2019 Virginia State Infrastructure Report
(January 1, 2019 – December 31, 2019)

May 2020

(updated July 2020)

This report reflects information for the portion of Virginia within the PJM service territory.

Table of Contents

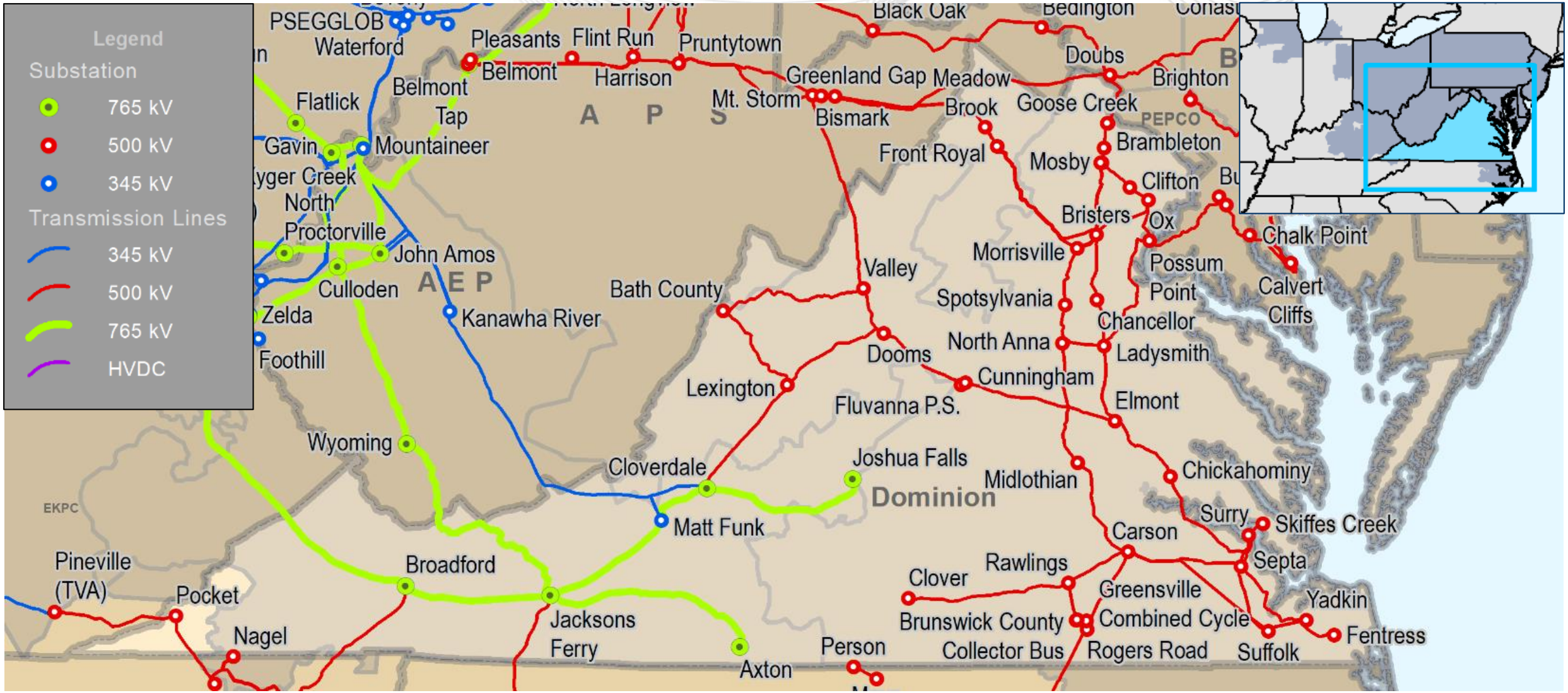
Executive Summary
(May 2020)

- **Existing Capacity:** Natural gas represents approximately 49.1 percent of the total installed capacity in the Virginia service territory while coal represents approximately 12.4 percent. In PJM natural gas and coal account respectively for 42.4 and 28.7 percent of total installed capacity.
- **Interconnection Requests:** Solar represents 57.1 percent of new interconnection requests in Virginia, while natural gas represents approximately 29.4 percent of new requests.
- **Deactivations:** 1,397.8 MW in Virginia gave notification of deactivation in 2019.
- **RTEP 2019:** Virginia's 2019 RTEP projects total approximately $1.4 billion in investment. Approximately 23.6 percent of that represents supplemental projects. These investment figures only represent RTEP projects that cost at least $5 million.

Executive Summary
(May 2020)

- **Load Forecast:** Virginia's load is projected to grow between 0.7 and 1.4 percent annually over the next ten years. Comparatively, the overall PJM RTO projected load growth rate is 0.6 percent.
- **2022/23 Capacity Market:** No Base Residual Auction was conducted in 2019. For the most recent auction results, please see the 2018 Virginia State Infrastructure Report.
- **1/1/19 – 12/31/19 Market Performance:** Virginia's average hourly LMPs were slightly higher than PJM average hourly LMPs.
- **Emissions:** 2019 carbon dioxide, sulfur dioxide, and nitrogen oxide emissions all decreased from 2018 levels.

PJM Service Area – Virginia

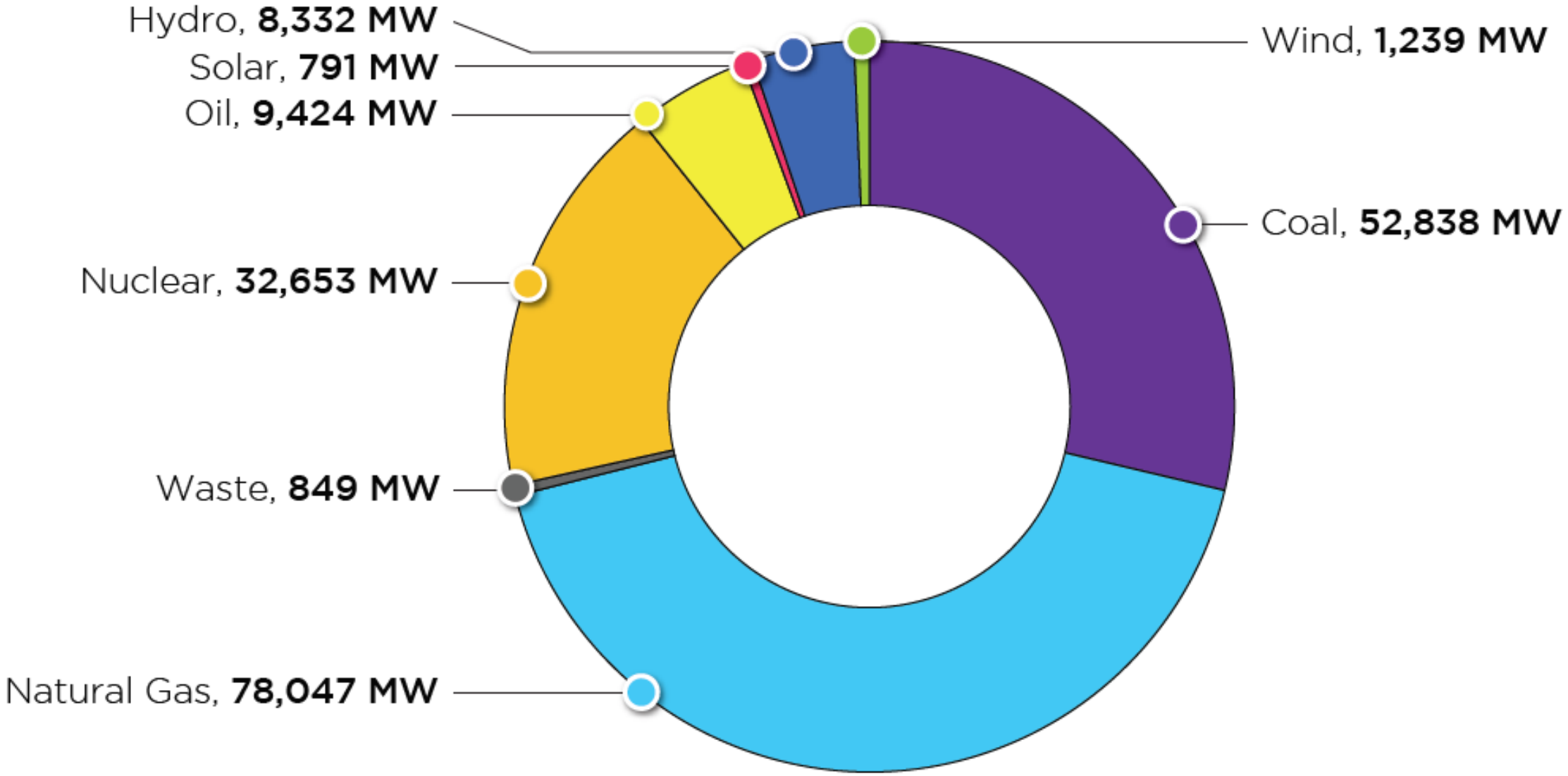


Planning

Generation Portfolio Analysis

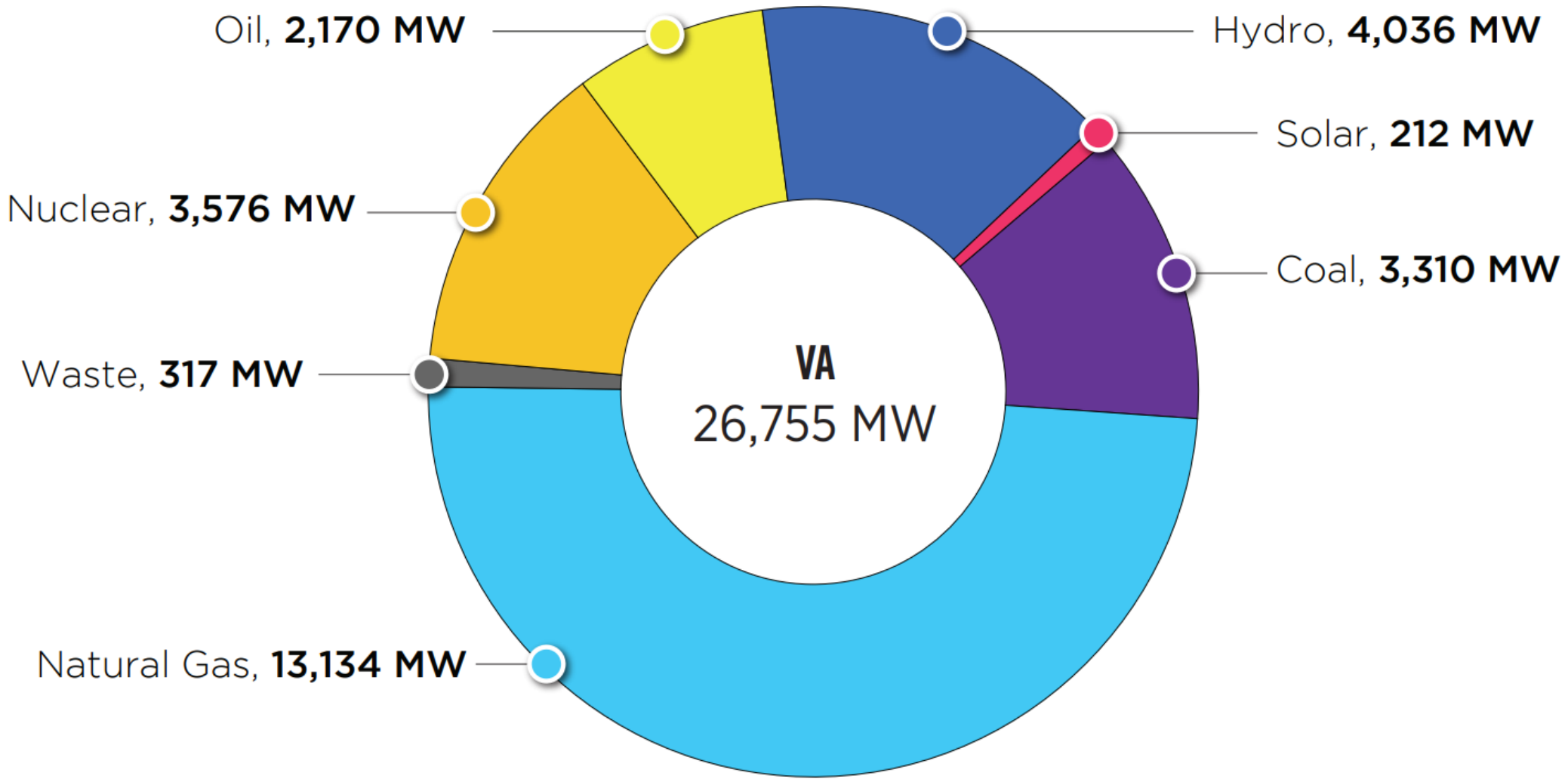
PJM – Existing Installed Capacity

(CIRs – as of Dec. 31, 2019)



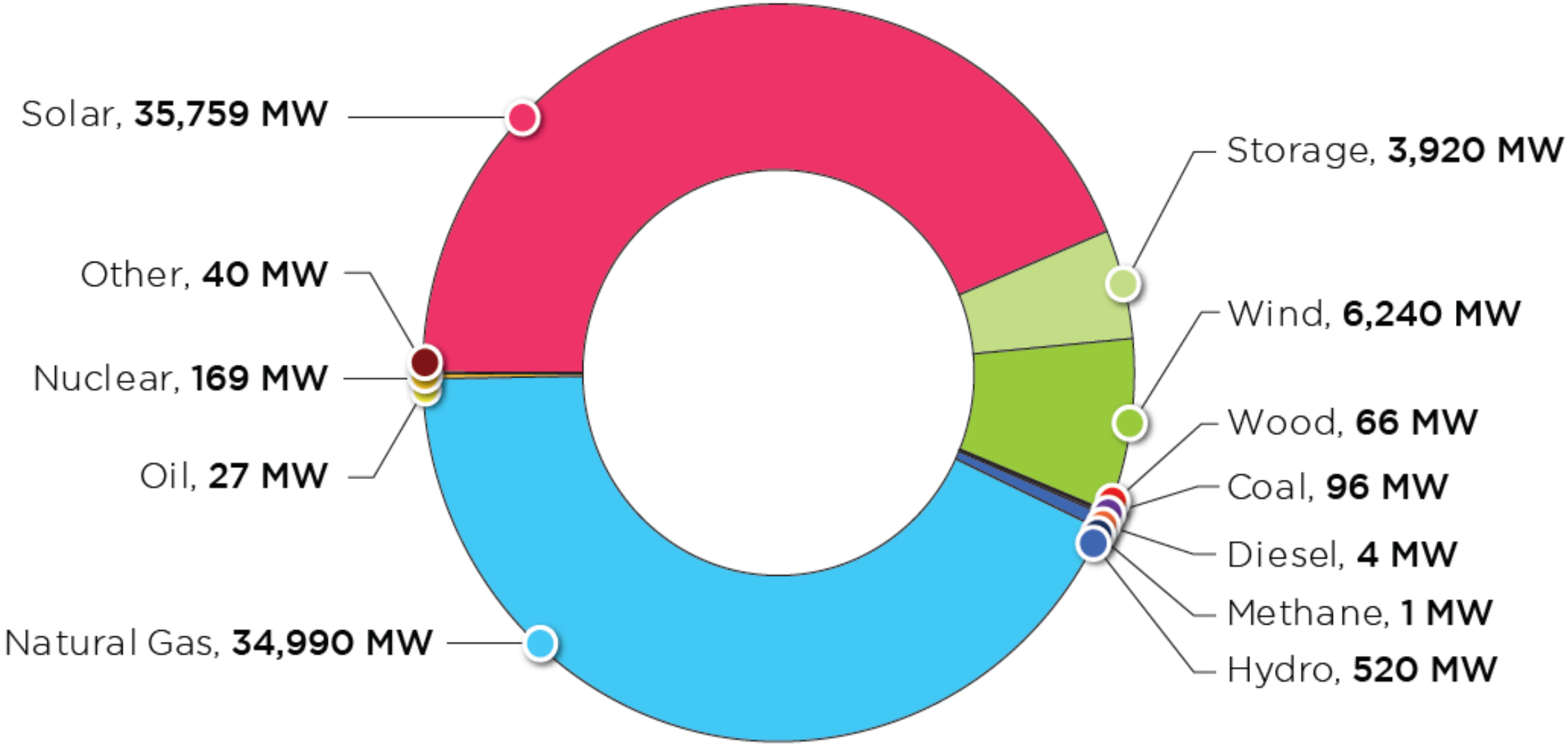
Virginia – Existing Installed Capacity

(CIRs – as of Dec. 31, 2019)



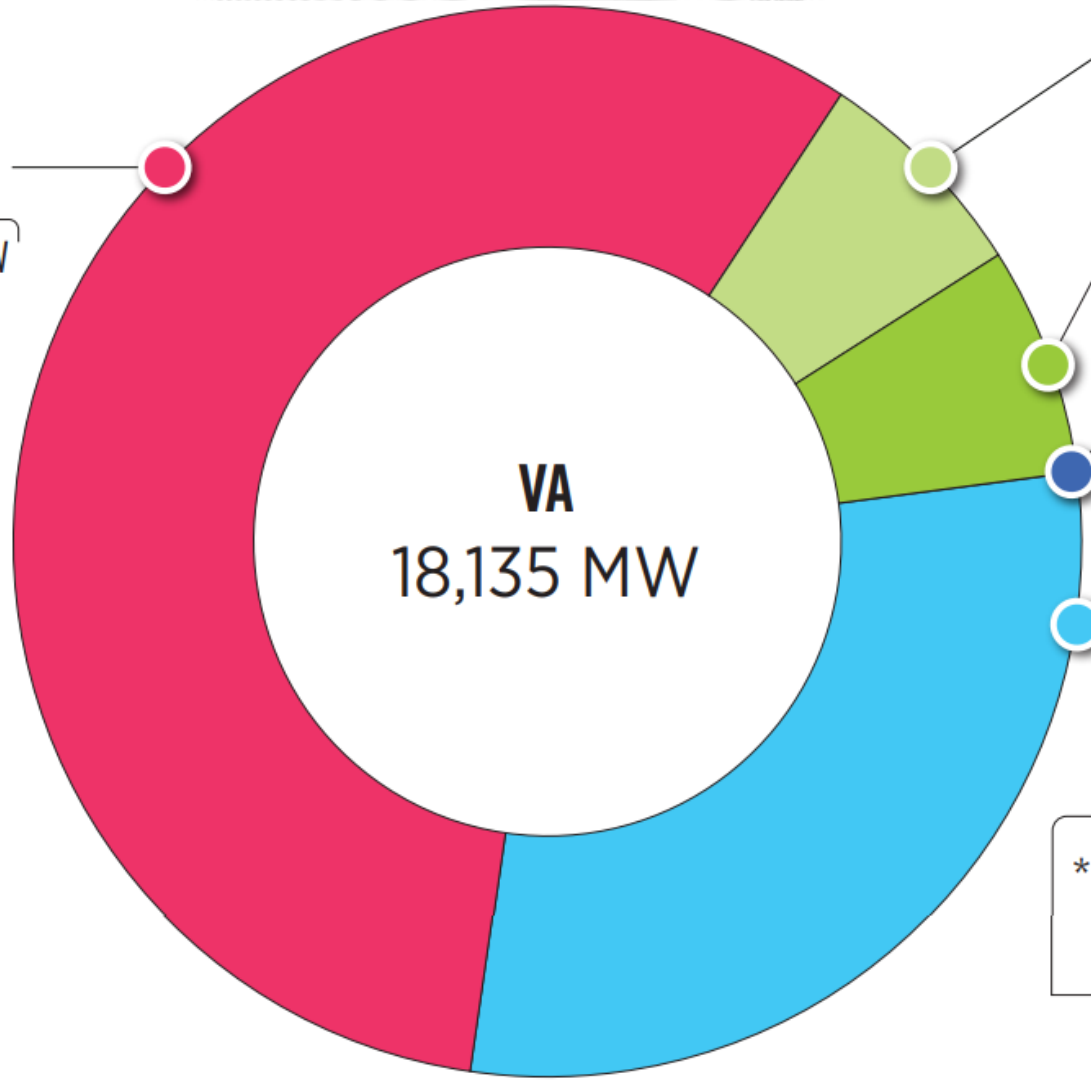
PJM – Queued Capacity (MW) by Fuel Type

(Requested CIRs – as of Dec. 31, 2019)



Virginia – Queued Capacity (MW) by Fuel Type

(Requested CIRs – as of Dec. 31, 2019)



Solar, **10,335 MW**

Nameplate Capacity, 17,046 MW

Storage, **1,221 MW**

Wind, **1,253 MW**

Nameplate Capacity, 5420 MW

Hydro, **2 MW**

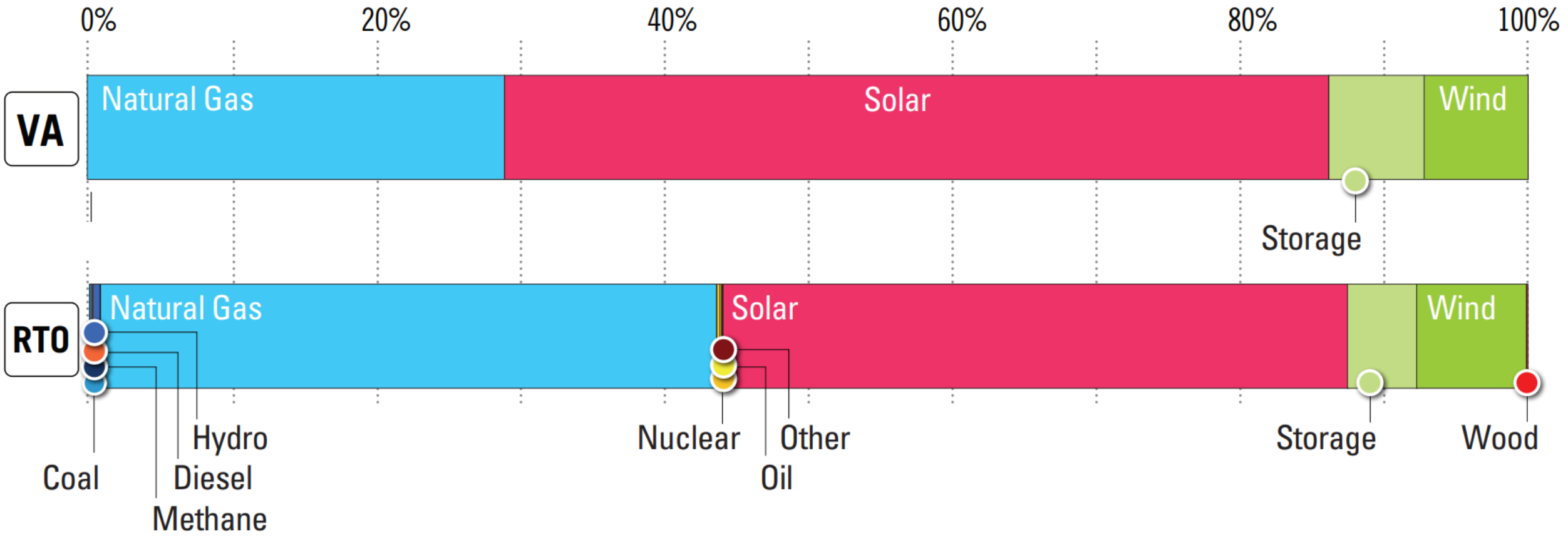
Nameplate Capacity, 0 MW

Natural Gas, **5,324 MW**

*__Note:__ Nameplate Capacity represents a generator's rated full power output capability.

Virginia – Percentage of MW in Queue by Fuel Type

(Dec. 31, 2019)



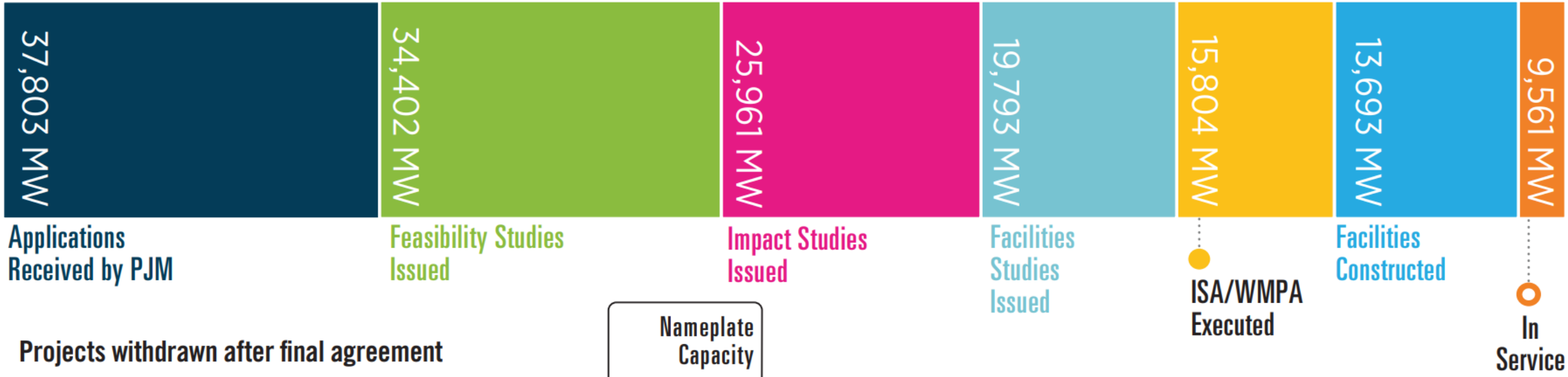
Virginia – Interconnection Requests

(Unforced Capacity – as of Dec. 31, 2019)

		In Queue						Complete				Grand Total	
		Active		Suspended		Under Construction		In Service		Withdrawn			
		No. of Projects	Capacity (MW)	No. of Projects	Capacity (MW)	No. of Projects	Capacity (MW)	No. of Projects	Capacity (MW)	No. of Projects	Capacity (MW)	No. of Projects	Capacity (MW)
Non-Renewable	Coal	0	0.0	0	0.0	0	0.0	8	718.9	2	35.0	10	753.9
	Diesel	0	0.0	0	0.0	0	0.0	2	2.1	2	20.2	4	22.3
	Natural Gas	7	2,607.6	2	2,660.0	3	56.6	44	7,239.5	40	16,052.5	96	28,616.2
	Nuclear	0	0.0	0	0.0	0	0.0	8	350.0	1	1,570.0	9	1,920.0
	Oil	0	0.0	0	0.0	0	0.0	6	322.2	2	40.0	8	362.2
	Other	0	0.0	0	0.0	0	0.0	1	0.0	2	136.3	3	136.3
	Storage	19	1,221.3	1	0.0	0	0.0	1	0.0	7	55.5	28	1,276.8
Renewable	Biomass	0	0.0	0	0.0	0	0.0	4	87.4	4	70.0	8	157.4
	Hydro	1	2.4	0	0.0	0	0.0	8	421.0	2	254.0	11	677.4
	Methane	0	0.0	0	0.0	0	0.0	15	100.4	11	81.8	26	182.2
	Solar	162	8,837.4	6	110.4	58	1,387.0	25	231.1	140	4,820.4	391	15,386.3
	Wind	7	1,224.6	2	19.3	2	9.1	0	0.0	30	878.6	41	2,131.5
	Wood	0	0.0	0	0.0	0	0.0	1	4.0	2	57.0	3	61.0
	Grand Total	**196**	**13,893.3**	**11**	**2,789.7**	**63**	**1,452.7**	**123**	**9,476.7**	**245**	**24,071.2**	**638**	**51,683.5**

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

Virginia – Progression History of Interconnection Requests

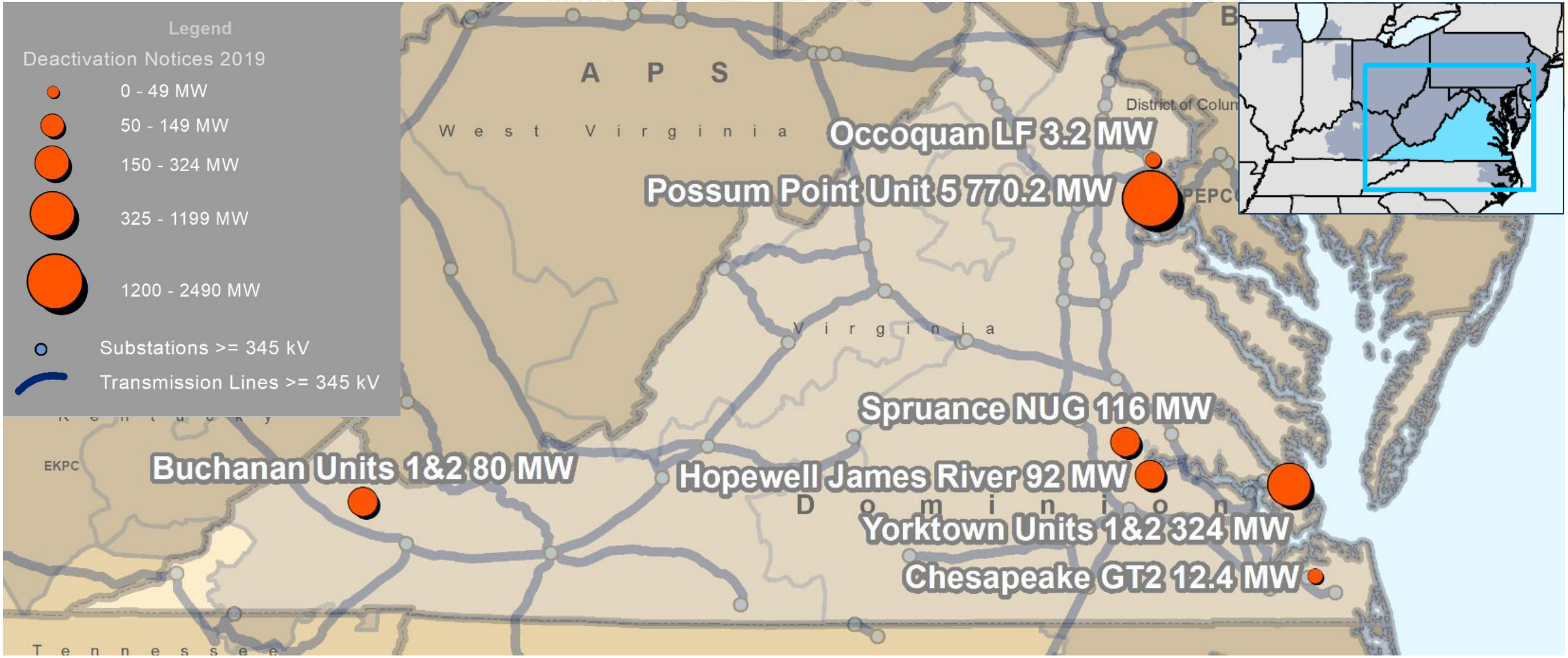


Projects withdrawn after final agreement		Nameplate Capacity
15 Interconnection Service Agreements	1,934 MW	2,275 MW
14 Wholesale Market Participation Agreements	136 MW	211 MW

Percentage of planned capacity and projects that have reached commercial operation	25% Requested capacity megawatt	28% Requested projects

This graphic shows the final state of generation submitted in all PJM queues that reached in-service operation, began construction, or was suspended or withdrawn as of Dec. 31, 2019.

Virginia – Generation Deactivation Notifications Received in 2019



Virginia – Generation Deactivation Notifications Received in 2019

Unit	TO Zone	Fuel Type	Request Received to Deactivate	Pending/Actual Deactivation Date	Age (Years)	Capacity (MW)
Chesapeake GT2	Dominion	Oil	4/18/2019	5/31/2019	0	12.4
Hopewell James River Cogeneration	Dominion	Coal	3/4/2019	6/25/2019	28	92.0
Occoquan 1 LF	Dominion	Methane	8/9/2019	11/7/2019	27	3.2
Possum Point 5	Dominion	Oil	3/26/2019	5/31/2021	29	770.2
Buchanan 1	AEP	Natural Gas	8/30/2019	6/1/2023	17	40.0
Buchanan 2	AEP	Natural Gas	8/30/2019	6/1/2023	17	40.0
Spruance NUG 1	Dominion	Coal	11/25/2019	1/12/2021	25	116.0
Yorktown 1	Dominion	Coal	11/7/2011	3/8/2019	54	159.0
Yorktown 2	Dominion	Coal	10/9/2012	3/8/2019	53	165.0

Planning

Transmission Infrastructure Analysis

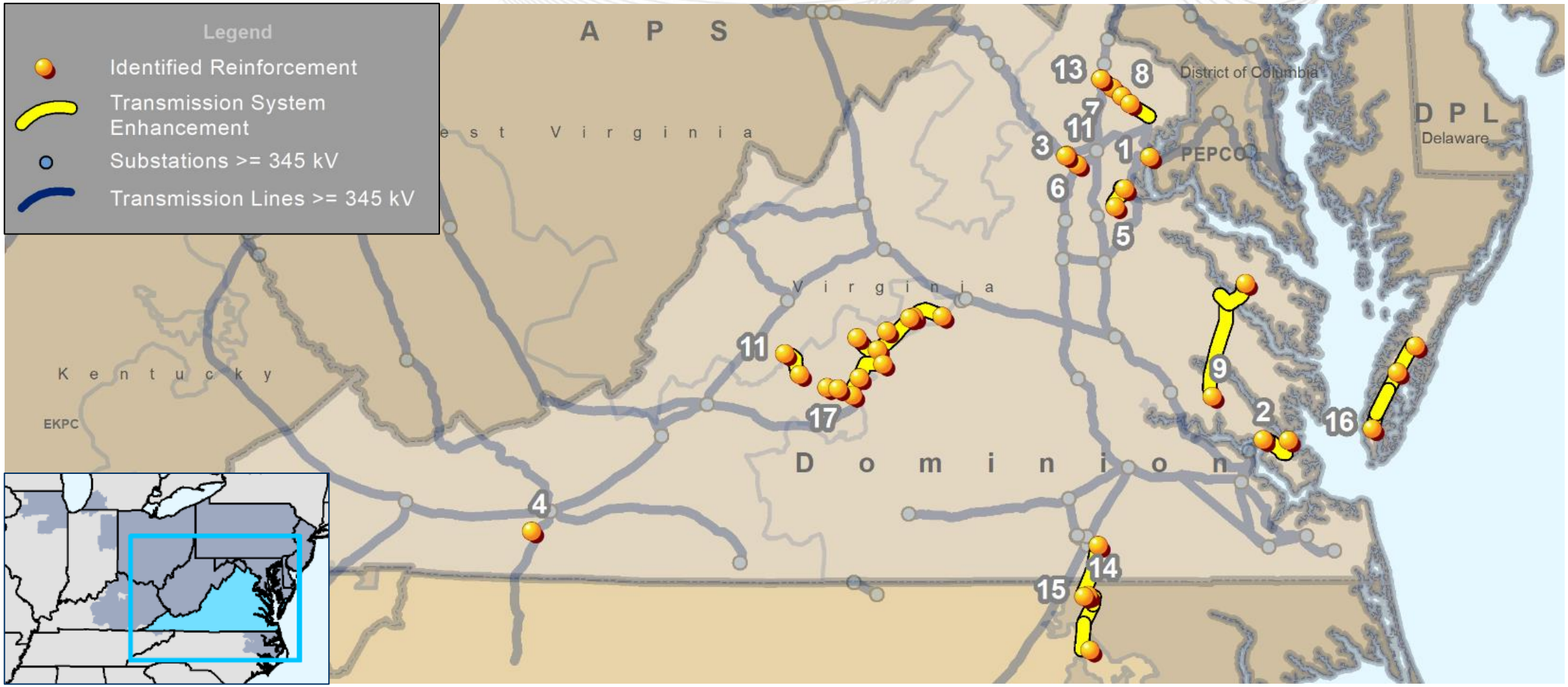
Please note that PJM historically used $5 million as the threshold for listing projects in the RTEP report. Beginning in 2018, it was decided to increase this cutoff to $10 million. All RTEP projects with costs totaling at least $5 million are included in this state report. However, only projects that 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/planning/rtep-upgrades-status/construct-status.aspx

Virginia – RTEP Baseline Projects

(Greater than $10 million)



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

Virginia – RTEP Baseline Projects

(Greater than $5 million)

Map ID	Project	Description	Projected In-Service Date	Project Cost ($M)	TO Zone	TEAC Date
1	b2443	Install a second 500/230 kV transformer at Possum Point substation and replace bus work and associated equipment as needed. Replace 19-63 kA 230 kV breakers with 19-80 kA 230 kV breakers.	6/1/2023	$338.8	Dominion	1/10/2019
2	b2626	Rebuild the Skiffes Creek-Yorktown 115 kV line No. 34 and the double circuit portion of 115 kV line No. 61 to current standards with a summer emergency rating of 353 MVA at 115 kV. Rebuild the 2.5 mile tap line to Fort Eustis as Double Circuit line to loop line No. 34 in and out of Fort Eustis station to current standard with a summer emergency rating of 393 MVA at 115 kV. Install a 115 kV breaker in line No. 34 at Fort Eustis station.	12/31/2018	$35.7	Dominion	3/9/2015
3	b2686	Replace the Remington CT 230 kV breaker 2114T2155 with a 63 kA breaker.	6/1/2019	$104.0	Dominion	5/16/2019

Virginia – RTEP Baseline Projects

(Greater than $5 million)

Map ID	Project	Description	Projected In-Service Date	Project Cost ($M)	TO Zone	TEAC Date
4	b2889	Install one 138/69 kV (90 MVA) transformer, one 138 kV circuit switcher, two 138 kV (40 kA 3000A) breakers, establish a 69 kV bus and install three 69 kV(40 kA 3000A) breakers at Jubal Early station. Extend the existing double circuit Cliffview 69 kV line 0.5 mile to the new Wolf Glade Station.	6/1/2021	$37.0	AEP	N/A
5	b2981	Rebuild 115 kV line No. 29 segment between Fredericksburg and Aquia Harbor to current 230 kV standards (operating at 115 kV) utilizing steel H-frame structures with 2-636 ACSR to provide a normal continuous summer rating of 524 MVA at 115 kV (1047 MVA at 230 kV).	12/31/2022	$20.0	Dominion	12/18/2017
6	b3019	Update the nameplate for Morrisville 500 kV breaker H1T594 to be 50 kA. Update the nameplate for Morrisville 500 kV breaker H1T545 to be 50 kA.	6/1/2018	$64.7	Dominion	12/13/2018

Virginia – RTEP Baseline Projects

(Greater than $5 million)

Map ID	Project	Description	Projected In-Service Date	Project Cost ($M)	TO Zone	TEAC Date
7	b3059	Rebuild Loudoun-Elklick line No. 2173.	12/31/2022	$13.5	Dominion	9/13/2018
8	b3060	Rebuild 4.6 mile Elk Lick-Bull Run 230 kV line No. 295 and the portion (3.85 miles) of the Clifton-Walney 230 kV line No. 265 which shares structures with line No. 295.	10/30/2018	$15.5	Dominion	9/13/2018
9	b3089	Rebuild 230 kV line No. 224 between Lanexa and Northern Neck, utilizing double circuit structures to current 230 kV standards. Only one circuit is to be installed on the structures with this project with a minimum summer emergency rating of 1047 MVA.	6/1/2018	$86.0	Dominion	12/13/2018
10	b3090	Convert the overhead portion (~1,500 Feet) of 230 kV lines No. 248 & No. 2023 to underground and convert Glebe substation to a gas insulated substation.	1/1/2021	$120.0	Dominion	12/13/2018
11	b3096	Rebuild Clifton-Ox 230 kV line No.2063 and part of Clifton-Keene Mill 230 kV line No. 2164 (with double circuit steel structures using double circuit conductor at current 230 kV northern Virginia standards with a minimum rating of 1,200 MVA.	6/1/2019	$22.0	Dominion	4/11/2019

Virginia – RTEP Baseline Projects

(Greater than $5 million)

Map ID	Project	Description	Projected In-Service Date	Project Cost ($M)	TO Zone	TEAC Date
12	**b3098**	Rebuild 9.8 miles of 115 kV line No. 141 between Balcony Falls and Skimmer and 3.8 miles of 115 kV line No. 28 between Balcony Falls and Cushaw to current standards with a minimum rating of 261 MVA.	6/1/2019	$20.0	Dominion	2/20/2019
13	**b3110**	Rebuild line No. 2008 between Loudoun to Dulles Junction using single circuit conductor at current 230 kV northern Virginia standards with minimum summer ratings of 1200 MVA. Cut and loop Clifton-Sully line No. 265 into Bull Run substation. Add three 230 kV breakers at Bull Run to accommodate the new line and upgrade the substation.	6/1/2019	$14.5	Dominion	3/7/2019
		Replace the Bull Run 230 kV breakers 200T244 and 200T295 with 50 kA breakers.				5/16/2019
14	**b3114**	Rebuild the 18.6 mile section of 115 kV line No. 81 which includes 1.7 miles of double circuit line No. 81 and 230 kV line No. 2056. This segment of line of No. 81 will be rebuilt to current standards with a minimum rating of 261 MVA. Line No. 2056 rating will not change.	6/1/2019	$25.0	Dominion	3/28/2019

Virginia – RTEP Baseline Projects

(Greater than $5 million)

Map ID	Project	Description	Projected In-Service Date	Project Cost ($M)	TO Zone	TEAC Date
15	**b3121**	Rebuild Clubhouse-Lakeview 230 kV line No. 254 with single-circuit wood pole equivalent structures at the current 230 kV standard with a minimum rating of 1,047 MVA.	6/1/2019	$27.0	Dominion	6/13/2019
16	**b3134**	Build a new single circuit 69 kV overhead from Kellam sub to new Bayview substation (21 miles) and create a line terminal at Belle Haven delivery point (three-breaker ring bus).	6/1/2019	$22.0	ODEC	5/31/2019
		Reconfigure the Belle Haven 69 kV bus to three-breaker ring bus and create a line terminal for the new 69 kV circuit to Bayview.				
		Build a new single circuit 69 kV overhead from Kellam sub to new Bayview Substation (21 miles).				

Virginia – RTEP Baseline Projects

(Greater than $5 million)

Map ID	Project	Description	Projected In-Service Date	Project Cost ($M)	TO Zone	TEAC Date
17	**b3208**	Retire ~38 miles of the 44 mile Clifford-Scottsville 46 kV circuit. Build new 138 kV in-and-out to two new distribution stations to serve the load formerly served by Phoenix, Shipman, Schuyler (AEP) and Rockfish stations. Construct new 138 kV lines from Joshua Falls-Riverville (~10 mi.) and Riverville-Gladstone (~5 mi.). Install required station upgrades at Joshua Falls, Riverville and Gladstone stations to accommodate the new 138 kV circuits. Rebuild Reusen-Monroe 69 kV (~4 mi.).	12/1/2022	$85.0	AEP	2/20/2019
	b3088	Rebuild 4.75 mile section of Line #26 between Lexington and Rockbridge with a minimum summer emergency rating of 261 MVA.	6/1/2018	$8.0	Dominion	11/29/2018
	b3097	Rebuild 4 miles of 115kV Line #86 between Chesterfield and Centralia to current standards with a minimum summer emergency rating of 393 MVA.	6/1/2019	$7.0	Dominion	2/20/2019

Virginia – RTEP Network Projects

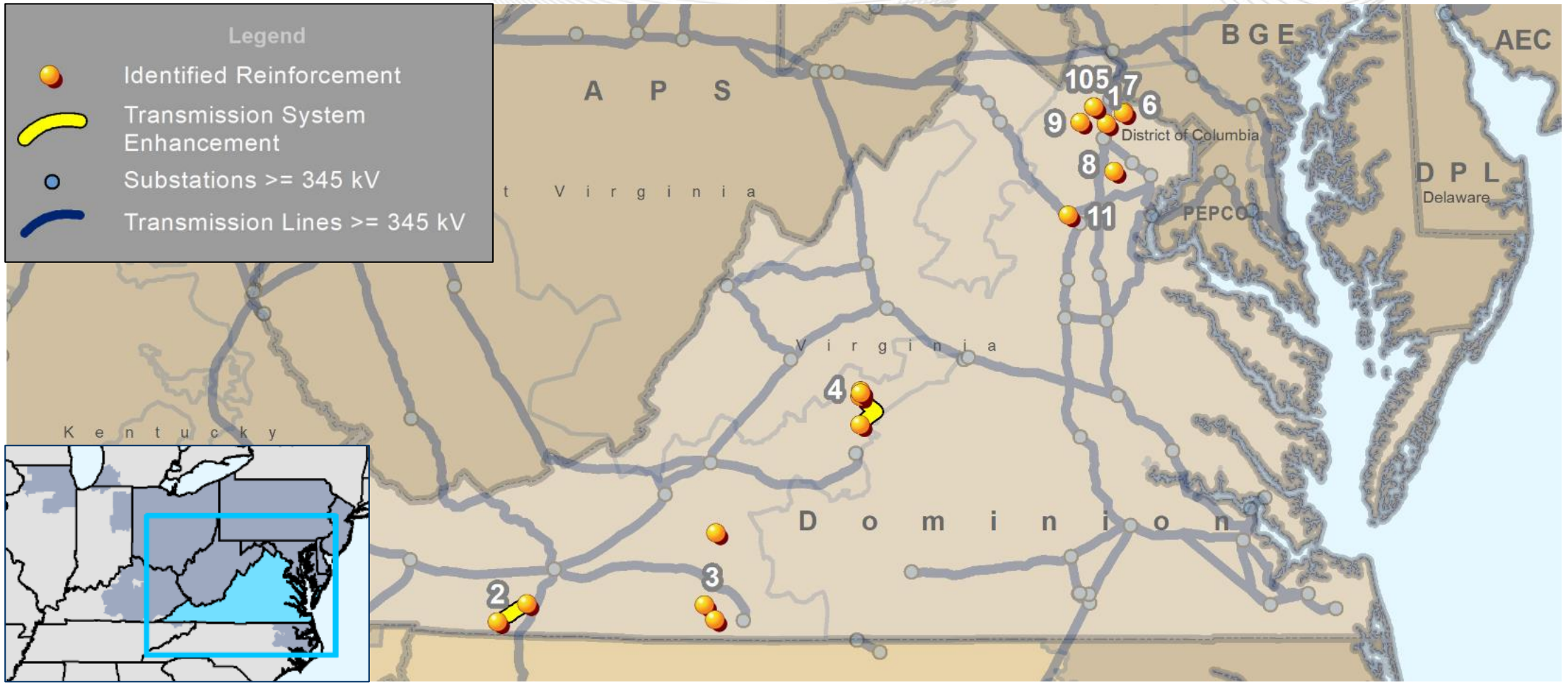
(Greater than $5 million)

Map ID	Project	Description	Auction Revenue Request	Required In-Service Date	Project Cost ($M)	TO Zone	TEAC Date
	n4784	Construct new Rocky Forge 230kV three breaker ring bus switching station.	AA1-038	12/31/2018	$6.76	Dominion	11/14/2019

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.

Virginia – TO Supplemental Projects

(Greater than $10 million)



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.

Virginia – TO Supplemental Projects

(Greater than $5 million)

Map ID	Project	Description	Projected In-Service Date	Project Cost ($M)	TO Zone	TEAC Date
1	s1838	Re-conductor 230 kV line No. 227 Cochran Mill-Ashburn and Ashburn-Beaumeade line segments using a higher capacity conductor as well as upgrade the terminal equipment to achieve a rating of 1,572 MVA.	6/1/2023	$15.8	Dominion	8/8/2019
2	s1851	Build a new Jubal Early-Independence 69 kV line (~15 miles). Install one 69 kV circuit breaker at Jubal Early Station and two 69 kV circuit breakers at Independence station.	6/1/2022	$32.5	AEP	1/11/2019

Virginia – TO Supplemental Projects

(Greater than $5 million)

Map ID	Project	Description	Projected In-Service Date	Project Cost ($M)	TO Zone	TEAC Date
3	s1852	At Fieldale station, replace synchronous condenser with two units (-50/+100 MVAR). Replace 138 kV circuit breakers AC and AB with new 3,000 A, 40 kA breakers. Replace 138 kV circuit switchers EE"& DD with new 3,000 A, 40 kA units. Replace 69 kV circuit breaker F with new 72.5 kV, 3,000 A, 40 kA circuit breaker. Retire 34.5 kV equipment including circuit breaker T, 7.2 MVAR capacitor bank and circuit cwitcher AA. Move 69 kV Fieldcrest Mills load to 12 kV service and retire radial 69 kV line to Fieldcrest Mills and Fieldcrest Mills Station.	12/1/2022	$57.0	AEP	2/20/2019
		Retire three 69 kV breakers A, B and C and replace with two line MOABs at DuPont Station.				
		Replace 138 kV S&C Mark V circuit switcher AA at Blaine Station.				
		Reconfigure existing 69 kV capacitor bank from a 15.6 MVAR to 10.8 MVAR at Morris Novelty station. Replace 34.5 kV FK oil-filled breakers F and E.				
		Add high side 69 kV circuit switcher to Rich Acres transformer No. 1.				

Virginia – TO Supplemental Projects

(Greater than $5 million)

Map ID	Project	Description	Projected In-Service Date	Project Cost ($M)	TO Zone	TEAC Date
4	s2000	Rebuild Monroe-Amherst 69 kV line section (~7.9 mi.). Rebuild Esmont-Scottsville 46 kV line section (~6.0 mi.).	10/1/2022	$39.0	AEP	5/20/2019
5	s2100	Interconnect the new Nimbus substation by cutting and extending 230 kV line No. 2152 (Buttermilk-Beaumeade). Terminate both ends into a four-breaker ring arrangement to create a Buttermilk-Nimbus line and a Nimbus-Beaumeade line.	11/15/2022	$20.0	Dominion	5/16/2019
6	s2101	Interconnect the new DTC substation by cutting and extending 230 kV line No. 2143 (Beaumeade-BECO) ~1.5 miles to the proposed DTC Substation. Terminate both ends into a six-breaker ring bus arrangement with four breakers installed to create a Beaumeade-DTC line and a BECO-DTC line. Install two 230 kV circuit switchers and any necessary high side switches and bus work for the new transformers.	11/15/2021	$25.0	Dominion	5/16/2019
7	s2104	Interconnect the new Buttermilk substation. Buttermilk substation will have a six-breaker 230 kV breaker and a half bus configuration. Install line switches, two 230 kV circuit switchers and high side switches, and necessary bus work for the new transformers.	12/30/2020	$11.0	Dominion	3/7/2019

Virginia – TO Supplemental Projects

(Greater than $5 million)

Map ID	Project	Description	Projected In-Service Date	Project Cost ($M)	TO Zone	TEAC Date
8	**s2108**	Interconnect the new Lockridge substation. Construct a 1.8 mile 230 kV loop to Lockridge substation. Install four 230 kV breakers (station arranged as six breaker ring) to terminate the two lines. Install two 230 kV circuit switchers and any necessary high side switches and bus work.	7/31/2022	$35.0	Dominion	8/8/2019
9	**s2111**	Interconnect the new Global Plaza substation. At Pacific, install two 230 kV breakers (completing the six-breaker ring) to terminate the two lines. At Global Plaza, install four 230 kV breakers (station arranged as breaker-and-a-half) to terminate the two lines. Install two 230 kV circuit switchers and any necessary high side switches and bus work for two initial transformers (five ultimate).	12/15/2021	$40.0	Dominion	5/16/2019
10	**s2113**	Interconnect Paragon Park substation by cutting and terminating both BECO-Sterling Park 230 kV line No. 2081 and Beaumeade-Sterling Park 230 kV line No. 2150 into a six-breaker 230 kV ring bus. Install two 230 kV circuit switchers and any necessary high side switches and bus work for the new transformers.	7/15/2021	$10.0	Dominion	5/16/2019
11	**s2117**	Replace the Peninusla transformer No. 4 224 MVA 230/115 kV transformer with a new 224 MVA 230/115 kV transformer. Build a 230 kV three-breaker ring bus.	4/30/2021	$16.1	Dominion	4/11/2019

Virginia – TO Supplemental Projects

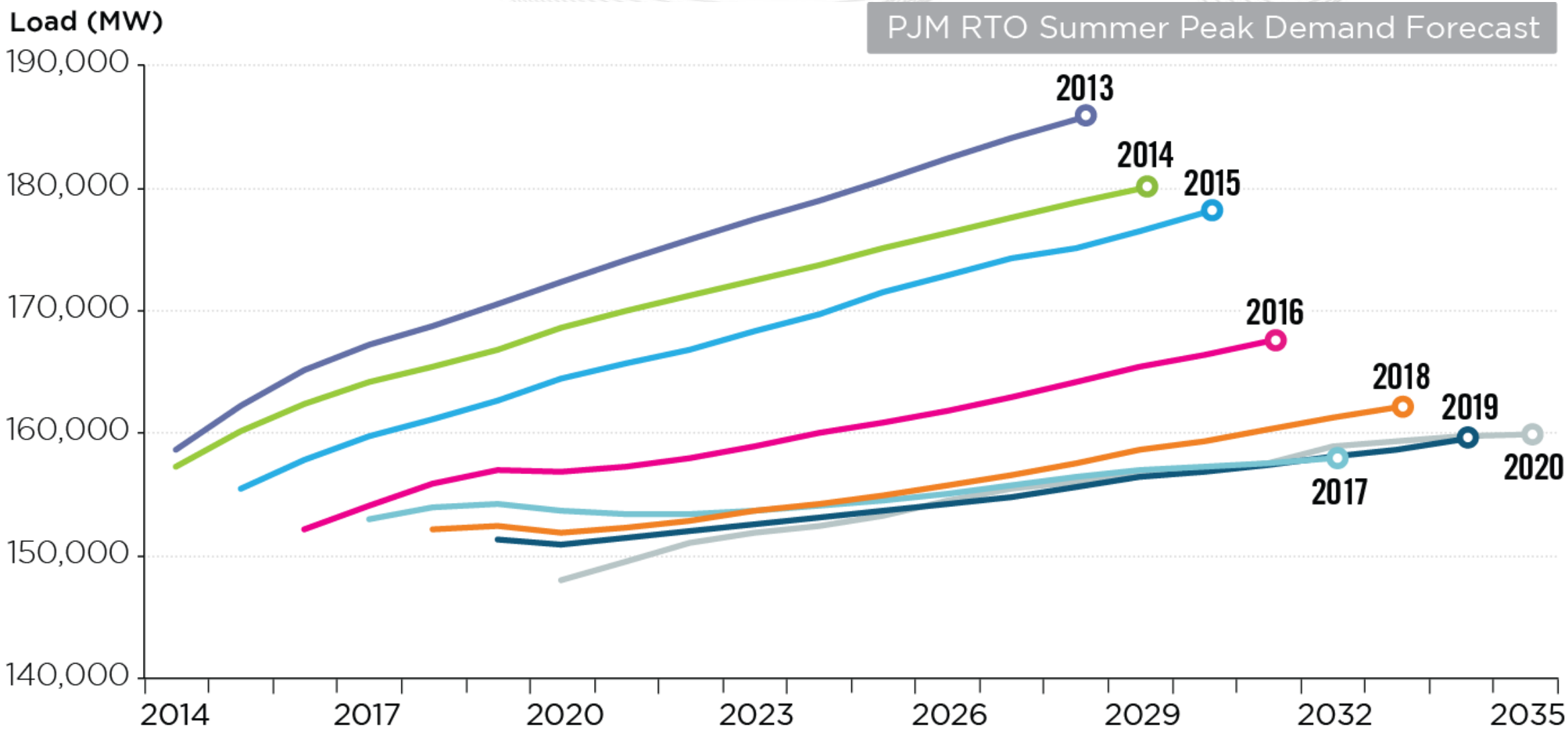
(Greater than $5 million)

Map ID	Project	Description	Projected In-Service Date	Project Cost ($M)	TO Zone	TEAC Date
	s1841	Build a new 230 kV Lucky Hill Substation.	7/15/2021	$7.5	Dominion	1/10/2019
		Install four (4) 230 kV breakers in a ring bus arrangement to create a 230 kV Gordonsville-Lucky Hill and Lucky Hill-Remington lines.	5/28/2020			
	s2026	Install underground section of the feed from Wattsville to Chincoteague 69 kV circuit	5/31/2022	$6.0	ODEC	8/27/2019
	s2105	Add a 3rd distribution transformer at Winterpock substation. A 4-breaker ring is required based on Dominion's Facility Interconnection Requirements for load higher than 100MW. Install a 230kV 4-breaker ring, a circuit switcher on the high side of the transformer and perform any other necessary transmission work at Winterpock substation.	9/15/2020	$8.5	Dominion	4/11/2019
	s2110	Interconnect the new DP substation Perimeter (NOVEC) by cutting and extending 230kV Line #2095 (Yardley-Shellhorn) to the new Cabin Run Switching Station. Terminate both ends into a four-breaker ring arrangement to create a 230kV Yardley-Cabin Run line and a 230kV Cabin Run-Shellhorn line. Provide two 230 kV feeds from the ring bus at Cabin Run to Perimeter DP.	12/1/2020	$8.0	Dominion	5/16/2019

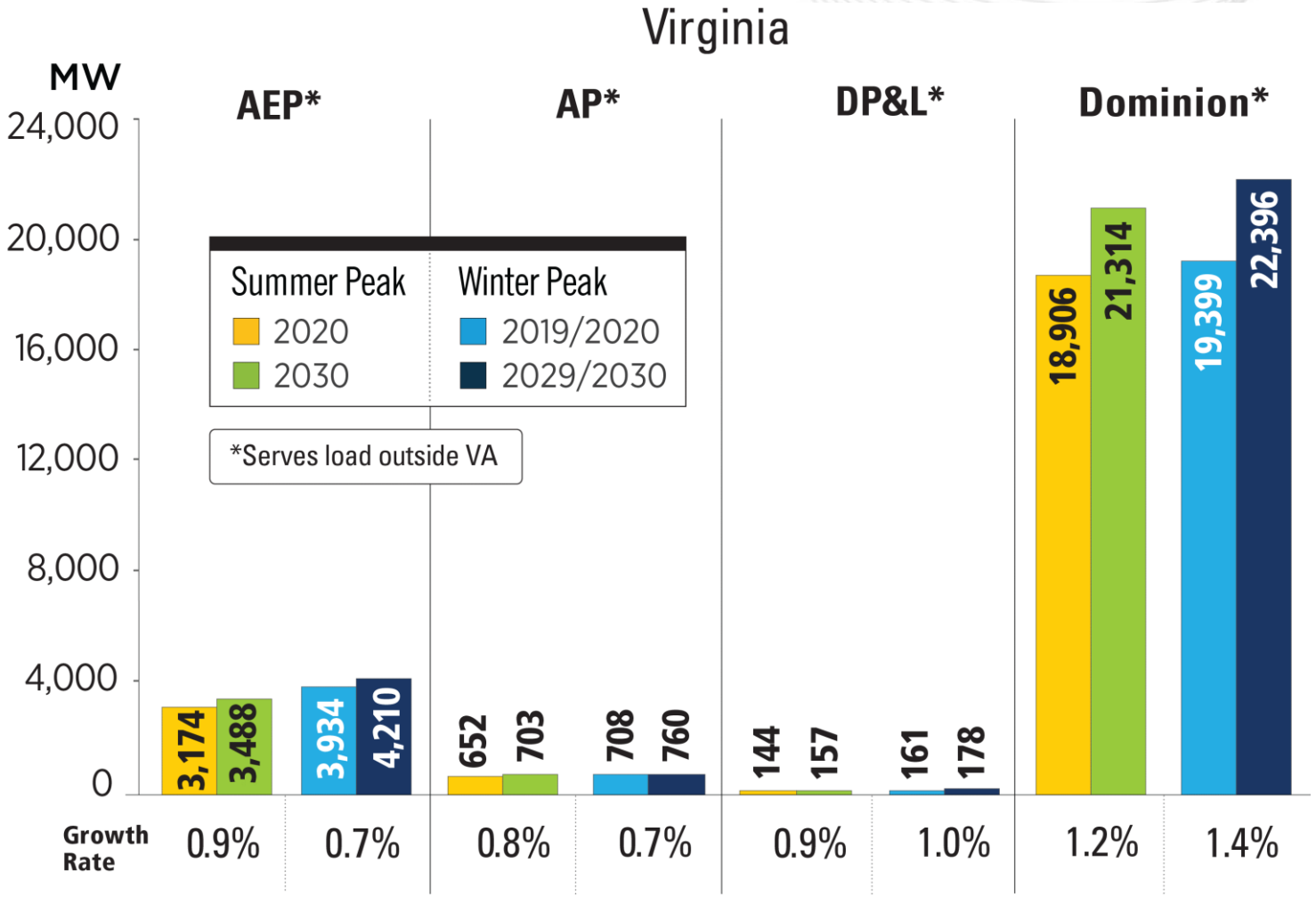
Planning
Load Forecast

PJM Annual Load Forecasts

(Jan. 2020)



Virginia – 2020 Load Forecast Report



PJM RTO Summer Peak

2020	2030
148,092 MW	157,132 MW

Growth Rate 0.6%

PJM RTO Winter Peak

2019/2020	2029/2030
131,287 MW	139,970 MW

Growth Rate 0.6%

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. 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.

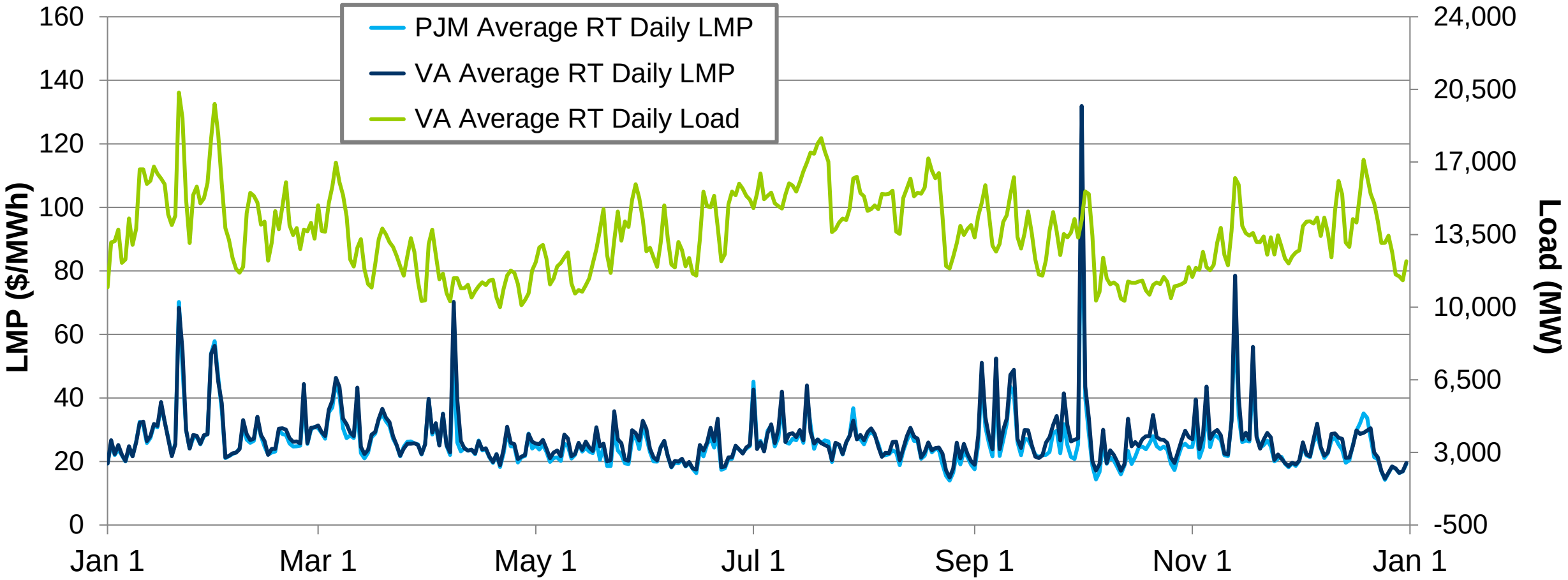
The Load Forecast was produced prior to COVID-19 and will be updated before the next Base Residual Auction to reflect changes in load patterns.

Markets

Market Analysis

Virginia – Average Daily Load and LMP

(Jan. 1, 2019 – Dec. 31, 2019)

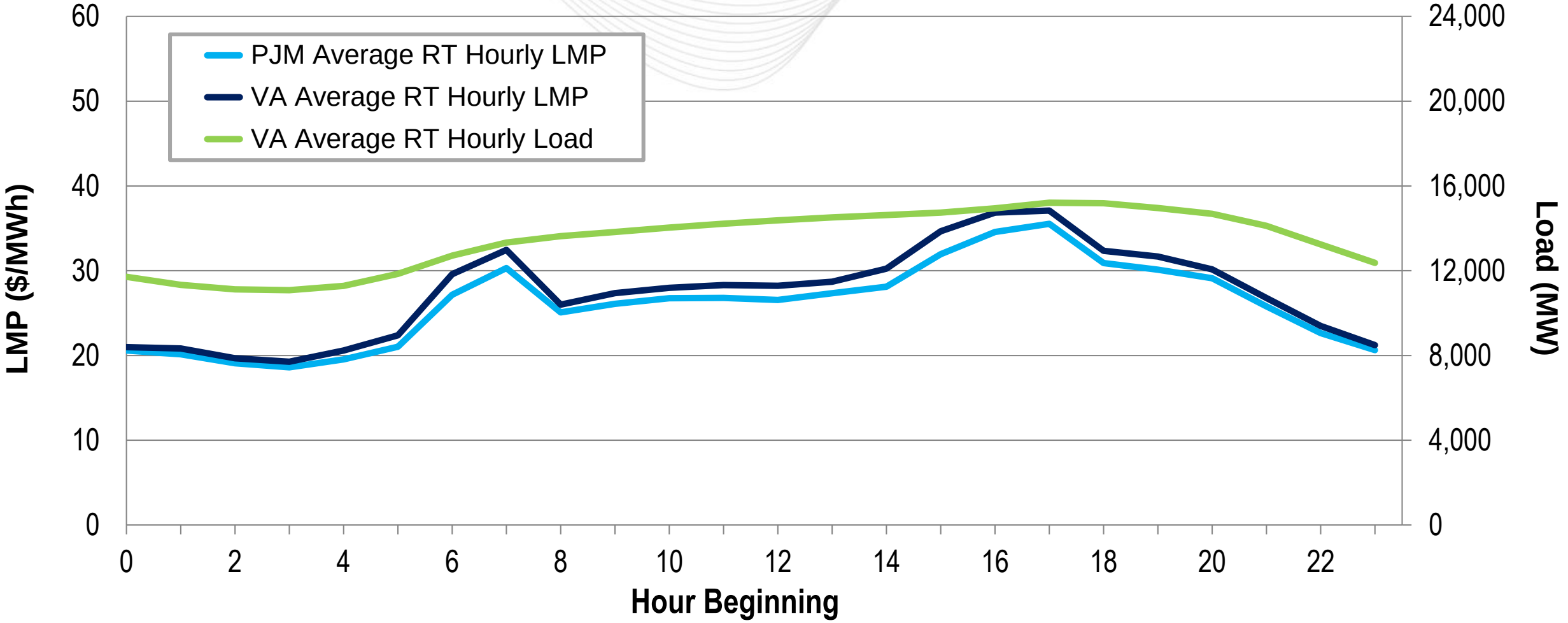


Note: The price spike in October reflects the Performance Assessment Interval event that occurred on October 2nd.

Virginia – Average Hourly Load and LMP

(Jan. 1, 2019 – Dec. 31, 2019)

Virginia's average hourly LMPs were slightly higher than the PJM average hourly LMP.



Virginia – Net Energy Import/Export Trend

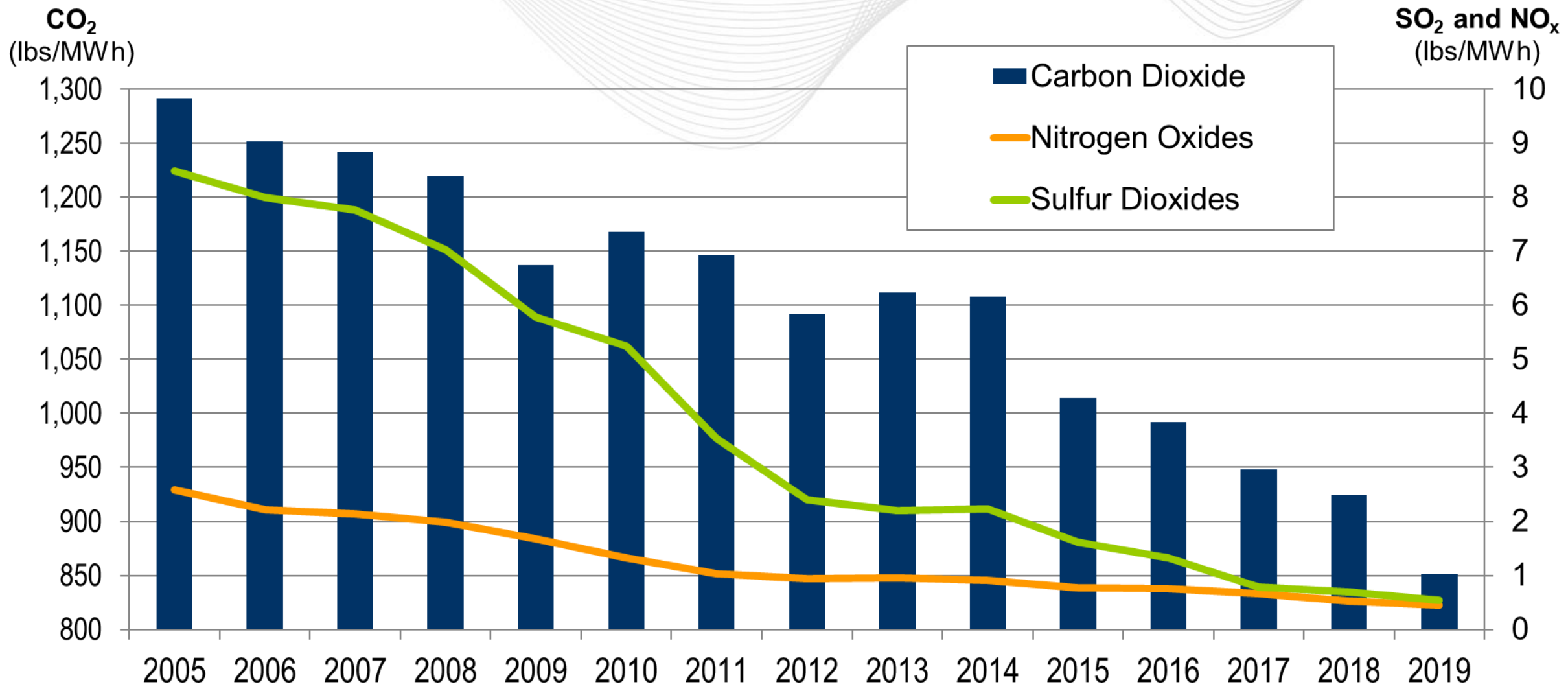
(May 2019 – April 2020)

This chart reflects the portion of Virginia that PJM operates. Positive values represent exports and negative values represent imports.

Note – A significant amount of generation from units owned by Virginia jurisdictional utilities and included in regulated rates charged to Virginia customers are physically located outside of Virginia. They are categorized as imports in the chart.

Operations
Emissions Data

2005 – 2019 PJM Average Emissions



Virginia – Average Emissions (lbs/MWh)

(February 7, 2020)