



Ohio State Report

July 2017



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- **Existing Capacity:** Natural gas represents approximately 34 percent of the total installed capacity in Ohio while coal represents approximately 56 percent. This differs from PJM where natural gas and coal are relatively even at 35 and 34 percent respectively.
- **Interconnection Requests:** Natural gas represents approximately 86 percent of new interconnection requests in Ohio.
- **Deactivations:** Approximately 94.6 MW of capacity in Ohio retired in 2016. This represents more than 24 percent of the 392 MW that retired RTO-wide in 2016.
- **RTEP 2016:** Ohio RTEP 2016 projects total more than \$160 million in investment. Approximately 44 percent of that represents supplemental projects.
- **Load Forecast:** Ohio 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, Ohio's distribution of generation, demand response and energy efficiency is similar.
- **6/1/14 – 5/31/17 Performance:** Ohio's average daily locational marginal prices were consistently at or below PJM average daily LMPs. Coal resources represented 44 percent of generation produced in Ohio while imports averaged 25 percent.
- **Emissions:** 2016 carbon dioxide emissions are slightly up from 2015; sulfur dioxides are slightly down while nitrogen oxides continue to hold flat from 2015.



PJM Service Area - Ohio



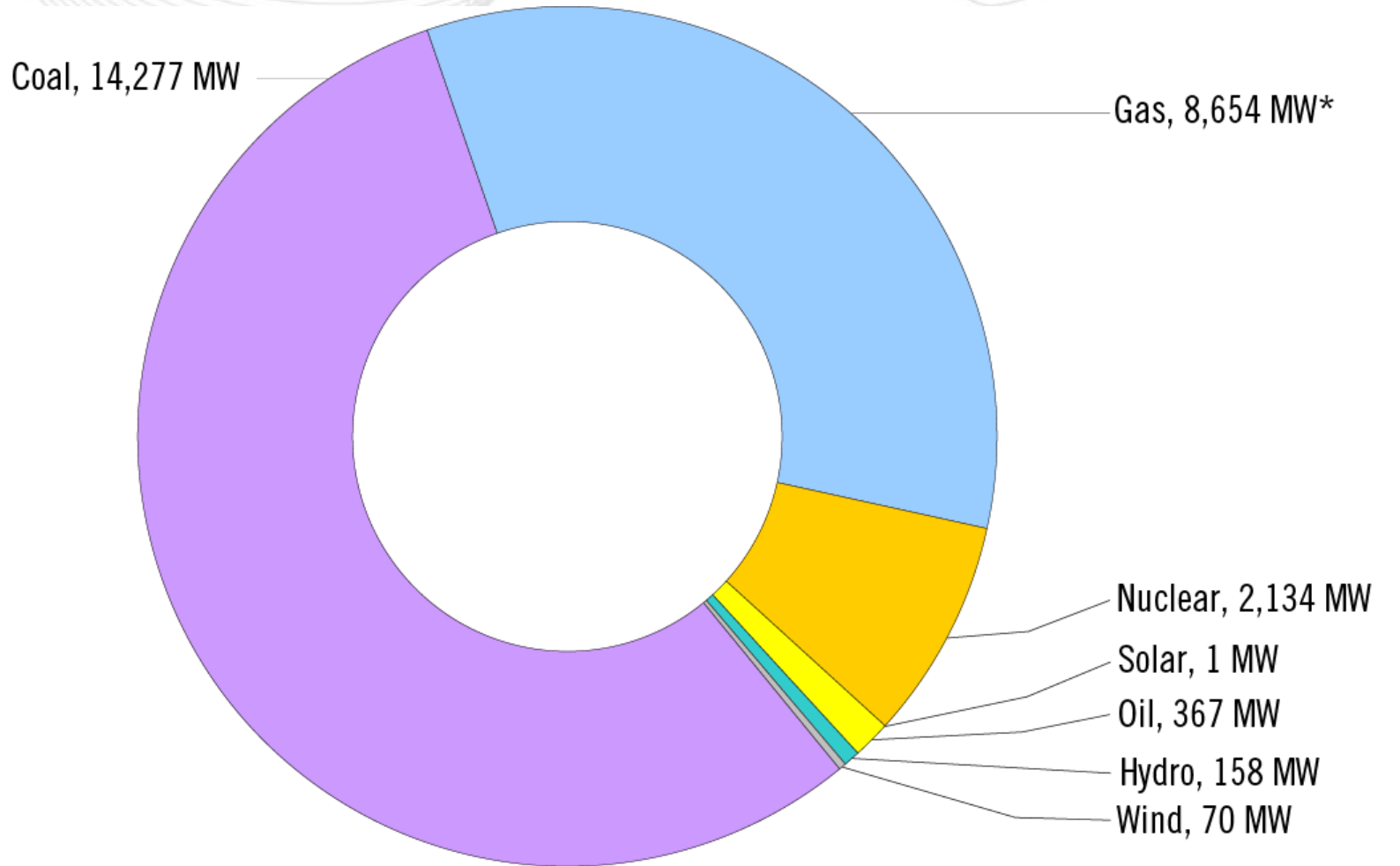
Planning

Generation Portfolio Analysis

Summary:

Natural gas represents approximately 34 percent of the total installed capacity in the Ohio territory while coal represents approximately 56 percent.

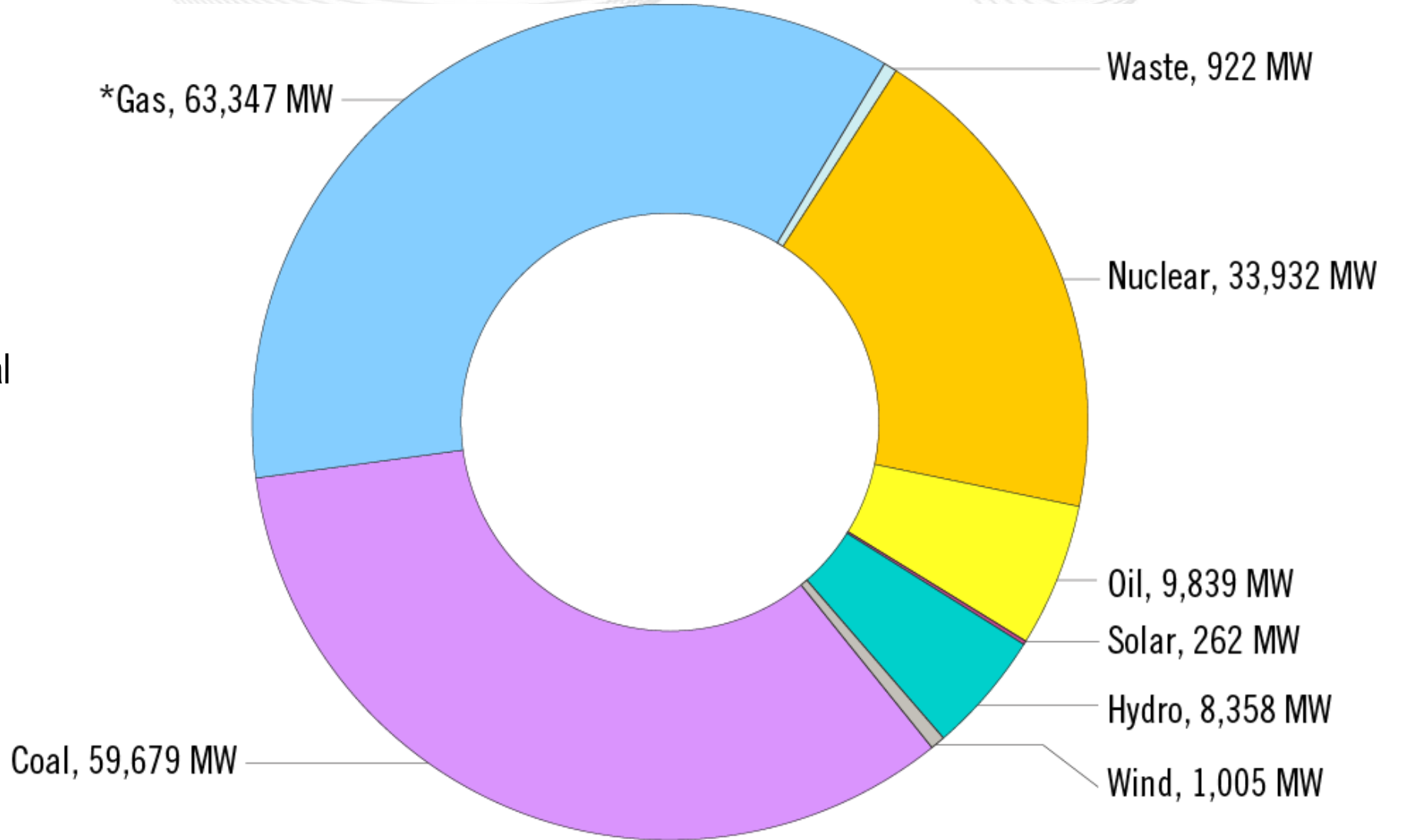
Overall in PJM, natural gas and coal are relatively even at 35 percent and 34 percent respectively.



* Gas Contains	
Natural Gas	8,601 MW
Other Gas	53 MW

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



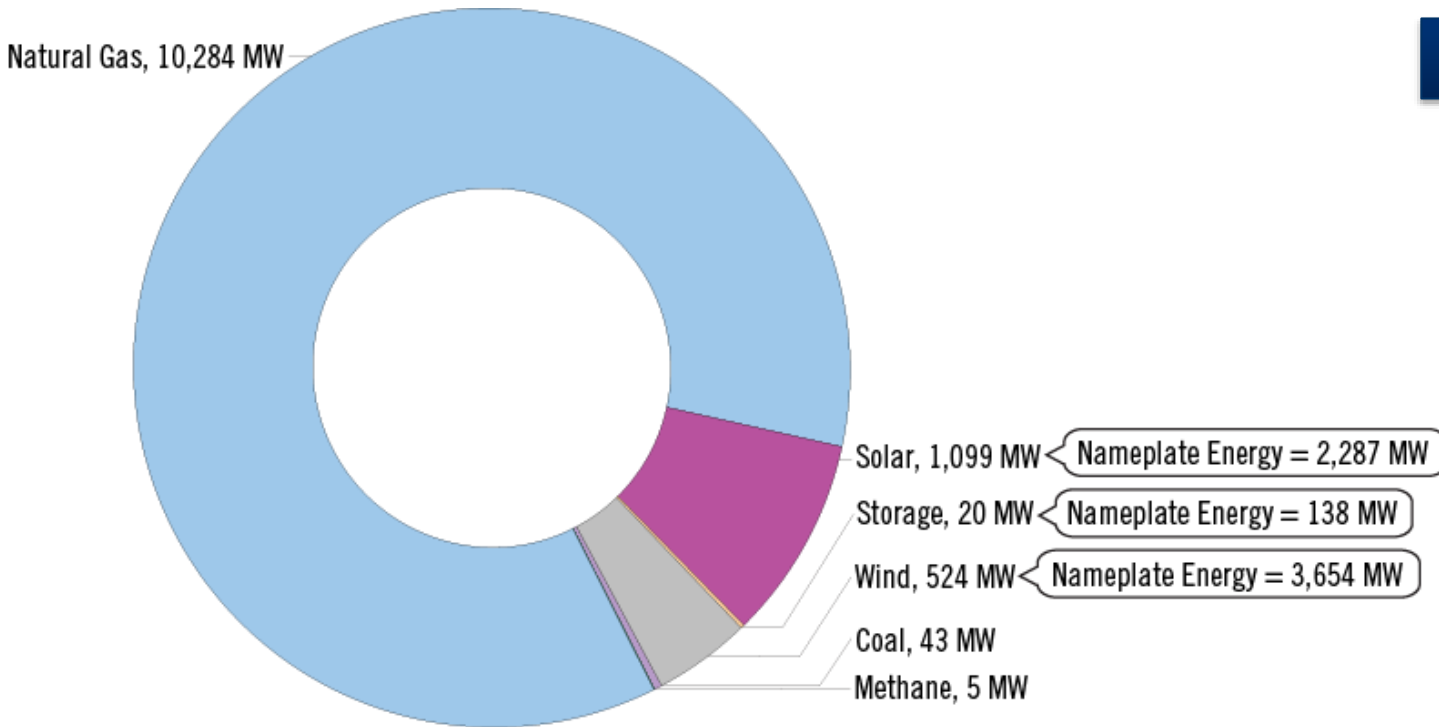
Ohio – Interconnection Requests

(Requested Capacity Rights, December 31, 2016)

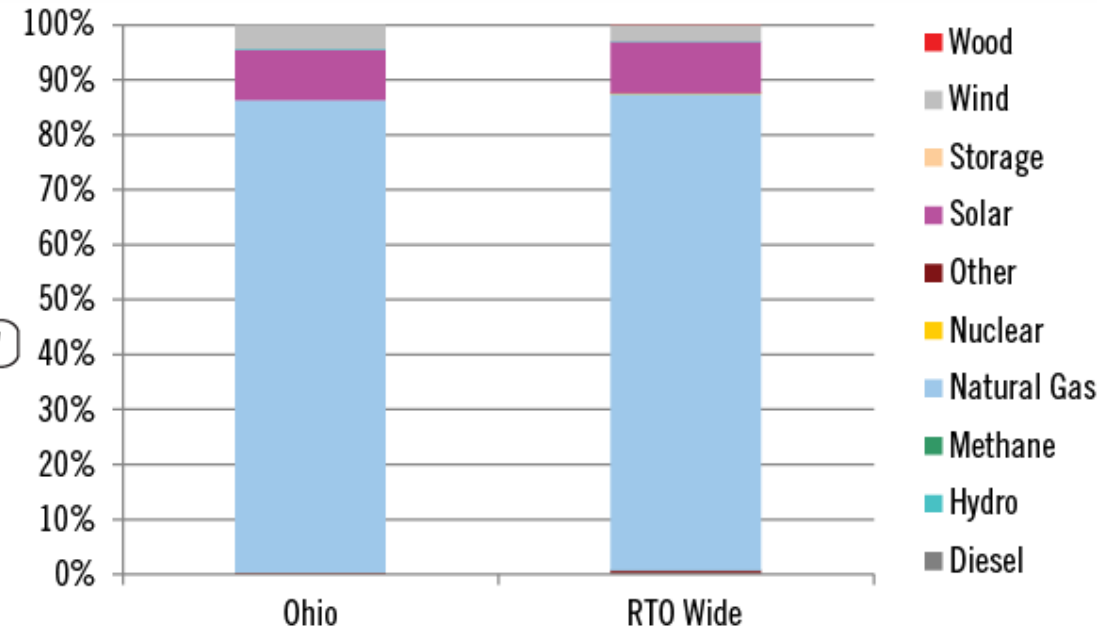
Natural gas represents approximately 86 percent of new interconnection requests in Ohio.

	MW	# of projects
Active	8,675	54
Under Construction	2,981	23
Suspended	319	14
Total	11,975	91

Total MW Capacity by Fuel Type



Fuel as a Percentage of Projects in Queue





Ohio – Interconnection Requests

	Executed final agreement (ISA/WMPA)						May have executed final agreement		Total Sum			
	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			0.0	1					0.0	1	0.0	2
Coal	31.0	2	288.5	16			12.0	1	8,883.0	15	9,214.5	34
Diesel			7.0	1							7.0	1
Hydro			112.0	1					76.2	8	188.2	9
Methane			46.1	8	0.0	1	4.8	2	23.1	7	74.0	18
Natural Gas	7,439.4	14	794.5	12			2,845.0	7	7,584.4	24	18,663.3	57
Nuclear			16.0	1							16.0	1
Oil									5.0	1	5.0	1
Solar	1,056.7	24	1.0	1	26.6	4	15.5	3	679.4	37	1,779.2	69
Storage	19.9	5	0.0	7			0.0	4	0.0	10	19.9	26
Other									320.0	4	320.0	4
Wind	128.1	9	100.0	2	292.2	9	103.9	6	1,248.3	53	1,872.6	79
Total	8,675.1	54	1,365.0	50	318.8	14	2,981.2	23	18,819.5	160	32,159.7	301

All MWs that enter the queue and either went into service, near operation or withdrew. (18,688MW)



Following Final Agreement execution 3,072 MW of capacity withdrew from PJM's interconnection process. Another 3,270 MW have executed agreements but were not in service as of December 31, 2015 (*Suspended or Under Construction*). Overall, 6% of requested capacity in Ohio reaches commercial operation. The PJM average over this time is 10%

Unit	MW Capacity	TO Zone	Age	Actual Deactivation Date
Avon Lake 7	94.6	ATSI	66	4/16/2016

Summary:

- One unit in Ohio deactivated in 2016.
- 11 generating units totaling 392 MW of capacity deactivated in PJM in 2016.



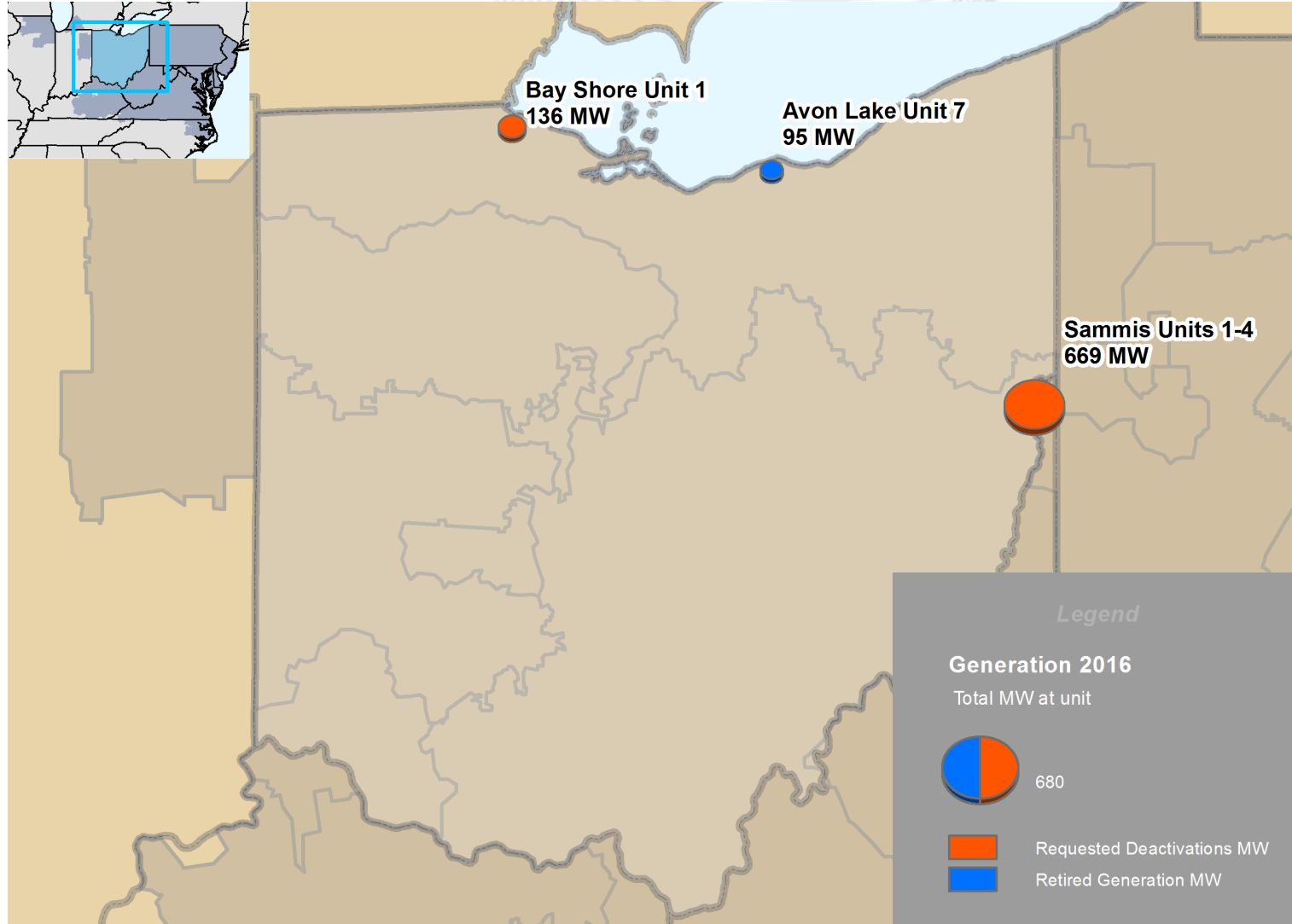
Ohio – Deactivation Notifications Received in 2016

Unit	MW Capacity	TO Zone	Age	Projected Deactivation Date
Bay Shore 1	136	ATSI	61	10/1/2020
W H Sammis 1	160	ATSI	57	5/31/2020
W H Sammis 2	160	ATSI	56	5/31/2020
W H Sammis 3	176	ATSI	55	5/31/2020
W H Sammis 4	172.6	ATSI	53	5/31/2020

Summary:

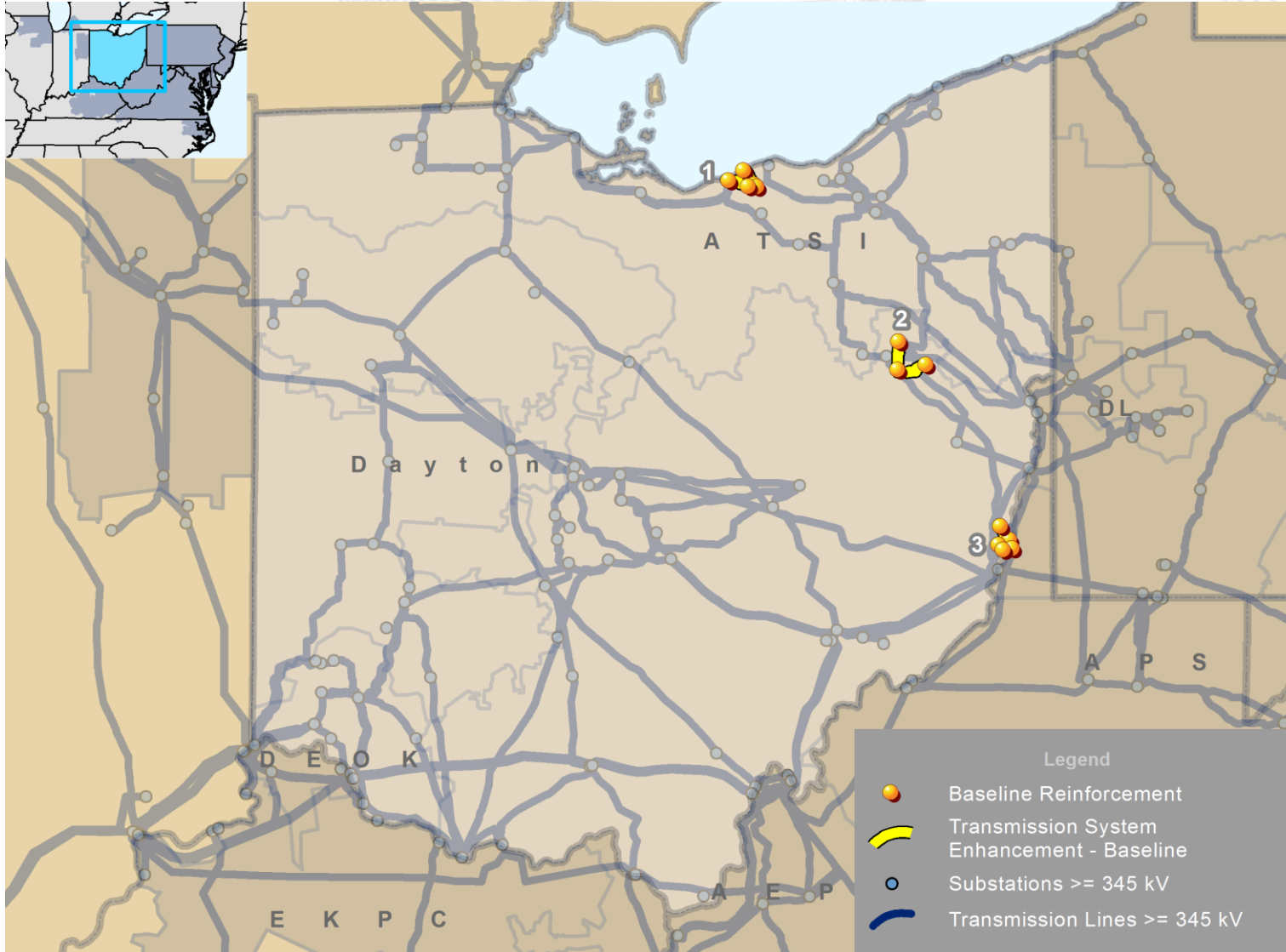
- In 2016 five generating units in Ohio announced their intention to deactivate, all in 2020.
- In 2016 there were a total of 23 PJM generating units that announced their intent to deactivate, ranging in date from 2016 - 2020.

Ohio – Actual Generation Deactivations and Deactivation Notifications Received in 2016



Planning

Transmission Infrastructure Analysis





Ohio - RTEP Baseline Projects

(Greater than \$5 million)

Ohio 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	b2725	Build new 345/138 kV Lake Avenue substation w/breaker and a half high side (2 strings), 2-345/138 kV transformers and breaker and a half (2 strings) low side (138 kV). Substation will tie Avon - Beaver 345 kV #1 / #2 and Black River - Johnson #1 / #2 lines				●		4/16/2016	\$40.00	ATSI	1/7/2016

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



Ohio - RTEP Baseline Projects

(Greater than \$5 million)

Ohio 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	b2725.1	Replace the Murray 138 kV breaker '453-B-4' with 40 kA breaker.				•		4/16/2016	\$0.28	ATSI	1/7/2016
2	b2731	Convert the Sunnyside - East Sparta - Malvern 23 kV sub-transmission network to 69 kV. The lines are already built to 69 kV standards.					•	8/1/2016	\$5.70	AEP	2/4/2016

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

Ohio 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	b2753.1	Replace existing George Washington station 138 kV yard with GIS 138 kV breaker and a half yard in existing station footprint. Install 138 kV revenue metering for new IPP connection.	●					1/1/2019	\$0.00	AEP	12/15/2016

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

Ohio Baseline Project Driver

Map ID	Project ID	Project	Ohio Baseline Project Driver						Required Date	Cost (\$M)	Designated Entity*	2016 TEAC Review
			Baseline Load Growth/ Deliverability & Reliability	Congestion Relief - Economic	Operational Performance	Generator Deactivation	TO Criteria Violation					
3	b2753.2	Replace Dilles Bottom 69/4 kV Distribution station as breaker and a half 138 kV yard design including AEP Distribution facilities but initial configuration will constitute a 3 breaker ring bus.	●					1/1/2019	\$9.00	AEP	12/15/2016	

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



Ohio - RTEP Baseline Projects

(Greater than \$5 million)

Ohio Baseline Project Driver

Map ID	Project ID	Project	Ohio Baseline Project Driver						Required Date	Cost (\$M)	Designated Entity*	2016 TEAC Review
			Baseline Load Growth/ Deliverability & Reliability	Congestion Relief - Economic	Operational Performance	Generator Deactivation	TO Criteria Violation					
3	b2753.3	Connect two 138 kV 6-wired circuits from "Point A" (currently de-energized and owned by First Energy) in circuit positions previously designated Burger #1 & Burger #2 138 kV. Install interconnection settlement metering on both circuits exiting Holloway St	•						1/1/2019	\$2.00	AEP	12/15/2016



Ohio - RTEP Baseline Projects

(Greater than \$5 million)

Ohio 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	b2753.4	Double capacity for 6 wire "Burger-Cloverdale No. 2" 138 kV line and connect at Holloway and "Point A"	•					1/1/2019	\$0.25	ATSI	12/15/2016

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

Ohio 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	b2753.5	Double capacity for 6 wire "Burger-Longview" 138 kv line and connect at Holloway and "Point A"	•					1/1/2019	\$0.25	ATSI	12/15/2016

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



Ohio - RTEP Baseline Projects

(Greater than \$5 million)

Ohio 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	b2753.6	Build double circuit 138 kV line from Dilles Bottom to "Point A". Tie each new AEP circuit in with a 6 wired line at Point A. This will create a Dilles Bottom - Holloway 138 kV circuit and a George Washington - Holloway 138 kV circuit.	•					1/1/2019	\$5.00	AEP	12/15/2016

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

Ohio 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	b2753.7	Retire line sections (Dilles Bottom - Bellaire and Moundsville - Dilles Bottom 69 kV lines) south of First Energy 138 kV line corridor, near "Point A". Tie George Washington - Moundsville 69 kV circuit to George Washington - West Bellaire 69 kV circuit.	●					1/1/2019	\$4.96	AEP	12/15/2016

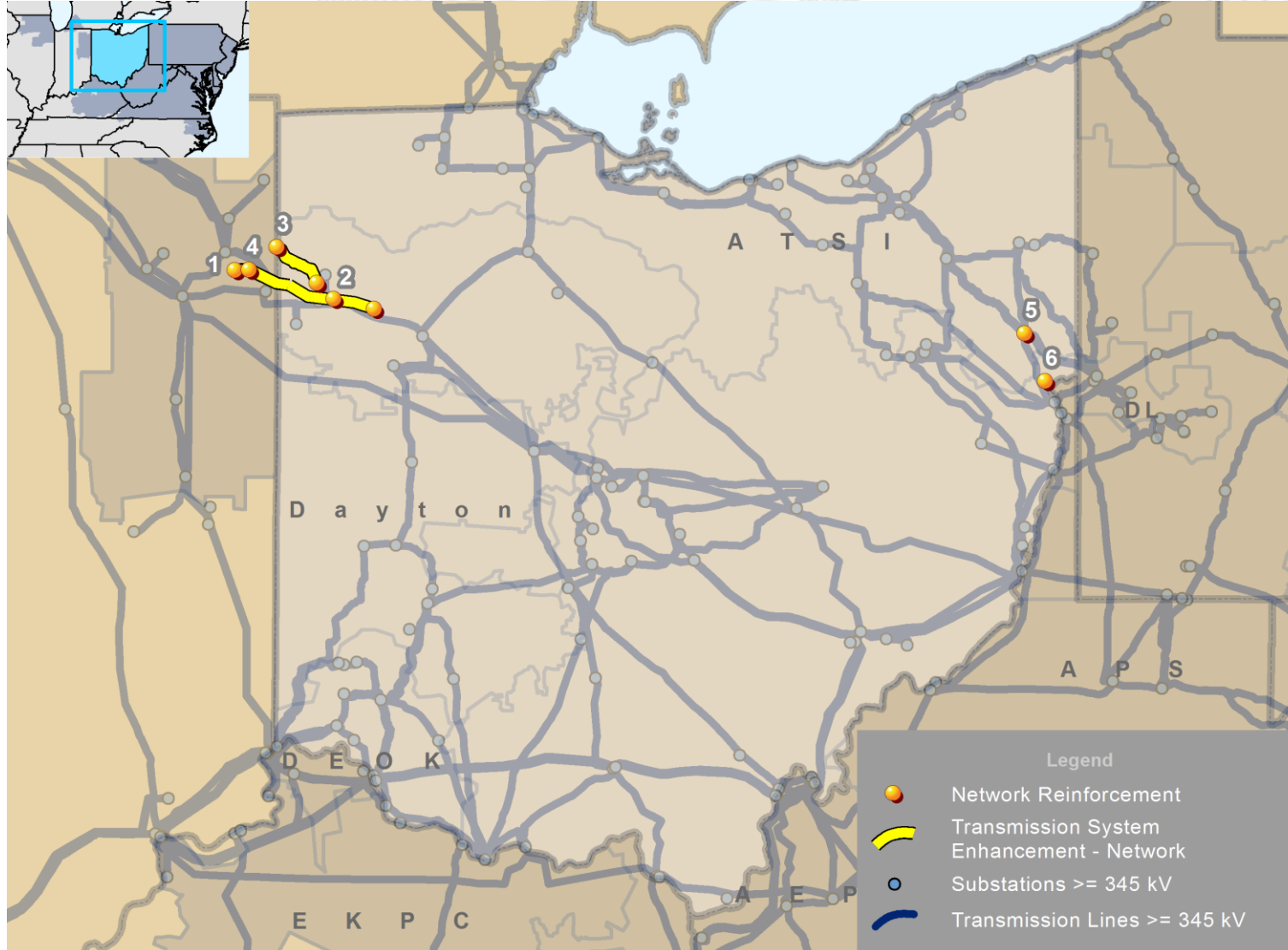
Note: Baseline upgrades are those that resolve a system reliability criteria violation.

Ohio 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	b2753.8	Rebuild existing 69 kV line as double circuit from George Washington - Dilles Bottom 138 kV. One circuit will cut into Dilles Bottom 138 kV initially and the other will go past with future plans to cut in.	●					1/1/2019	\$3.56	AEP	12/15/2016

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

Ohio – RTEP Network Projects (Greater than \$5 million)





Ohio - RTEP Network Projects

(Greater than \$5 million)

Ohio Network Project Drivers

Map ID	Project ID	Project	Ohio Network Project Drivers			Required Date	Cost (\$M)	TO Zone(s)	2016 TEAC Review
			Generation Interconnection	Merchant Transmission Interconnection	Long-term Firm Transmission Service				
1	n1467	Rebuild the circuit between Lincoln and Anthony Substations i.e. 17 miles of 138 kV circuit	T131			10/30/2010	\$26.00	AEP	10/6/2016
2	n1493	Lincoln - Sterling - Construct a 3 breaker 138kV ring bus interconnection substation in the circuit between Project S73 and North Delphos	T131			10/31/2010	\$5.00	AEP	10/6/2016
3	n1501	Rebuild, reconductor and replace towers in the approx. 8 mile 138 kV circuit between Haviland and Milan Substations	T131			10/31/2010	\$12.00	AEP	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.

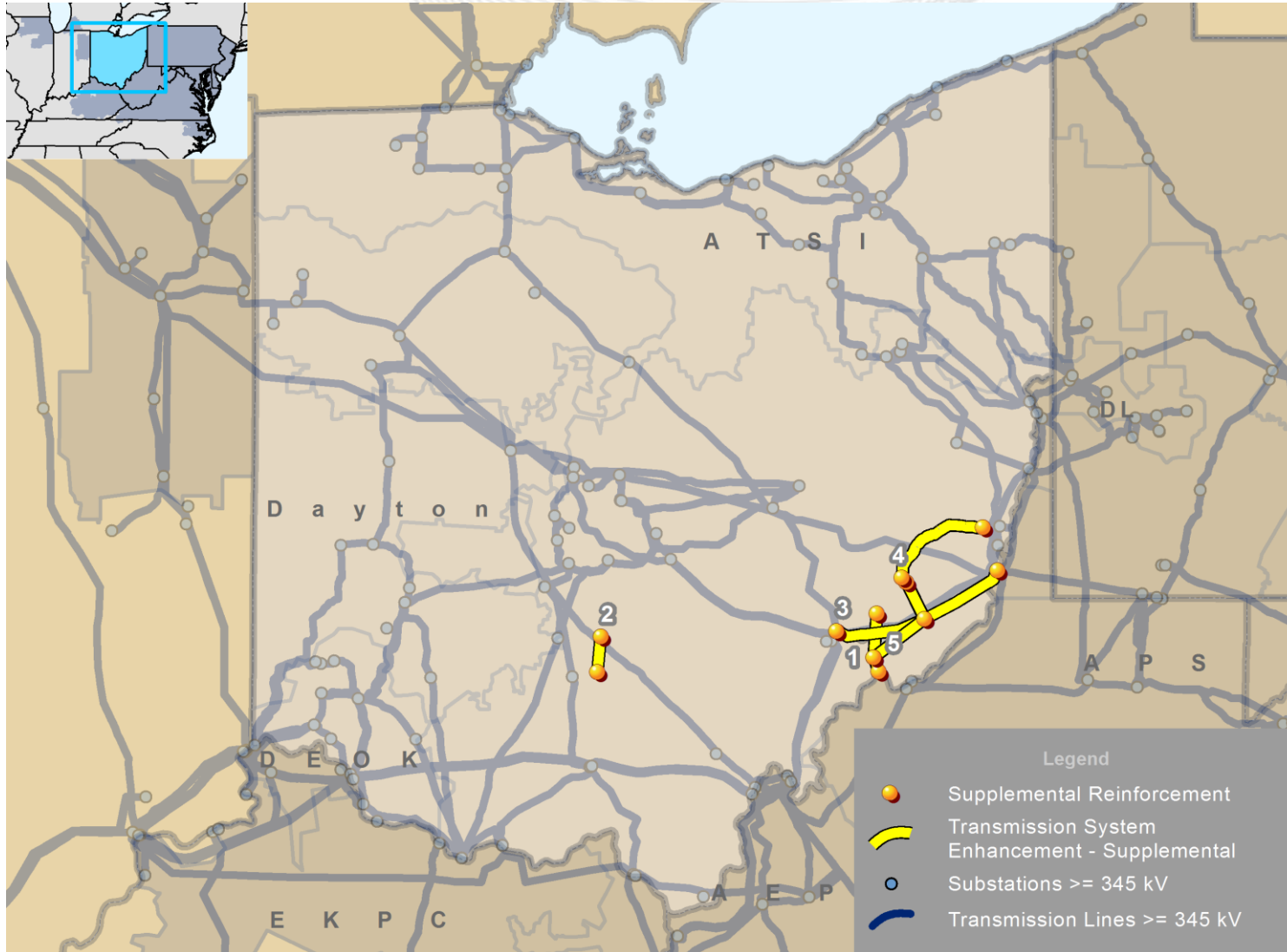


Ohio - RTEP Network Projects

(Greater than \$5 million)

Map ID	Project ID	Project	Ohio Network Project Drivers			Required Date	Cost (\$M)	TO Zone(s)	2016 TEAC Review
			Generation Interconnection	Merchant Transmission Interconnection	Long-term Firm Transmission Service				
4	n1504	Rebuild, reconductor and replace towers of approx. 17 mile 138 kV circuit between Lincoln and North Delphos Substations	T131			10/31/2010	\$26.00	AEP	10/6/2016
5	n4387	Build new 345 kV five-breaker ring bus substation to interconnect project Z2-028	Z2-028			4/1/2017	\$11.91	ATSI	10/6/2016
6	n4694	Build new 345kV, 3-breaker ring bus for the AA1-123 project.	AA1-123			12/1/2019	\$8.36	ATSI	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.





Ohio - TO Supplemental Projects

(Greater than \$5 million)

Map ID	Project ID	Project	Required Date	Cost (\$M)	TO Zone(s)	2016 TEAC Review
1	s1125	Construct a new 138 kV transmission network to support the retirement of AEP Ohio's deteriorated 23 kV distribution system in Washington County. Marietta North will build new 138 kV between South Caldwell and Devola stations	6/1/2021	\$103.30	AEP	2/4/2016
2	s1131	Tap the existing AEP Delano - Scioto Trail 138 kV circuit, build a 138 kV ring bus station called Tuscany Station, and provide dual feeds to the customer	8/1/2017	\$10.04	AEP	2/4/2016
3	s1134	Construct a new 345-138 kV substation "Lamping" connected to AEP's Kammer - Muskingum 345 kV circuit. Build a new 10 mile 138 kV circuit from Lamping to Blue Racer substation	6/1/2019	\$40.00	AEP	2/4/2016
4	s1158	Rebuild and upgrade approx. 32 miles of 69 kV line from Summerfield station to Glencoe station	6/1/2019	\$37.20	AEP	7/26/2016

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.



Ohio - TO Supplemental Projects

(Greater than \$5 million)

Map ID	Project ID	Project	Required Date	Cost (\$M)	TO Zone(s)	2016 TEAC Review
5	s1160	Construct a new 345-138 kV substation "Lamping", connected to AEP's Kammer - Muskingum 345 kV circuit. Build a new 24 mile 138 kV circuit from Lamping - Devola substation, serving the R.E.C. customer stations along the way	6/1/2022	\$68.00	AEP	7/26/2016

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.

Ohio - Merchant Transmission Project Requests

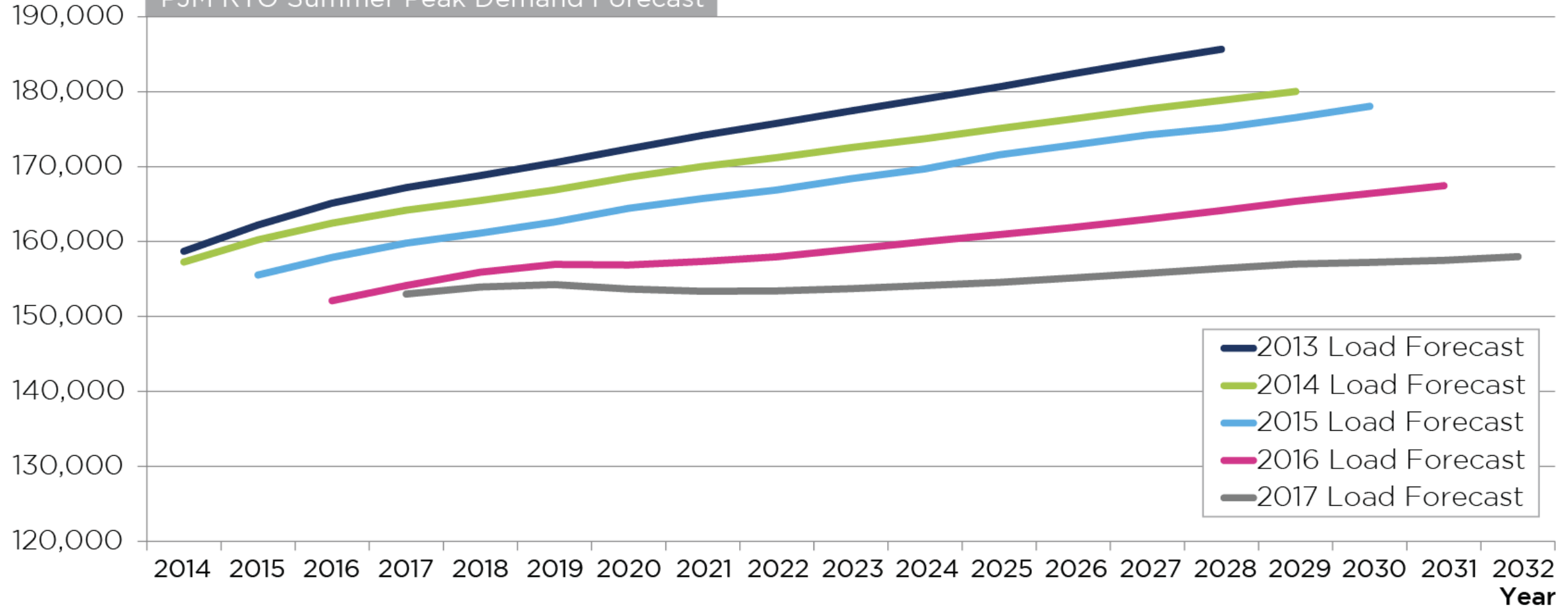


Queue	Project Name	MFO	Status	In Service Date	TO
Y3-064	Pierce-Beckjord 138kV	160	Suspended	04/03/19	DEOK

Planning Load Forecast

Load (MW)

PJM RTO Summer Peak Demand Forecast



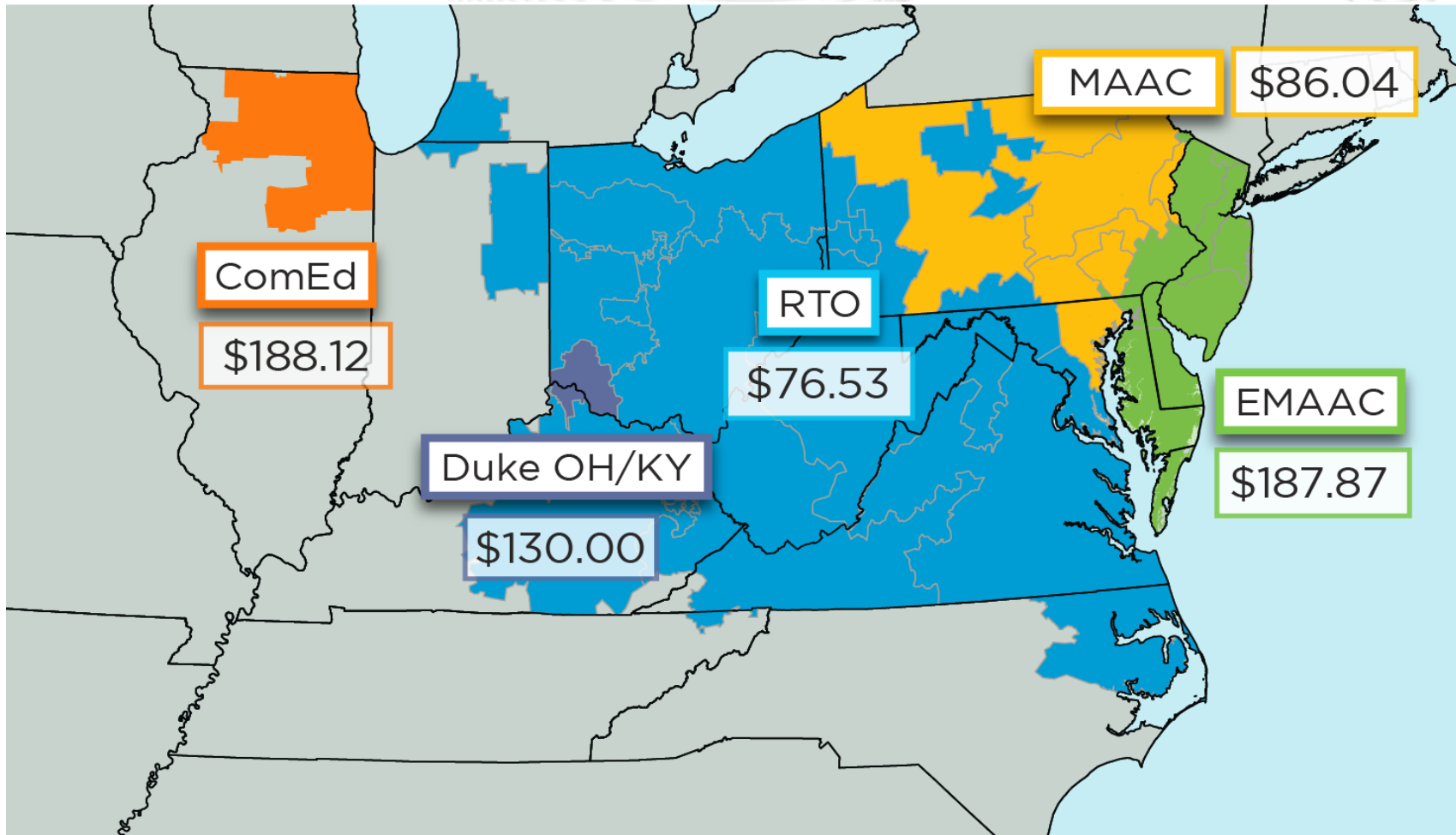
Transmission Owner	Summer Peak (MW)			Winter Peak (MW)		
	2017	2027	Growth Rate (%)	2016/17	2026/27	Growth Rate (%)
American Electric Power Company *	10,534	10,967	0.4%	9,153	9,647	0.5%
American Transmission Systems, Inc. *	12,098	12,268	0.1%	9,795	9,991	0.2%
Dayton Power and Light	3,479	3,503	0.1%	2,934	2,954	0.1%
Duke Energy Ohio and Kentucky *	4,528	4,729	0.4%	3,718	3,879	0.4%
PJM RTO	152,999	155,773	0.2%	131,391	134,915	0.3%

*AEP, ATSI and Duke Energy serve load other than in Ohio. The Summer Peak and Winter Peak MW values in this table each reflect an estimated amount of forecasted load to be served by each of those transmission owners solely in Ohio. Estimated amounts were calculated based on the average share of each transmission owner's real-time summer and winter peak load located in Ohio 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



	Cleared MW (Unforced Capacity)	Change from 2019/20 Auction
Generation	20,023	(3,692)
Demand Response	1,692	(311)
Energy Efficiency	225	102
Total	21,940	(3,901)

RTO Locational Clearing Price
\$76.53

Duke Energy Ohio Kentucky Locational Clearing Price
\$130.00

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)



Ohio – Offered and Cleared Resources in 2020/21 Auction

(May 23, 2017)

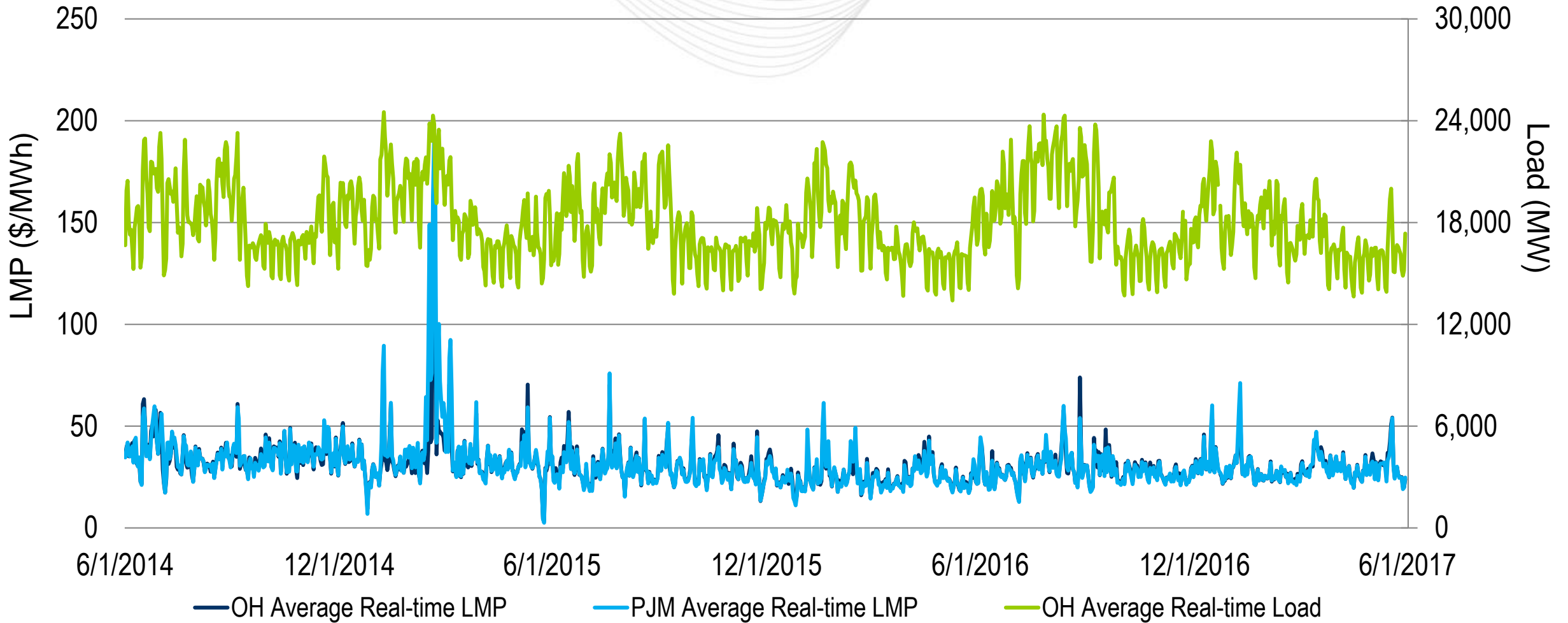
		Unforced Capacity
Generation	Offered MW	22,490
	Cleared MW	20,023
Demand Response	Offered MW	1,874
	Cleared MW	1,692
Energy Efficiency	Offered MW	252
	Cleared MW	225
Total Offered MW		24,616
Total Cleared MW		21,940

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.

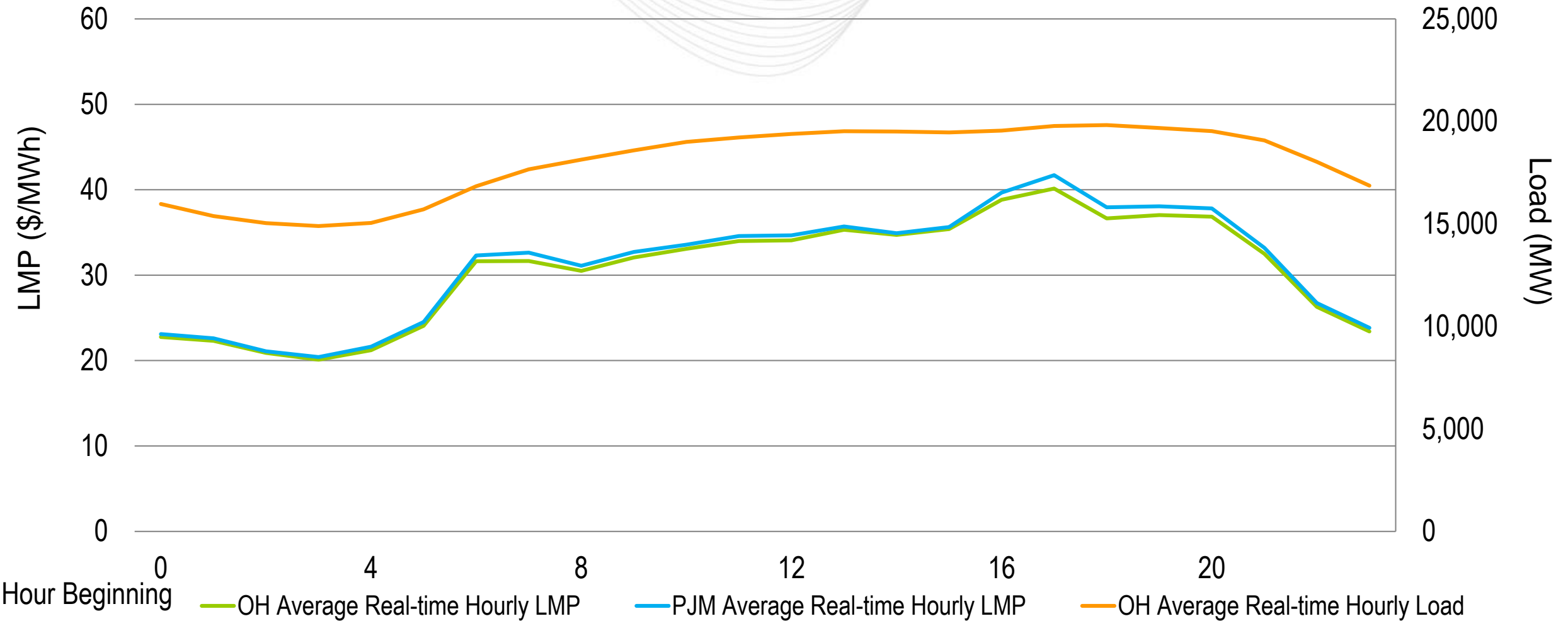
Markets

Market Analysis

Ohio's average daily LMPs generally align with the PJM average daily LMP



Ohio's hourly LMPs generally aligned with the PJM average.



Operations Emissions Data

