/21/2020	
		Construct a new 138 kV line (~10 mi.) from Kenna to the existing Sisson 138 kV station.				
		Install three new 138 kV circuit breakers at Sisson and perform remote end relaying work at Amos station.				
		Install 138 kV bus and two new 138 kV circuit breakers at Kenna.				
		Install one new 138 kV circuit breaker at Ripley.				
4	s2189	Rebuild ~27.8 miles of the existing Baileysville-Hales Branch 138kV circuit.	8/1/2026	\$98.50		2/21/2020



West Virginia – TO Supplemental Projects

(Greater than \$5 million)

Map ID	Project	Description	Projected In-Service Date	Project Cost (\$M)	TO Zone	TEAC Date
5	s2225	Retire the existing 7.5-mile long Belle-Cabin Creek No. 1 and No. 2 circuits from Belle to Cabin Creek.	4/1/2023	\$41.80	AEP	3/19/2020
		Construct new double-circuit 46 kV line (designed to 138 kV) from Belle to Hernshaw (~4 miles).				
		At Hernshaw station, install four new circuit breakers, 3000 A 40 kA, 46 kV (138 kV design) in a ring configuration. Install two new 138/46 kV, 90 MVA transformers at Hernshaw with two circuit breakers, 3000 A 40 kA, 138 kV, on the high side of each new transformer.				
		Remote end work and retire circuit breakers AA and AB at Cabin Creek station.				
		Install Chesapeake 46 kV substation to eliminate existing hard tap currently serving Praxair. Install a new line extension to Praxair (0.2 miles).				
		Replace the existing switches at Marmet Station to accommodate the new line construction.				
		Marmet hydro hard tap will be relocated to be positioned between 46 kV circuit breaker G at Belle and the new switches at Marmet station. Remote end work required at Marmet hydro station.				
Belle Station work to replace CCVTs with new 46 kV PTs and upgrade line surge arresters.						
6	s2226	Construct ~10 miles of new 138 kV line between Glen Lyn and Speedway. New right-of-way will be required for the new Glen Lyn-Speedway 138 kV line. Retire the existing section of line from Glen Lyn to Hatcher switch (~8 miles), including Hatcher switch.	5/1/2023	\$55.40		
		Retire Hatcher switch. Install MOABs at Speedway on new line to Glen Lyn and existing line towards South Princeton. Install a circuit switcher on the Speedway transformer.				
		Rebuild ~7.3 miles of the Glen Lyn-South Princeton 138 kV circuit between Speedway station and the previous Hatcher switch.	12/1/2026			



West Virginia – TO Supplemental Projects

(Greater than \$5 million)

Map ID	Project	Description	Projected In-Service Date	Project Cost (\$M)	TO Zone	TEAC Date
7	s2270	Construct a new 500-138 kV station (Panhandle), connecting to the Kammer-502 Junction 500 kV circuit (~10.3 miles from Kammer, 31.7 miles from 502 Junction). Install a three-breaker 500 kV ring bus; 450 MVA 500-138 kV transformer; three-breaker 138 kV ring bus.	3/1/2022	\$68.70	AEP	5/12/2020
		Construct a new 138 kV switching station (Nauvoo Ridge) with eight 138 kV breakers in a breaker-and-a-half design. The station will have one circuit to Gosney Hill, two circuits to the customer's facility, two circuits to Panhandle, and a 23 MVAR, 138 kV cap bank.				
		At Gosney Hill, install a new 138 kV breaker toward Nauvoo Ridge. Update station protection. Replace the 795 AAC risers and strain bus with 2000 AAC risers.				
		Construct a new 4.7-mile, 138kV line south of Gosney Hill station to Nauvoo Ridge. Utilize 1033 ACSR conductor. Acquire new right-of-way.				
		Construct a new 1.3 mile, double-circuit 138 kV line from Nauvoo Ridge to the customer's substation. Acquire new right-of-way.				
		Construct a new 1.5 mile, double-circuit 138 kV line from Panhandle to Nauvoo Ridge. Utilize 1033 ACSR conductor for each circuit. Acquire new right-of-way.				
		Extend the Kammer-502 Junction 500 kV transmission line 0.1 mile into Panhandle station (0.2 mile total).				



West Virginia – TO Supplemental Projects

(Greater than \$5 million)

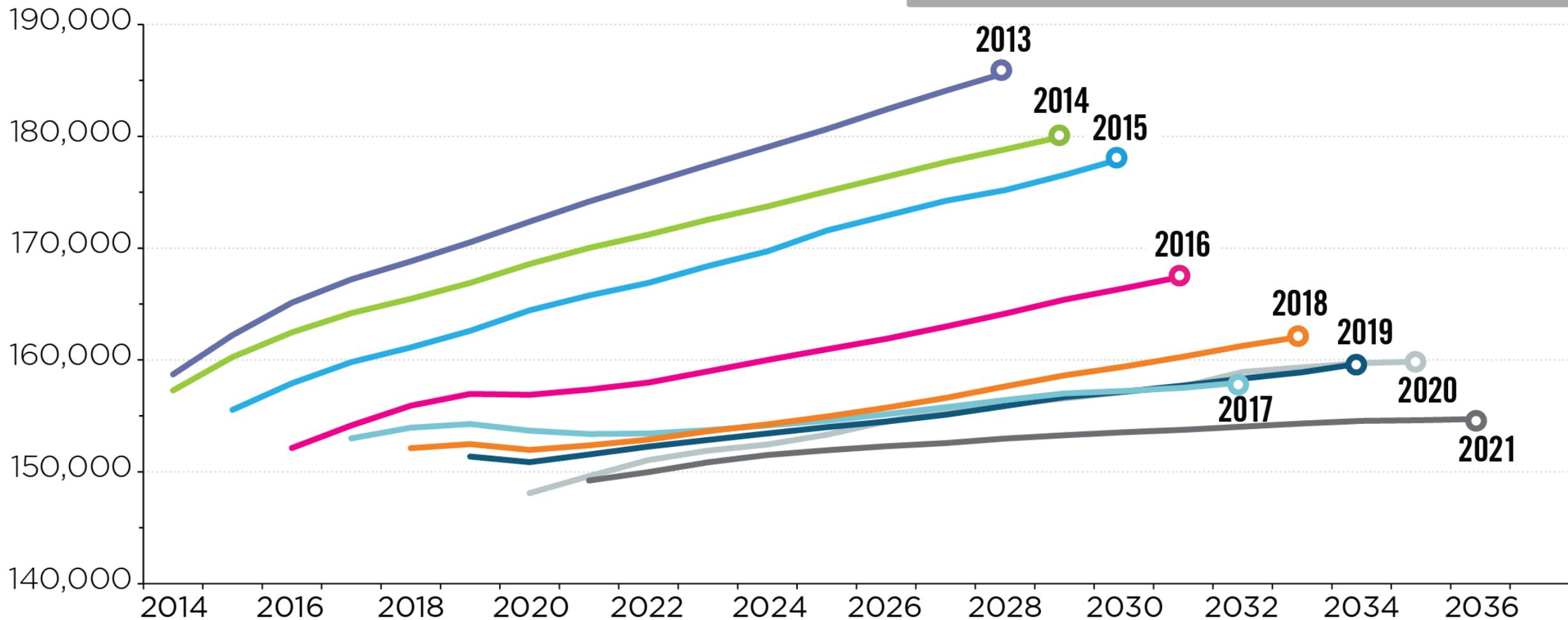
Map ID	Project	Description	Projected In-Service Date	Project Cost (\$M)	TO Zone	TEAC Date
8	s2346	Replace existing 138 kV CBs G, H, I, K, L and N with six new 138 kV, 40 kA circuit breakers. Replace existing 138 kV cap bank BB and install a new 138 kV breaker on the new cap bank. Replace existing 46 kV cap bank switcher with a new cap bank switcher. Install a high-side circuit switcher on the existing 138/46 kV transformer. Upgrades will be made to the existing road into the station to improve access and space constraints. A flood wall will be installed to mitigate flooding concerns. Note: 138 kV CS CC failed and has been replaced.	7/1/2022	\$10.10	AEP	7/17/2020
9	s2348	At Chemical station, replace existing 138/46 kV, 45 MVA transformers No. 1 and No. 2 with two new 138/46 kV, 90 MVA transformers and install two 138 kV high-side circuit switchers on each transformer. Retire 138/46 kV transformer No. 4. Retire 46 kV, 18 MVAR capacitor and switcher DD. Retire 46 kV bus No. 1, bus No. 2 and bus No. 3. Rebuild the 46 kV into a fourteen-breaker ring configuration. Replace grounding banks No. 7 and No. 8.	10/17/2022	\$35.30		
		Line work is required to accommodate the new station configuration on the Chemical-Turner 138 kV line and Chemical-Chesterfield 46 kV line.				
		Remote-end work is required at Turner station, Central Avenue station and Ward Hollow stations.				
		Rebuild the Chemical-South Charleston No. 1 and Chemical-South Charleston No. 2 46 kV lines with a new double-circuit 46 kV line (69 kV standards) from Chemical-Criel Mound.				
		At South Charleston, retire the existing circuit breakers A and B and install four new 46 kV, 40 kA circuit breakers in a ring at a new station (Criel Mound) adjacent to the existing South Charleston station.				
	s2347	Replace existing grounding bank with a new grounding bank at Mullens station. Install high side circuit breaker for the existing 138/34.5 kV transformer. Install a new 138 kV 3000 A 40 kA circuit breaker towards Wyoming station. Install a new DICM.	2/17/2022	\$6.70		7/17/2020

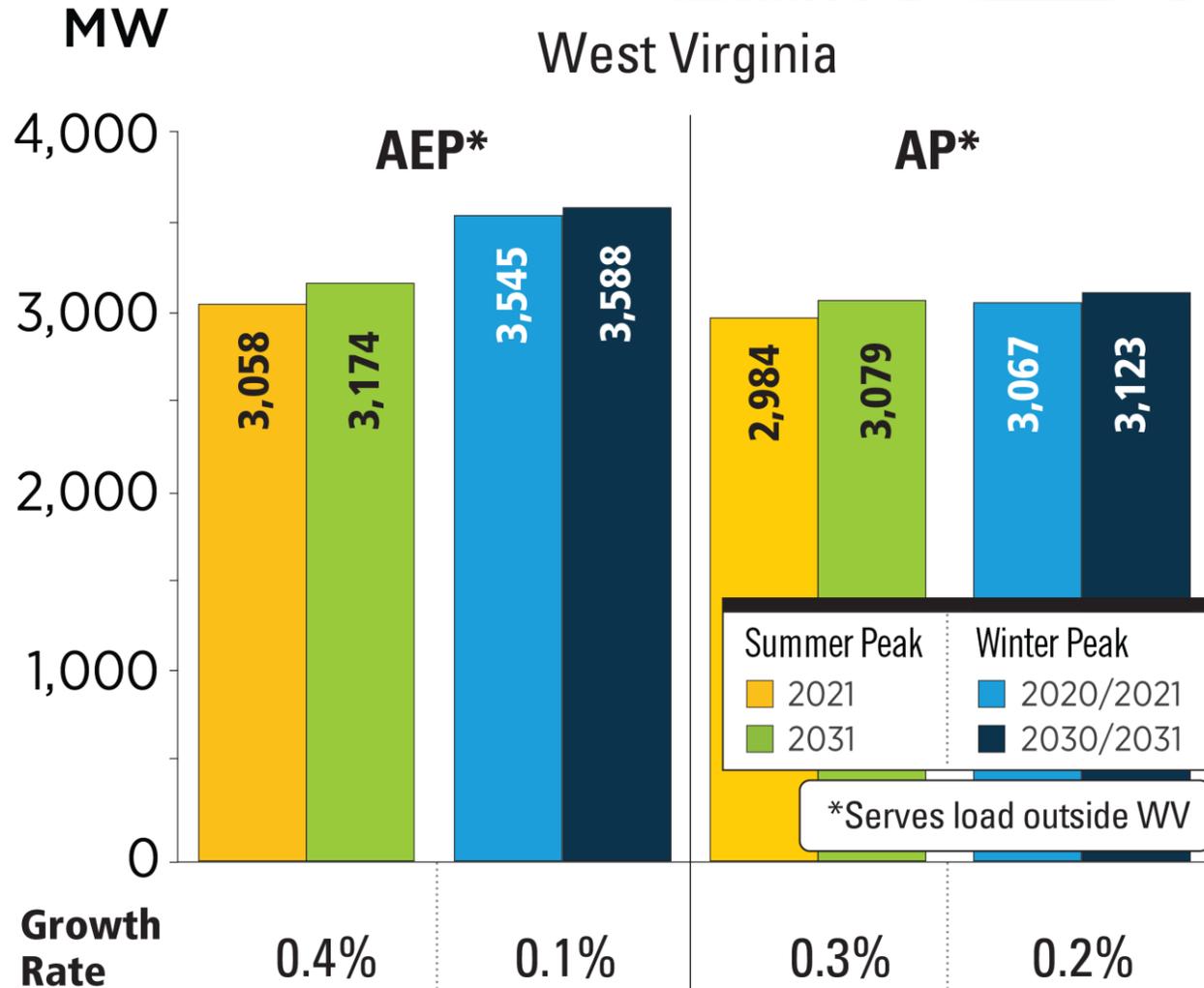
Planning

Load Forecast

PJM RTO Summer Peak Demand Forecast

Load (MW)





PJM RTO Summer Peak		PJM RTO Winter Peak	
2021	2031	2020/2021	2030/2031
149,223 MW	153,759 MW	132,027 MW	135,568 MW
Growth Rate 0.3%		Growth Rate 0.2%	

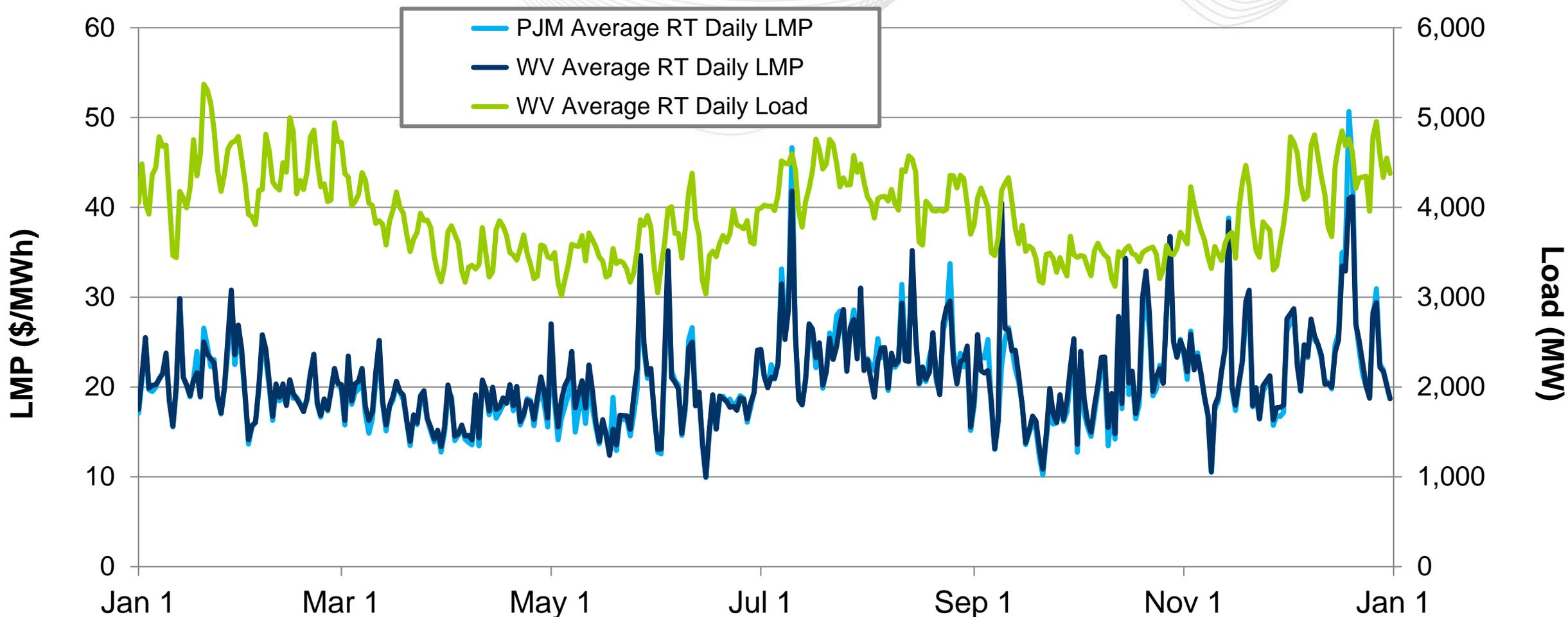
The summer and winter peak megawatt values reflect the estimated amount of forecasted load to be served by each transmission owner in the noted state/district. Estimated amounts were calculated based on the average share of each transmission owner's real-time summer and winter peak load in those areas over the past five years.

Markets

Market Analysis

West Virginia – Average Daily LMP and Load

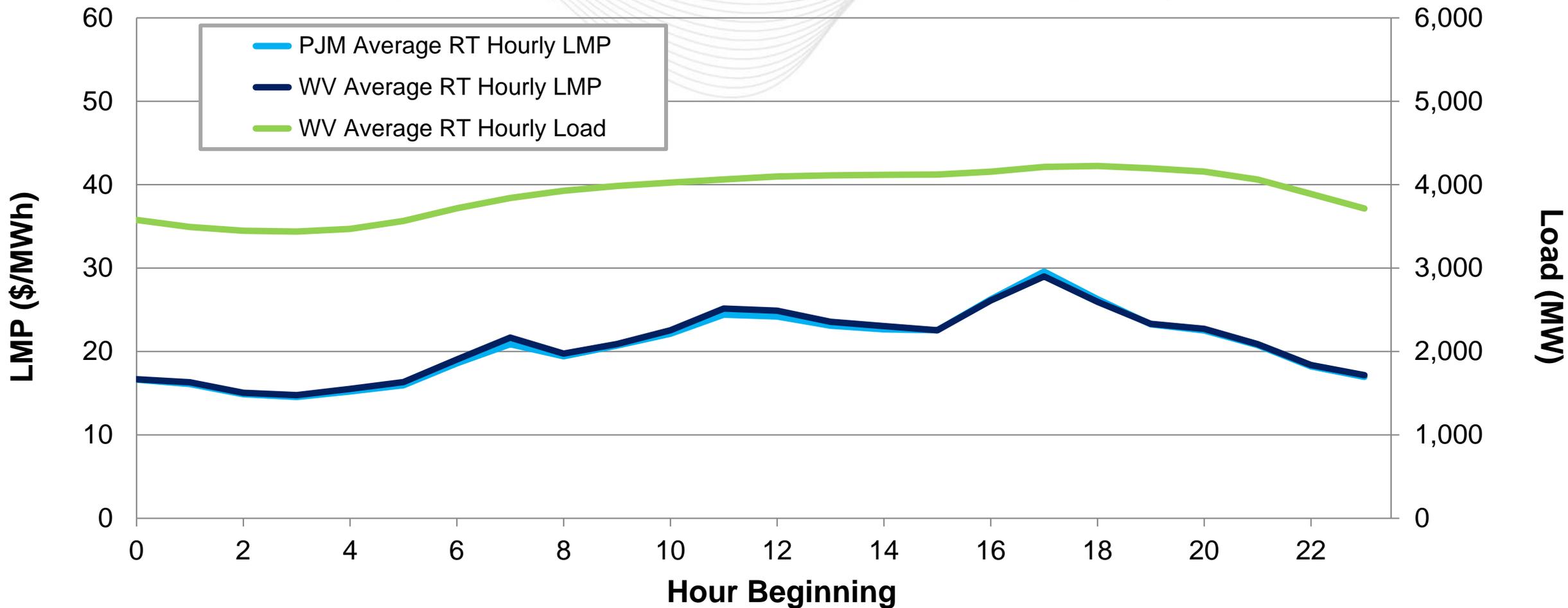
(Jan. 1, 2020 – Dec. 31, 2020)



West Virginia – Average Hourly LMP and Load

(Jan. 1, 2020 – Dec. 31, 2020)

West Virginia's average hourly LMPs aligned with the PJM average hourly LMP.





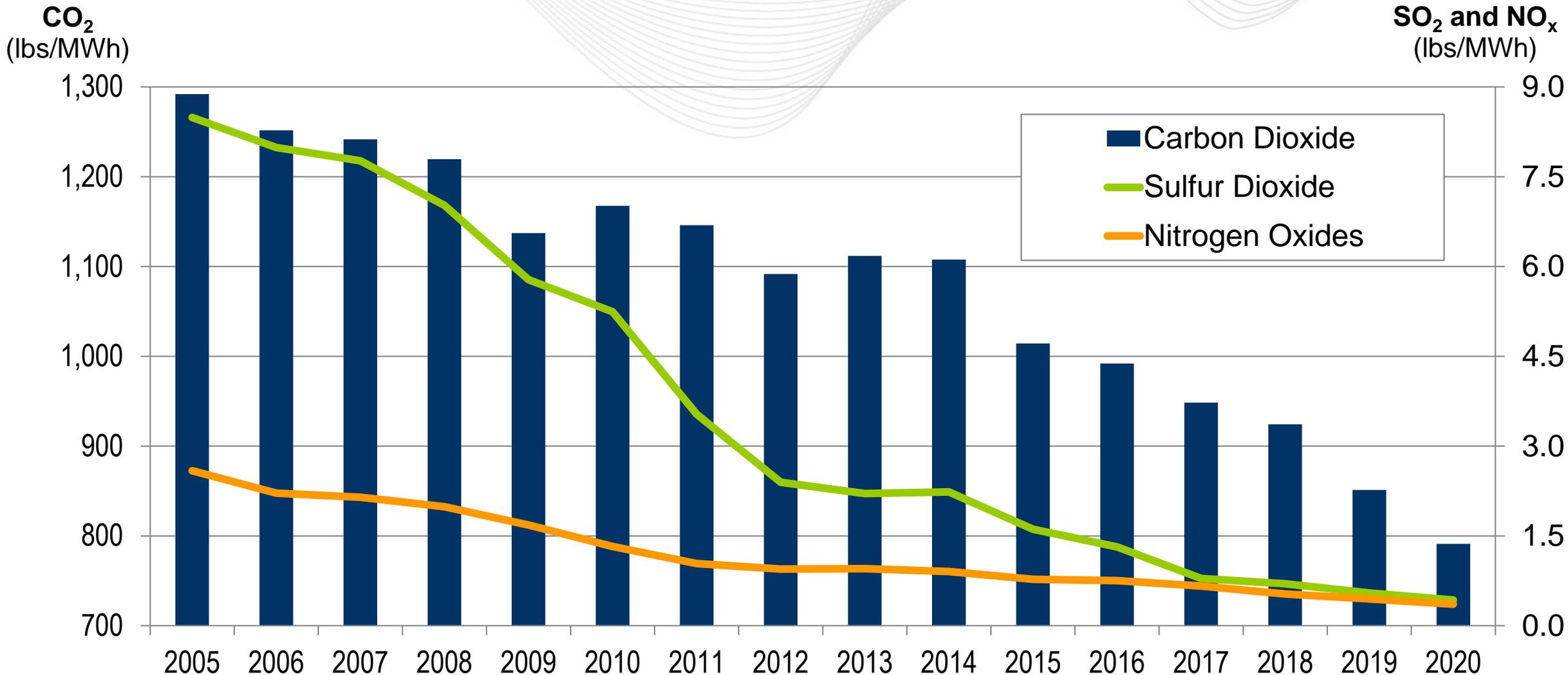
West Virginia – Net Energy Import/Export Trend

(Jan. 2020 – Dec. 2020)



Positive values represent exports and negative values represent imports.

Operations Emissions Data





West Virginia – Average Emissions (lbs/MWh)

(Feb. 2021)

CO₂
(lbs/MWh)

SO₂ and NO_x
(lbs/MWh)

