



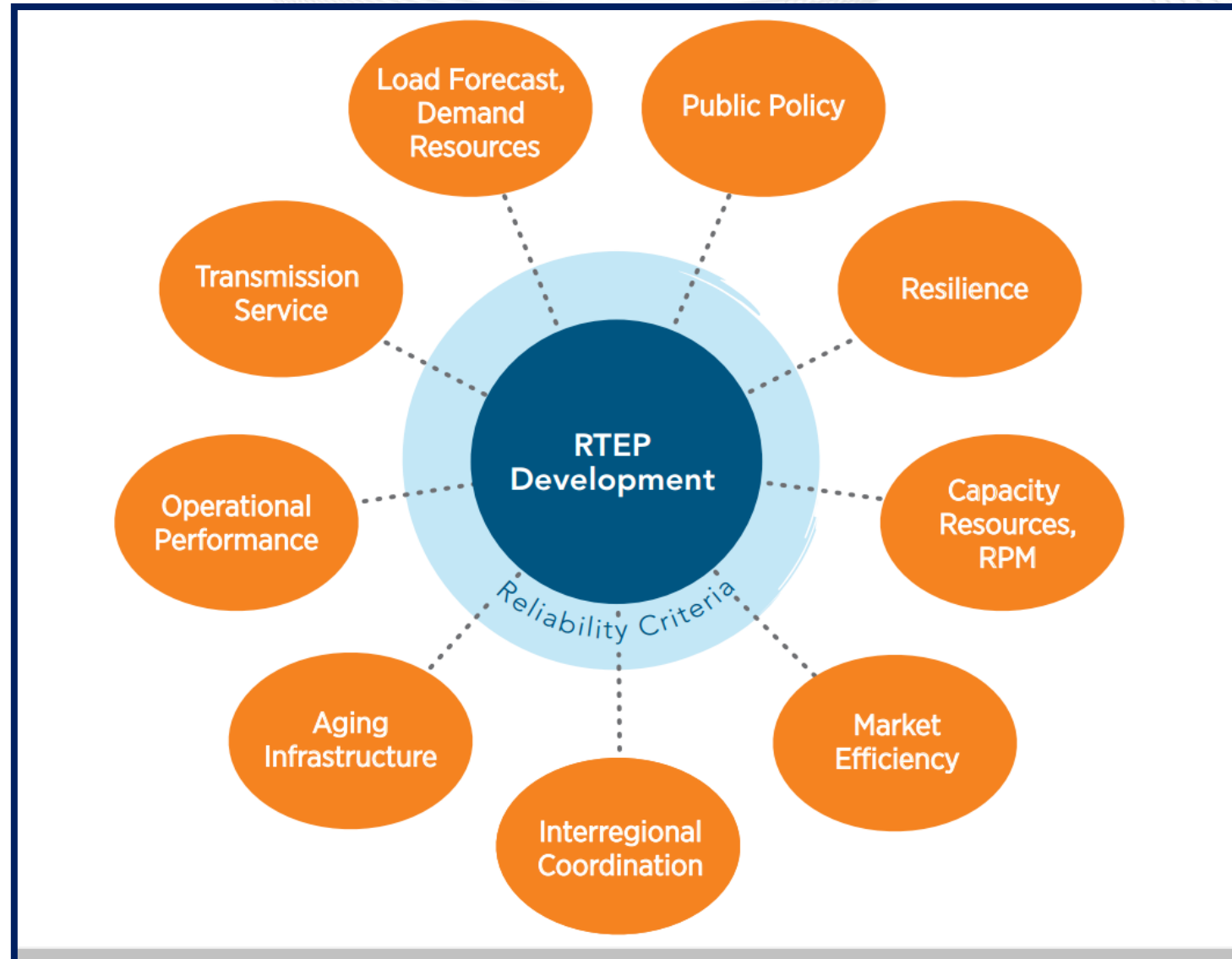
PJM Regional Transmission Expansion Planning (RTEP) Process

IPSAC

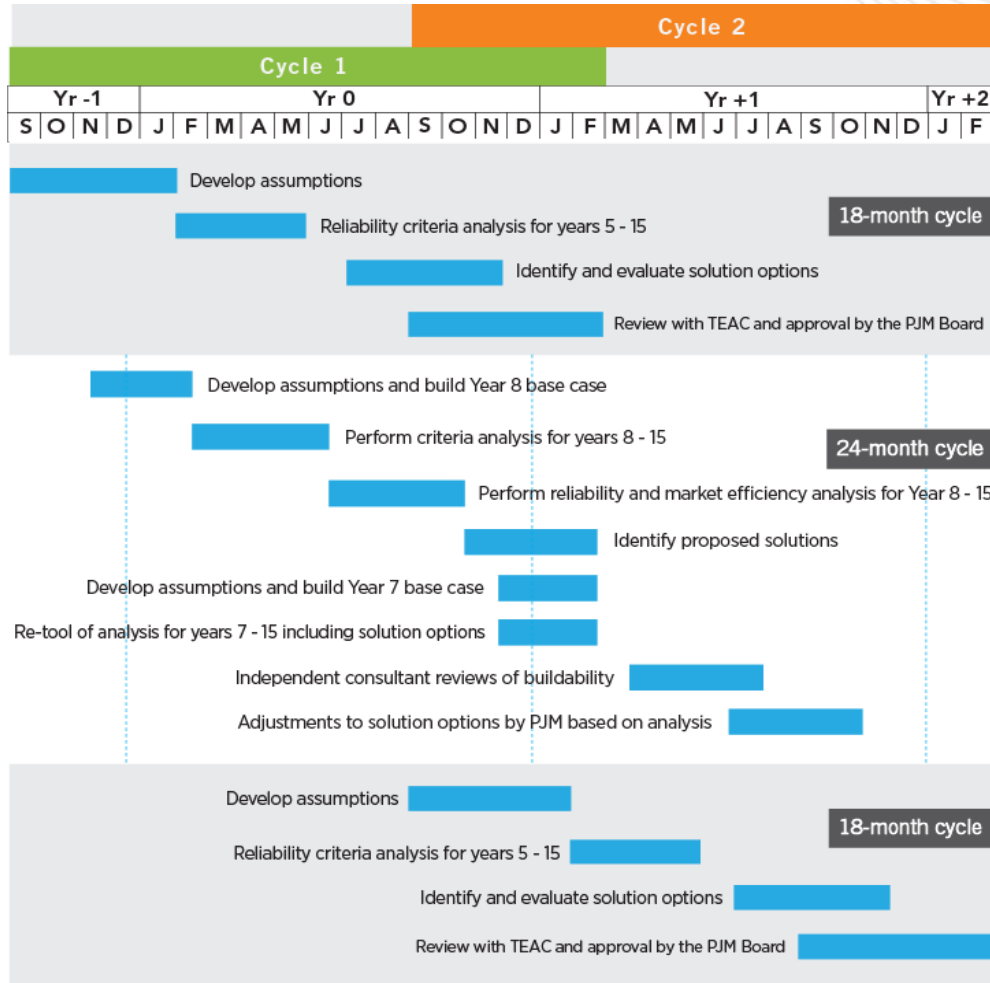
May 13, 2019

- Planning Committee (PC)
 - <http://www.pjm.com/committees-and-groups/committees/pc.aspx>
- Transmission Expansion Advisory Committee (TEAC)
 - <http://www.pjm.com/committees-and-groups/committees/teac.aspx>
- Interregional Planning
 - <http://www.pjm.com/planning/interregional-planning.aspx>
- Services and Requests
 - <http://www.pjm.com/planning/services-requests.aspx>
- RTEP Development
 - <http://www.pjm.com/planning/rtep-development.aspx>
- Manual 14B
 - <http://www.pjm.com/-/media/documents/manuals/m14b.ashx>

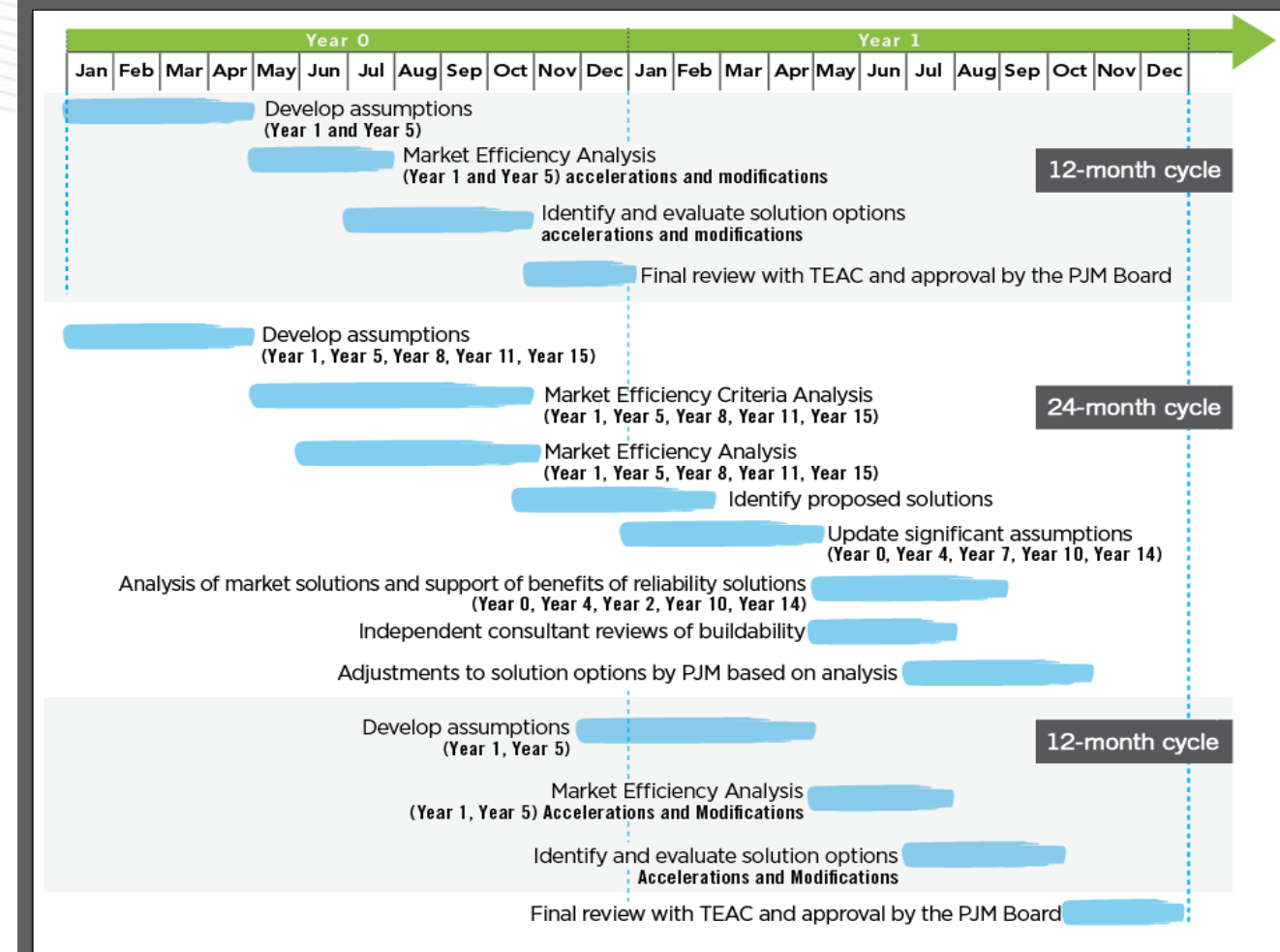
PJM RTEP Planning Cycles



PJM's 2-year Reliability



PJM's 2-year Market Efficiency



PJM 2019 RTEP Assumptions

- Update of standard RTEP assumptions
- 2019 RTEP
 - TPL-001-4
- Modeling
 - MOD-032 (GOs and TOs)
 - <http://pjm.com/planning/rtep-development/powerflow-cases/mod-032.aspx>
 - Siemens PSS®MOD – Model On Demand (TOs)
 - PJM.com Planning Center Online Tool (Gen Model) – GOs
- RTEP Proposal Windows

- **Load Flow Modeling**

- Power flow models for outside world load, capacity, and topology will be based on the following 2018 Series MMWG power flow cases
 - 2018 Series 2023SUM MMWG outside world for
 - 2019 Series 2024SUM RTEP, 2022SUM RTEP
 - 2018 Series 2023SLL MMWG outside world for
 - 2019 Series 2024LL RTEP
 - 2018 Series 2023WIN MMWG outside world for
 - 2019 Series 2024WIN RTEP
- PJM to work with neighbors to identify any updates to topology/corrections
- PJM topology for all cases sourced from Model On Demand
 - Include all PJM Board approved upgrades through the December 2018 PJM Board of Manager approvals as well as all anticipated February 2019 PJM Board approvals
- OVEC will be included as a part of PJM

- Firm Commitments
 - Long term firm transmission service consistent with those coordinated between PJM and other Planning Coordinators during the 2018 Series MMWG development
- Outage Rates
 - Generation outage rates will be based on the most recent Reserve Requirement Study (RRS) performed by PJM
 - Generation outage rates for future PJM units will be estimated based on class average rates

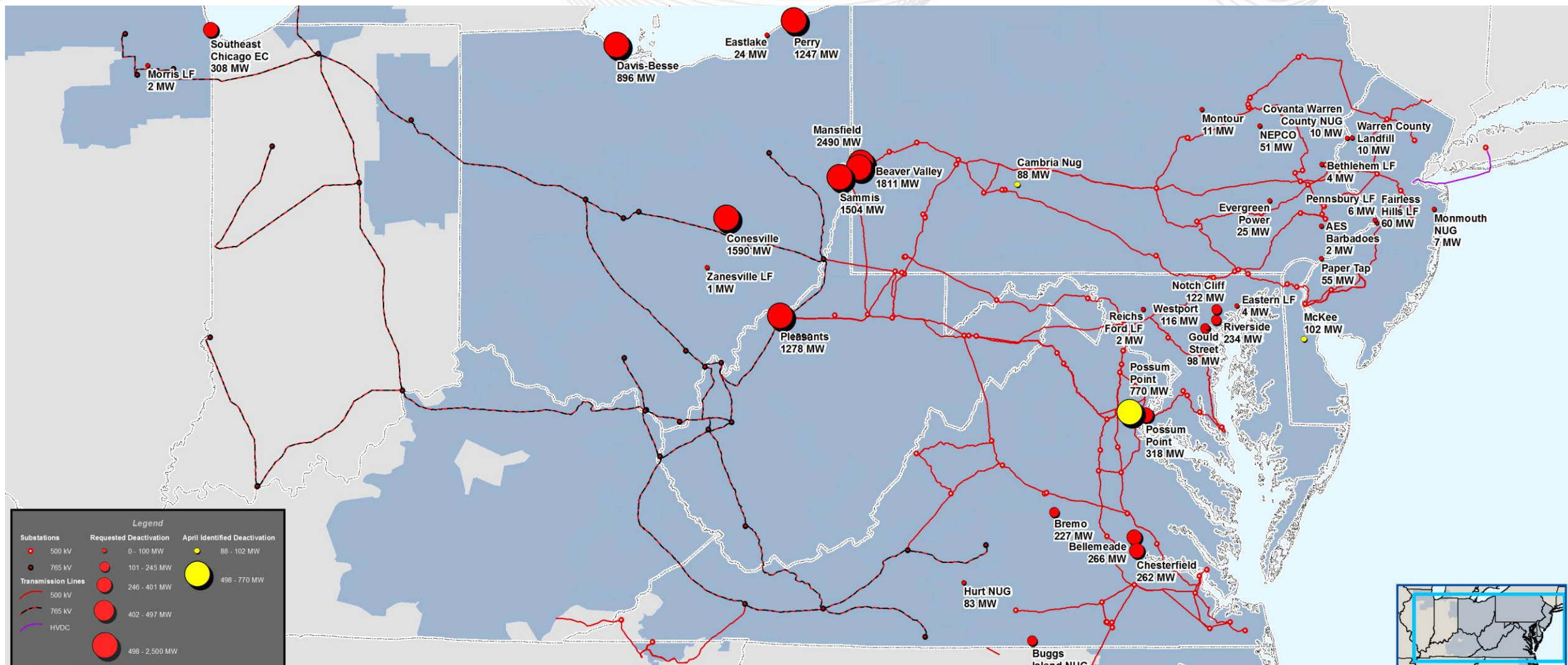
- Summer Peak Load
 - Summer Peak Load will be modeled consistent with the 2019 PJM Load Forecast Report
 - The final load forecast released in December 2018
- Winter Peak Load
 - Winter Peak Load will be modeled consistent with the 2019 PJM Load Forecast Report
- Light Load
 - Modeled at 50% of the Peak Load forecast per M14B
 - The Light Load Reliability Criteria case will be modeled consistent with the procedure defined in M14B
- Load Management, where applicable, will be modeled consistent with the 2019 Load Forecast Report
 - Used in LDA under study in load deliverability analysis
 - Include Demand Response (DR) based on what cleared in the 2021/22 BRA

- At a minimum, all PJM bulk electric system facilities, all tie lines to neighboring systems and all lower voltage facilities operated by PJM will be monitored.
- At a minimum, contingency analysis will include all bulk electric system facilities, all tie lines to neighboring systems and all lower voltage facilities operated by PJM.
- Thermal and voltage limits will be consistent with those used in operations.

- PJM/NYISO Interface
 - B & C cables will be modeled out of service consistent with NYISO modeling
- Linden VFT
 - Withdrawal : Modeled at 330 MW Non-Firm Transmission Withdrawal Rights & Modeled 330 MW Long-Term Firm Transmission Service (PJM-NYISO)
 - Injection : Modeled at 315 MW Capacity Transmission Injection Rights
- HTP
 - Modeled at 673 MW Non-Firm Transmission Withdrawal Rights

- Similar to the 2018 RTEP and per the PJM Operating Agreement, a proposal window will be conducted for all reliability needs that are not Immediate Need reliability upgrades or are otherwise ineligible to go through the window process.
- FERC Order 1000 implementation will be similar to the 2018 RTEP
 - Advance notice and posting of potential violations
 - Advance notice of window openings
 - Window administration

Generation Deactivation Notification Update (as of April 1, 2019)



Unit(s)	Transmission Zone	Requested Deactivation Date	PJM Reliability Status
Possum Point 3&4 (317.7 MW)	Dominion	Deactivated on 12/13/2018	Reliability analysis complete. No impacts identified.
Chesterfield 3&4 (262.1 MW)	Dominion	Deactivated on 12/13/2018	Reliability analysis complete. New baseline upgrade was issued to resolve the identified issue.
Mansfield 1&2 (1660 MW)	ATSI	Deactivated on 2/5/2019	Reliability analysis complete. New baseline upgrade was issued to resolve the identified issue.
Montour ATG (11.4 MW)	PPL	Deactivated on 2/19/2019	Reliability analysis complete. No impacts identified.
Riverside 7 (20 MW)	BGE	Deactivated on 3/14/2019	Reliability analysis complete. No impacts identified.

Unit(s)	Transmission Zone	Requested Deactivation Date	PJM Reliability Status
Warren County NUG (10 MW)	JCPL	6/1/2019	Reliability analysis complete. No impacts identified.
Fairless Hills Landfill A&B (60 MW)	PECO	6/1/2020	Reliability analysis complete. New baseline upgrade was issued to resolve the identified issue.
Notch Cliff GT1–GT8 (128 MW)	BGE	6/1/2020	Reliability analysis complete. No impacts identified
Pennsbury Generator Landfill 1&2 (6 MW)	PECO	6/1/2020	Reliability analysis complete. No impacts identified
Westport 5 (116 MW)	BGE	6/1/2020	Reliability analysis complete. No impacts identified
Conesville 5&6 (810 MW)	AEP	6/1/2019	Reliability analysis complete. No impacts identified

Unit(s)	Transmission Zone	Requested Deactivation Date	PJM Reliability Status
Colver NUG (110 MW)	Penelec	9/1/2020	Reliability analysis complete. New baseline upgrade was issued to resolve the identified issue.
BL England 2 (155 MW)	ACE	4/30/2019	Reliability analysis complete. New baseline upgrade was issued to resolve the identified issue.
Possum Point 5 (770.2 MW)	Dominion	5/31/2021	Reliability analysis complete. No impacts identified
McKee 3 (102 MW)	DPL	6/1/2021	Reliability analysis complete. No impacts identified
Cambria CoGen (88 MW)	Penelec	6/7/2019	Reliability analysis complete. No impacts identified
Hopewell James River Cogeneration (92 MW)	Dominion	5/31/2019	Reliability analysis complete. No impacts identified

Unit(s)	Transmission Zone	Requested Deactivation Date	PJM Reliability Status
Gould Street Generation Station (98 MW)	BGE	6/1/2019	Reliability analysis complete. No impacts identified
Riverside 8 (20 MW)	BGE	12/1/2019	Reliability analysis complete. No impacts identified
Southeast Chicago CT5–CT12 (304 MW)	ComEd	12/1/2019	Reliability analysis complete. No impacts identified
Conesville 4 (780 MW)	AEP	6/1/2020	Reliability analysis complete. New baseline upgrade was issued to resolve the identified issue.
Spruance NUG 1 (116 MW)	Dominion	1/12/2020	Reliability analysis complete. No impacts identified

RTEP Projects Electrically Near the PJM-NYISO Interface as of April 2019



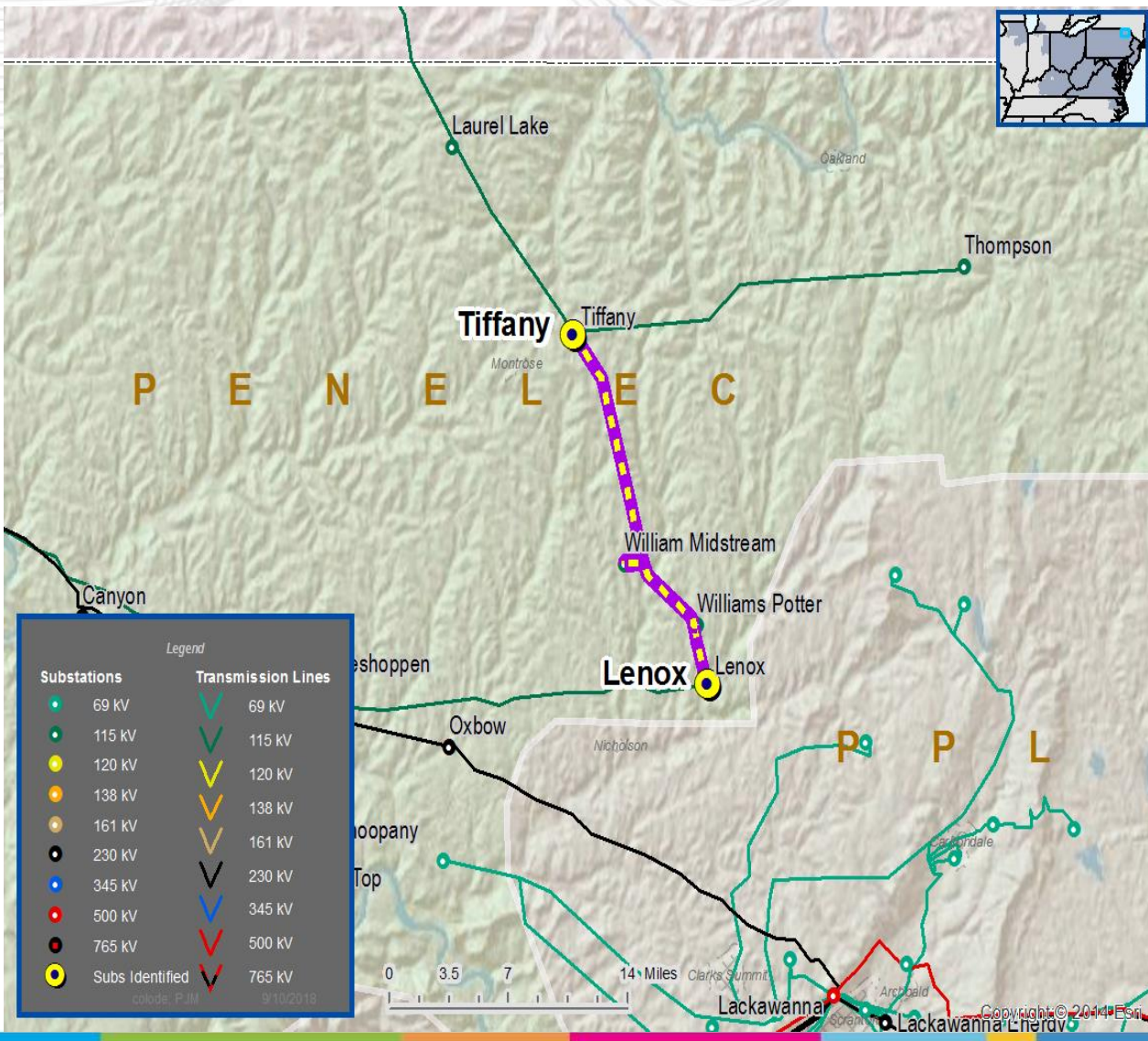
Need Number: PN-2018-010
Process Stage: Local Plan
Need Presented: 9/21/2018
Solution Presented: 10/29/2018

Project Driver(s):
Customer Service

Specific Assumption Reference(s)
New customer connection request will be evaluated per FirstEnergy’s “Requirements for Transmission Connected Facilities” document and “Transmission Planning Criteria” document.

Problem Statement
New Customer Connection – A customer requested 115 kV service for load of approximately 16 MW near the Lenox – Tiffany 115 kV line. Requested in-service date is 7/2019.

Penelec Transmission Zone



Need Number: PN-2018-010

Selected Solution:

Provide 115 kV Service

- Tap the existing Lenox – Tiffany 115 kV line (s1778.1)
- Install two 115 kV line switches (s1778.2)
- Install 115 kV line trap at tap location (s1778.3)
- Install 115 kV switch on tap (s1778.3)
- Construct ~200 ft of 115 kV line to customer substation








Estimated Project Cost: \$1.2M

Projected IS Date: 4/1/2019

Status: Conceptual

Supplemental Project Number: s1778.1, s1778.2, s1778.3



Legend	
500 kV	
230 kV	
138 kV	
115 kV	
69 kV	
46 kV	
New	

RTEP Projects Previously Presented to IPSAC



Previously Presented Projects sorted by Projected In Service Date

Upgrade ID	Description	Transmission Owner	Date Presented to IPSAC	Projected In Service Date
s1646	Install a second Wayne 345/115 kV 168/224 MVA transformer. Convert the 115 kV yard to a 4 breaker ring bus.	PENELEC	12/10/2018	6/1/2019
s1731	Convert the Erie West 115 kV substation into a five (5) breaker ring bus.	PENELEC	12/10/2018	12/31/2019
b3029	Install 69 kV underground transmission line from Harings Corner Station terminating at Closter Station (about 3 miles).	RECO	12/10/2018	5/31/2020
s1350	Niles Valley-Wellsboro. Construct ~5 miles of 115 kV line using existing right-of-way (where possible). Install new 115 kV bus tie breaker at Niles Valley. Relocate Potter 115 kV line at Niles Valley. Install two SCADA controlled switches. Install switch structure for future network line extension.	PENELEC	5/18/2018	6/1/2020
s1729	Expand the existing North Meshoppen 115 kV yard to a breaker-and-a-half configuration	PENELEC	12/10/2018	12/31/2020
b3017.1	Rebuild Glade to Warren 230 kV line with hi-temp conductor and substation terminal upgrades. 11.53 miles. New conductor will be 1033 ACSS. Existing conductor is 1033 ACSR.	PENELEC	12/10/2018	6/1/2021
b3017.2	Glade substation terminal upgrades. Replace bus conductor, wave traps, and relaying.	PENELEC	12/10/2018	6/1/2021
b3017.3	Warren substation terminal upgrades. Replace bus conductor, wave traps, and relaying.	PENELEC	12/10/2018	6/1/2021
b3016	Upgrade terminal equipment at Corry East 115 kV to increase rating of Four Mile to Corry East 115 kV line. Replace bus conductor.	PENELEC	12/10/2018	6/1/2021
b3024	Upgrade terminal equipment at Corry East 115 kV to increase rating of Warren to Corry East 115 kV line. Replace bus conductor.	PENELEC	12/10/2018	6/1/2021
b2836	Convert the N-1340 and T-1372/D-1330 (Brunswick – Trenton) 138 kV circuits to 230 kV circuits	PSEG	5/18/2018	12/31/2021
b2952	Replace the North Meshoppen #3 230/115kV transformer eliminating the old reactor and installing two breakers to complete a 230kV ring bus at North Meshoppen	PENELEC	5/18/2018	6/1/2022
b2837	Convert the F-1358/Z1326 and K1363/Y-1325 (Trenton - Burlington) 138 kV circuits to 230 kV circuits	PSEG	5/18/2018	6/1/2022
s1672	Rebuild ~66 miles of 115 kV line (Seward-Piney-Glory) using double circuit 230 kV construction (Install 1033 ACSR conductor (six-wired) energized at 115 kV)	PENELEC	12/10/2018	12/1/2023

Market Efficiency Update

Market Efficiency Process Enhancement Task Force Update

- Market Efficiency Process Enhancement Task Force (MEPETF) was approved in January 2018
 - Address challenges and opportunities for improvements to the Market Efficiency process since implementing Order 1000 processes
- On October 10, 2018, PJM filed proposed revisions to the benefit/cost analysis it conducts in its evaluation of economic-based enhancements or expansions as part of its regional transmission expansion plan (RTEP) process.
- On December 14, 2018, PJM filed revisions to its economic transmission planning process to address the generation assumptions that go into PJM's market efficiency analysis.
- In February 2019, FERC accepted PJM's proposed revisions.



FERC Ruling for PJM Filing on Generation Assumptions

Docket No.ER19-562-000, effective Feb 13, 2019

Item	PJM Modification	FERC Ruling	FERC Reasoning
FSA Modeling	Consider all FSA and Suspended ISA resources at time of case build	FERC accepted PJM's proposed Operating Agreement (OA) change.	Record evidence supports PJM's proposal to change the default treatment of generation with executed FSAs or executed ISAs under suspension. PJM has a reasonable basis to exclude those generation projects as a default in conducting its market efficiency analysis.
FSA Exception	If FSA /Suspended ISA units are included in the base case, TEAC will be notified and the assumptions will be reviewed at TEAC on an as needed basis.	FERC accepted PJM's proposed Operating Agreement (OA) change.	
Annual Information Filing	N/A	PJM to file with the Commission an annual informational filing regarding executed FSAs, executed ISAs under suspension, and executed ISAs. Filing required for a total of three years.	Improves transparency for stakeholders as PJM gains additional information and experience utilizing the new assumptions. Addresses concerns raised regarding generation trends and visibility of the analysis.



FERC Ruling for PJM Filing on Benefit/Cost Analysis

Docket Nos. ER19-80-000 and ER19-80-001, effective Dec 10, 2018

Item	PJM Modification	FERC Ruling	FERC Reasoning
Regional and Lower Voltage Benefits Calculation Period	15 years from in-service year, capped at RTEP+14	FERC accepted PJM's proposed Operating Agreement (OA) changes.	PJM's proposal to use the same 15-year planning period for evaluating all projects is just and reasonable and not unduly discriminatory modification to PJM's existing benefit/cost ratio calculation, given that the data for periods outside of the planning period are less accurate.
Project Cost Calculation Period	15 years of annual revenue requirements from in-service year, capped at RTEP+14	FERC accepted PJM's proposed Operating Agreement (OA) changes.	

2018/19 Long Term Window Update

2018/19 RTEP Window Posted Congestion Drivers

2018/19 RTEP Market Efficiency Window Eligible Congestion Drivers*				Simulated Annual Congestion (\$M)		Hours Binding				
FG#	Constraint	From Area	To Area	2023 Simulated Year	2026 Simulated Year	2023 Simulated Year	2026 Simulated Year	Line is conductor limited?	Comment	Potential Upgrades
ME-1	Hunterstown to Lincoln 115 kV	METED	METED	\$20.77	\$29.62	1720	1832	Yes	Internal Flowgate	
ME-2	Monroe to Wayne 345 kV	MISOE	MISOE	\$1.44	\$0.61	45	30	MISO	M2M	
ME-6	Marblehead 161/138 kV	MISOC	MISOC	\$1.41	\$1.18	195	138	MISO	M2M	A PJM/MISO TMEP has been approved for this facility.
ME-7	Bosserman to Trail Creek 138 kV	AEP	MISOE	\$1.47	\$1.69	66	89	Yes	M2M	


* Market Efficiency Base Case without FSA/Susp ISA units

Note: In February 2019, Eligible Congestion Drivers were updated due to FERC Order, issued on February 12, 2019, accepting PJM's filed revisions to exclude from its Market Efficiency assumptions, with exceptions, generation with an executed Facilities Study Agreement (FSA) or an executed Interconnection Service Agreement (ISA) under suspension.

Summary of Received Proposals

- PJM Long Term Proposal Window was closed on March 15, 2019
- 22 proposals addressing Hunterstown - Lincoln 115 kV
- 9 proposals on interregional congestion drivers
- 2 proposals not addressing PJM-identified congestion drivers
- 10 Proposing entities (including 1 joint proposal)
- 6 battery proposals and 1 Smart Wire proposal

Congestion Driver	Transmission Zone	# of Greenfield Proposals	# of Upgrade Proposals	Total Proposals Count	Cost Range
Hunterstown - Lincoln 115 kV	METED	19	3	22	\$5M - \$291M
Bosserman - Trail Creek 138 kV	AEP-MISOE	4	2	6	\$14M - \$266M
Marblehead XFMR	MISOC	1	1	2	\$36M
Monroe 1&2 - Wayne 345 kV	MISOE	-	1	1	\$0.5M
Total	-	25	8	33	-

- 
- A vertical timeline graphic on the left side of the slide, consisting of six blue chevron shapes pointing downwards, each corresponding to a task in the timeline.
- Data Validation Mar-Apr 2019
 - Independent review of cost and ability to build Apr-Nov 2019
 - Finalize Mid-cycle base case May 2019
 - Analysis of proposed solutions* May-Oct 2019
 - Review of Analysis with TEAC Jun-Nov 2019
 - Determination of Final Projects Dec 2019

* Due to the need to coordinate with MISO, interregional proposals will be analyzed first.

Questions?

