PJM Regional Transmission Expansion Planning (RTEP) Process

Nebiat Tesfa, Transmission Planning

IPSAC December 5, 2022

PJM Planning Links

- 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

2022 RTEP Update

RTEP Process

- The 2022 RTEP Assumptions were presented at the May IPSAC meeting. Refer to https://www.pjm.com/-/media/committees-groups/stakeholder-meetings/ipsac/2022/20220516/20220516-item-02-1-pjm-regional-transmission-expansion-planning-process.ashx
- Baseline Projects –Projects that are driven by reliability criteria violations, operational performance issues, congestion constraints and public policy.
- Supplemental Projects – Projects that are not required to address system reliability, operational performance or economic criteria. Supplemental projects are planned according to the Tariff Attachment M-3 process.

FERC 1000 Process

- Per the PJM Operating Agreement, multiple proposal windows were conducted for all reliability needs that were not Immediate Need reliability upgrades or were otherwise ineligible to go through the window process.
- 3 FERC Order 1000 proposal windows opened during the 2022 RTEP cycle
  - 2022 Multi Driver Window 1- 60 day window
  - 2022 RTEP Window 1 - 60 day window
  - 2022 RTEP Window 2 - 30 day window

2022 RTEP Multi Driver Window 1 Update

2022 RTEP Multi Driver Window 1

- 2022 RTEP Multi-Drive Window 1 (60 days window) opened on June 7, 2022 and was closed August 8, 2022.
  - The Multi Drive-Window 1 was conducted to address reliability and market efficiency problems identified on the 2027 RTEP year case.
  - For this Window, PJM sought technical solutions, also called proposals, to resolve potential reliability criteria violations on multi-driver facilities identified below in accordance with all applicable planning criteria (PJM, NERC, SERC, RFC, and Local Transmission Owner criteria).
  - 14 total proposals submitted from 3 different entities (includes 3 carry-over proposals from 2021 Proposal Window 2)
    - 8 Greenfields
    - 6 Upgrades
  - Cost Estimates: Approximate range from $215K – 127M
  - PJM's reliability evaluation for the proposals is underway is expected to be completed sometime in December of 2022.

2022 RTEP Window 1 Update

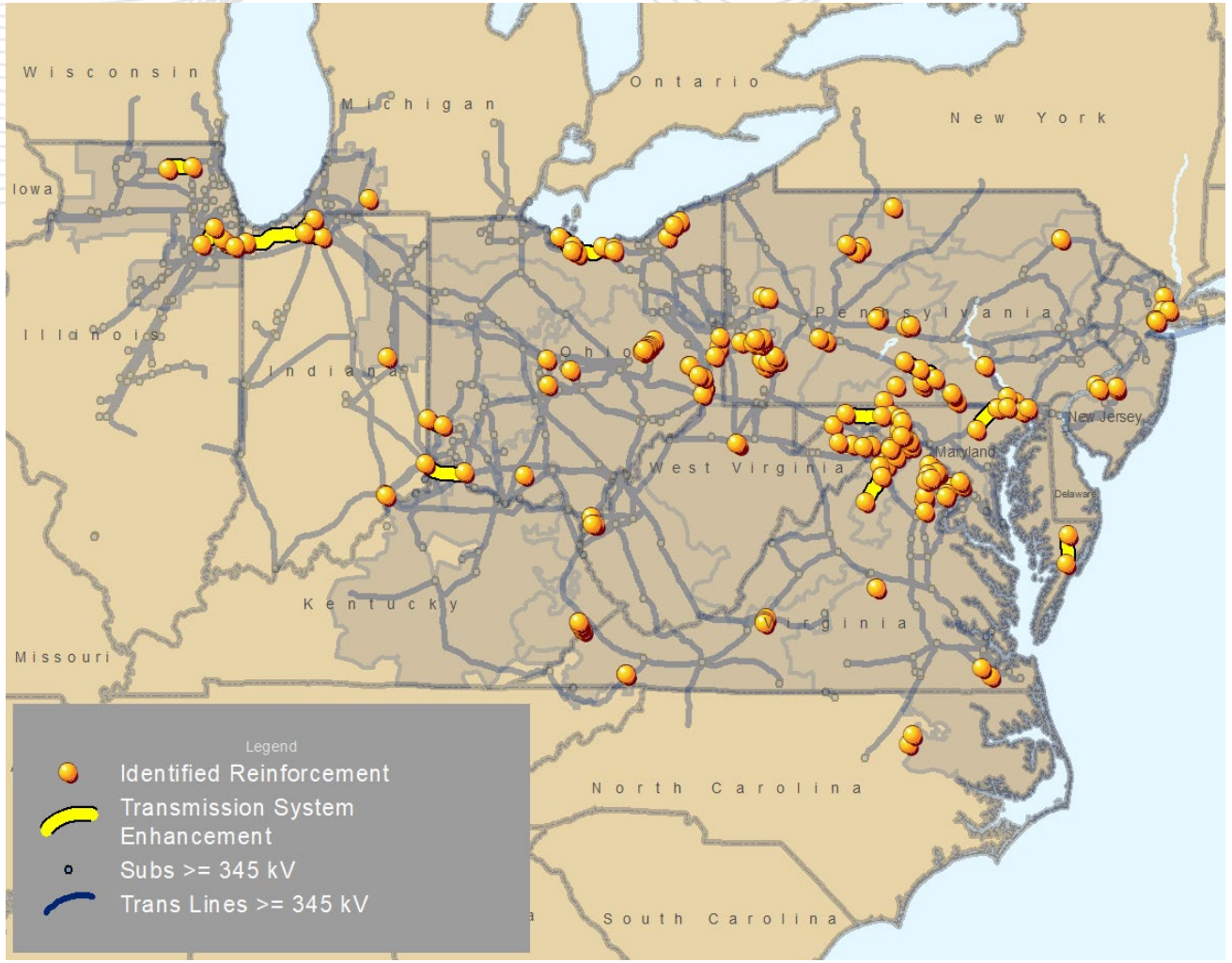
- PJM as part of the annual Regional Transmission Expansion Plan conducted studies and identified needs on 852 flowgates. PJM determined 269 of those flowgates were eligible for competition, and 583 of the flowgates were excluded from the competition for various reasons.
  - Window opened on 7/01/2022
  - Window closed on 8/30/2021

Overview of 2027 RTEP Results

Overview of 2027 Results
Total of 852 flowgates identified

- 269 flowgates are eligible
  - 19 in the PJM Mid-Atlantic Region
  - 250 in the PJM Western Region

- 583 flowgates excluded
  - 407 due to the below 200kv Exclusion
  - 39 due to Substation Equipment Exclusion
  - 20 due to Immediate Need Exclusion
  - 13 are addressed in the Multi Drive window 1
  - 63 in Dominion and are either addressed with an immediate Need or will be addressed in the 2022 Window 2
  - 41 due to other variety reasons



- For this Window, PJM sought technical solutions, also called proposals, to resolve potential reliability criteria violations on facilities identified in accordance with all applicable planning criteria (PJM, NERC, SERC, RFC, and Local Transmission Owner criteria).
- 17 total proposals submitted from 7 different entities (see https://www.pjm.com/-/media/committees-groups/committees/teac/2022/20220906/item-09b---reliability-analysis-update.ashx)
  - 6 Greenfield
  - 11 Upgrades
- Cost Estimates: Approximate range from $0.26k to $386.73M
- 7 Proposals identified with Cost Containment

- PJM completed the evaluation for majority of the proposals, and the projects already went through the stakeholder review process. The projects will go to the December PJM board meeting for approval.
- The evaluation for the remaining proposed projects is in progress and is expected to be completed by the end of December 2022.

2022 RTEP Window 2 Update

- 2022 RTEP Window 2 (30 days window) opened on November 1, 2022 and is anticipated to be closed on December 1, 2022
  - Window 2 is required to address the remaining Window 1 violations in the Dominion area after inclusion of the Immediate Need solution.

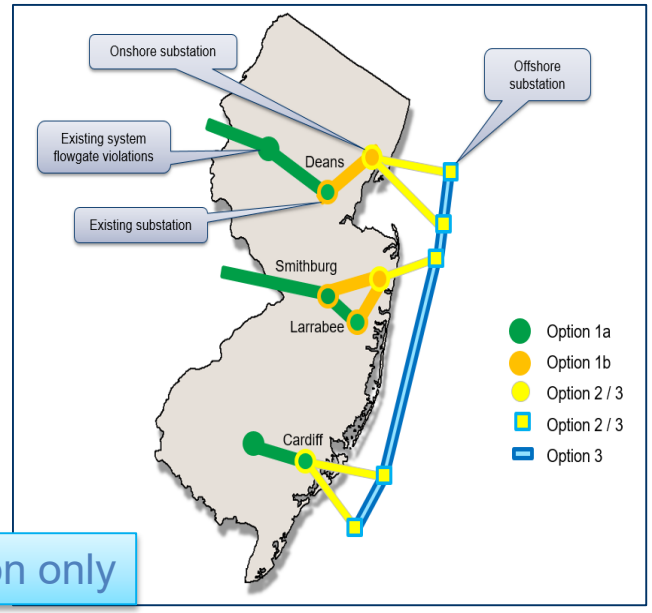
2021 SAA Proposal Window to Support NJ OSW Update

New Jersey Request to Use the SAA Process

- On November 18, 2020, the NJ Board of Public Utilities (NJBPU) issued an order formally requesting that PJM open a competitive proposal window to solicit project proposals to identify a transmission project that addresses New Jersey's public policy goals for 7,500 MW of offshore wind (OSW)
- On February 16, 2021, the Commission accepted the State Agreement Approach (SAA) Study Agreement between PJM and the NJBPU that:
  - authorized PJM to implement the SAA process to conduct an open proposal window for OSW transmission facilities that effectuate NJ's public policy goals; and
  - established key dates and milestones

2021 SAA Proposal Window

- PJM opened an RTEP proposal window to solicit submissions to build the necessary transmission to meet New Jersey's goal of facilitating the delivery of a total of 7,500 MW of offshore wind through 2035
    - Window opened April 15, 2021
    - Window closed September 17, 2021
- Proposals were sought for upgrades for the follow options:
    - Option 1a – Onshore transmission upgrades
    - Option 1b – Onshore New Transmission Connection Facilities
    - Option 2 – Offshore New Transmission Connection Facilities
    - Option 3 – Offshore New Transmission Network



for illustration only

Note: Option designations refer to the four portions of the requested proposal as outlined in the *PJM RTEP – 2021 NJ OFFSHORE WIND TRANSMISSION SAA PROPOSAL WINDOW OVERVIEW* document

Changes to Offshore Wind Injection Assumptions to Align with Updated NJ BPU Solicitation Schedule

Default POIs and Injection Amounts		Prior to June 30, 2021		After June 30, 2021	
Solicitation	POI	Awarded MW	Modelled* MW	Awarded MW	Modelled* MW
1	Oyster Creek 230 kV	1,100	816*	1,100	816*
1	BL England 138 kV		432*		432*
2	Cardiff 230 kV		900	1,510	1,510
2	Smithburg 500 kV		1,200	1,148	1,148
3-5	Deans 500 kV		3,100		2,542
3-5	Larrabee		1,200		1,200
TOTAL		**1,100**	**7,648**	**3,758**	**7,648**

* Solicitation #1 modeled MW per awarded queue position.

Proposal Window and Proposing Entities

PJM received 80 proposals from 13 different entities to construct onshore and offshore transmission projects Window Status

- Anbaric Development Partners, LLC
- Atlantic City Electric Company
- Atlantic Power Transmission (APT), a Blackstone Infrastructure Partners portfolio company
- Con Edison Transmission, Inc.
- Jersey Central Power & Light Company
- LS Power Grid Mid-Atlantic, LLC
- Mid-Atlantic Offshore Development, LLC, a joint venture of EDF Renewables North America (EDFR) and Shell New Energies US, LLC (Shell New Energies)
- NextEra Energy Transmission MidAtlantic Holdings, LLC
- Outerbridge New Jersey, LLC, a subsidiary of Rise Light & Power, LLC
- PPL Electric Utilities
- PSEG Renewable Transmission LLC and Orsted N.A. Transmission Holding, LLC
- Public Service Electric & Gas Company
- Transource Energy, LLC

2021 SAA Proposal Window

- Of the 80 project proposals received from the 13 applicants, there were 27 Option 1a solutions, 11 Option 1b solutions, 34 Option 2 solutions, and eight Option 3 solutions. The proposals represented a mixture of competitive onshore and offshore transmission solutions to support New Jersey's offshore wind needs.
- In addition to the competitive proposals submitted in the window, transmission upgrades were provided by the incumbent Transmission Owners (TOs) to address new violations that were identified as a result of the reliability analysis and were not previously identified as part of the posted problem statement for the default points of injection
  - PJM received 27 Option 1a proposals as part of this window to resolve potential reliability criteria violations on PJM facilities in accordance with all applicable planning criteria (PJM, NERC, SERC, ReliabilityFirst and local transmission owner criteria)
  - PJM received 11 Option 1b proposals, submitted by four entities in this window. Each of these proposals represented onshore-only projects with all necessary upgrades and/or greenfield solutions for transferring the offshore wind generation from new onshore substations to default or alternative POIs.
- PJM first performed an initial reliability analysis screening of 28 offshore wind scenarios.
  - PJM worked with the NJBPU to create 28 offshore wind-injection scenarios involving various combinations of the submitted Option 1b and Option 2 proposals

2021 SAA Proposal Window

- The completion of the initial reliability analysis screening and identification of an initial set of onshore upgrades for each scenario was necessary to provide the NJBPU with a comparative framework of preliminary transmission cost estimates for the scenarios under evaluation that consider both the offshore and onshore transmission needs. The NJBPU used this information to select four scenarios for a final, comprehensive reliability evaluation that included both a further review of the competitive Option 1a proposal clusters as necessary and a full set of reliability studies.
  - The four finalist scenarios were
    - Scenario 1.2c
    - Scenario 16a
    - Scenario 18
    - Scenario 18a
- PJM performed a comprehensive reliability analysis on these four finalist scenarios, to ensure the final transmission buildout satisfied all PJM reliability criteria.
- PJM also performed economic analysis, constructability evaluation, cost Containment review and energy/capacity Market benefits simulations as part of the initial screening.

2021 SAA Proposal Window

- After the comprehensive reliability analysis and all other evaluations were complete, PJM provided the results to NJBPU.
- The NJBPU completed its independent evaluation of the proposals and selected the project, inclusive of all necessary components, that it will sponsor as a public policy project.
- The NJBPU issued an order notifying PJM of its selection of the transmission project, inclusive of all components, that it will sponsor to achieve its stated public policy goals of injecting 7,500 MW of offshore wind into New Jersey by 2035.
- The NJBPU has selected Scenario 18a solution identified as the “Larrabee Tri-Collector Solution” or “MAOD-JCP&L Option 1b Solution,” which includes elements of the Jersey Central Power & Light (JCP&L) Option 1b proposal, as well as scaled-down elements of Mid-Atlantic Offshore Development’s (MAOD’s) Option 2 proposal, and the necessary Option 1a upgrades to create the SAA Capability associated with the SAA scenario evaluating the Larrabee Tri-Collector Solution. The total cost for the selected solution is estimated to be $1.08 billion.

For more detail see links below

https://www.pjm.com/-/media/committees-groups/committees/teac/2022/20221104-special/nj-osw-saa-summary-report.ashx

https://www.pjm.com/-/media/committees-groups/committees/teac/2022/20221104-special/item-01---nj-osw-saa.ashx

2022 RTEP M-3 Process

2022 RTEP M-3 Projects Update

- Development of Supplemental Projects:
  - PJM coordinated the Supplemental projects planning as described in the Tariff, Attachment M-3.
    - PJM received/presented 257 Supplemental Needs from 1/1/2022 to 10/30/2022
      - Solutions were proposed for 114 of the 257 projects
      - 49 projects completed all necessary reviews and the projects will be integrated into the 2023 Regional Transmission Expansion Plan.
    - Prior to 2022 projects:
      - Needs presented prior to 2022
      - Solution proposed and presented for 91 Needs from previous years
      - 69 projects completed all necessary reviews and the projects will be integrated into the 2023 Regional Transmission Expansion Plan.

RTEP Projects Electrically Near the PJM-NYISO Interface in 2022

PPL Transmission Zone: Baseline

Process Stage: Second Review

Criteria: Summer Generator Deliverability

Assumption Reference: 2027 RTEP assumption

Model Used for Analysis: 2027 RTEP Summer case

Proposal Window Exclusion: None

Problem Statement:

The Lackawanna 500/230 kV transformer # T3 is overloaded for line fault stuck breaker contingency.

Violations were posted as part of the 2022 Window 1: FG# GD-S595

Recommended Solution:
Proposal ID 127: Re-terminate the Lackawanna T3 and T4 500/230 kV transformers on the 230 kV side to remove them from the 230 kV buses and bring them into dedicated bay positions that are not adjacent to one another. (B3730)

Estimated Cost: $10.7 M

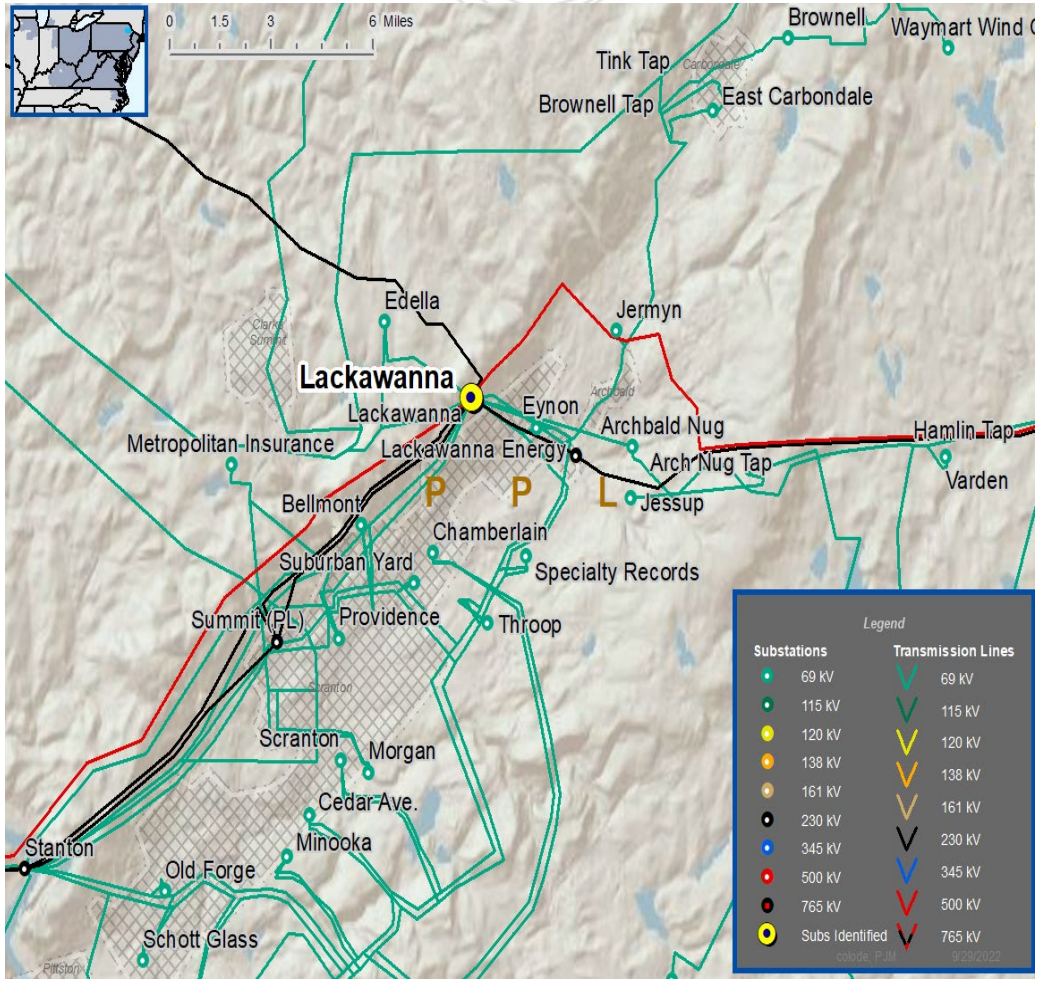
Alternatives:

Proposal ID 553: Replace the existing Lackawanna 500/230 kV T3 and T4 transformers with larger 1250 MVA units. Upgrade bay equipment to accommodate the new higher rated transformers. (Cost Estimate: $55.97 M)

Proposal ID 907: Re-terminate the Lackawanna Energy from 230 kV to 500 kV through new 500/230 kV transformer. (Cost Estimate: $51.48 M)

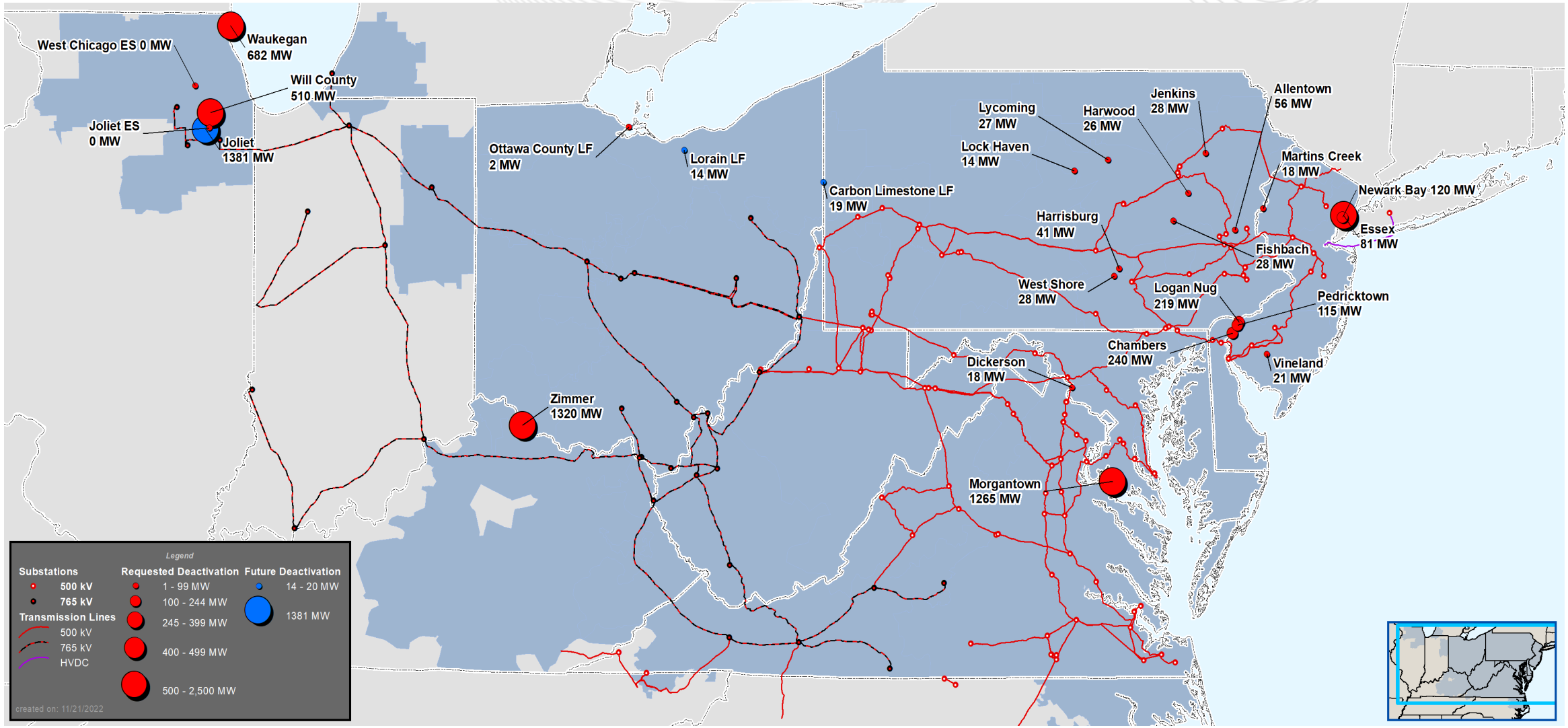
Required In-Service: 6/1/2027

Projected In-Service: 1/30/2026



Generation Deactivation Notification Update (Between 4/1/2022 and 11/1/2022)

Retirements



Deactivation Status

Unit(s)	Fuel Type	Transmission Zone	Requested Deactivation Date	PJM Reliability Status
Lorain 1 LF (14 MW)	Methane	ATSI	4/1/2023	Reliability analysis underway
Joliet 6,7 & 8 (1381 MW)	Natural Gas	ComEd	6/1/2023	Reliability analysis complete; no impacts identified
Carbon Limestone LF (19.3 MW)	Methane	ATSI	11/15/2022	Reliability analysis complete. No violation identified

Deactivation Status

Unit Name	Fuel Type	Transmission Zone	Actual Deactivation Date	PJM Reliability Status
Dickerson CT1 (18 MW)	Oil	PEPCO	10/23/2022	Reliability analysis complete; no impacts identified
Vineland West CT (21.61MW)	Oil	ACE	10/14/2022	Reliability analysis complete; no impacts identified
Morgantown CT1 & CT2 (14 MW)	Oil	PEPCO	10/1/2022	Reliability analysis complete; no impacts identified
Will County 4 (510 MW)	Coal	ComEd	06/30/2022	Reliability analysis complete; no impacts identified
Chambers CCLP (240 MW)	Coal	ACE	06/07/2022	Reliability analysis complete; no impacts identified

Deactivation Status

Unit Name	Fuel Type	Transmission Zone	Actual Deactivation Date	PJM Reliability Status
Allentown CT1, CT2, CT3 & CT4 (56 MW)	Oil	PPL	6/1/2022	Reliability analysis complete; no impacts identified
Essex 9 (81 MW)	Natural Gas	PSEG	6/1/2022	Reliability analysis complete; no impacts identified
Harrisburg CT1,CT2 & CT3 (41.1 MW)	Oil	PPL	6/1/2022	Reliability analysis complete; no impacts identified
Martins Creek CT 3 (18 MW)	Oil	PPL	6/1/2022	Reliability analysis complete; no impacts identified
New Bay Cogen CC (240 MW)	Natural Gas	PSEG	6/1/2022	Reliability analysis complete; upgrades expected to be completed in future, but interim operating measures identified and unit can deactivate as scheduled

Deactivation Status

Unit Name	Fuel Type	Transmission Zone	Actual Deactivation Date	PJM Reliability Status
Pedricktown Cogen CC (115.3 MW)	Natural Gas	AEC	5/31/2022	Reliability analysis complete; no impacts identified
Harwood 1 & 2 (25.2 MW)	Natural Gas	PPL	5/31/2022	Reliability analysis complete; no impacts identified
Morgantown Unit 1 & 2 (1,232.7 MW)	Coal	PEPCO	5/31/2022	Reliability analysis complete and upgrades expected to be completed in time for unit to deactivate as scheduled.
Logan (219 MW)	Coal	ACE	5/31/2022	Reliability analysis complete; no impacts identified
Ottawa County Project (1.7 MW)	Methane	ATSI	5/31/2022	Reliability analysis complete; no impacts identified

Deactivation Status

Unit Name	Fuel Type	Transmission Zone	Actual Deactivation Date	PJM Reliability Status
Waukegan 7 & 8 (682.4 MW)	Coal	ComEd	5/31/2022	Reliability analysis complete; no impacts identified
Zimmer 1 (1320 MW)	Coal	PPL	5/31/2022	Reliability analysis complete and upgrades expected to be completed in time for unit to deactivate as scheduled.
Joliet Energy Storage (0 MW)	Battery	ComEd	5/31/2022	Reliability analysis complete and upgrades expected to be completed in time for unit to deactivate as scheduled.
West Chicago Energy Storage (0 MW)	Battery	ComEd	4/29/2022	Reliability analysis complete; no impacts identified
Fishbach CT 1 & CT 2 (28 MW)	Oil	PPL	4/1/2022	Reliability analysis complete; no impacts identified

Deactivation Status

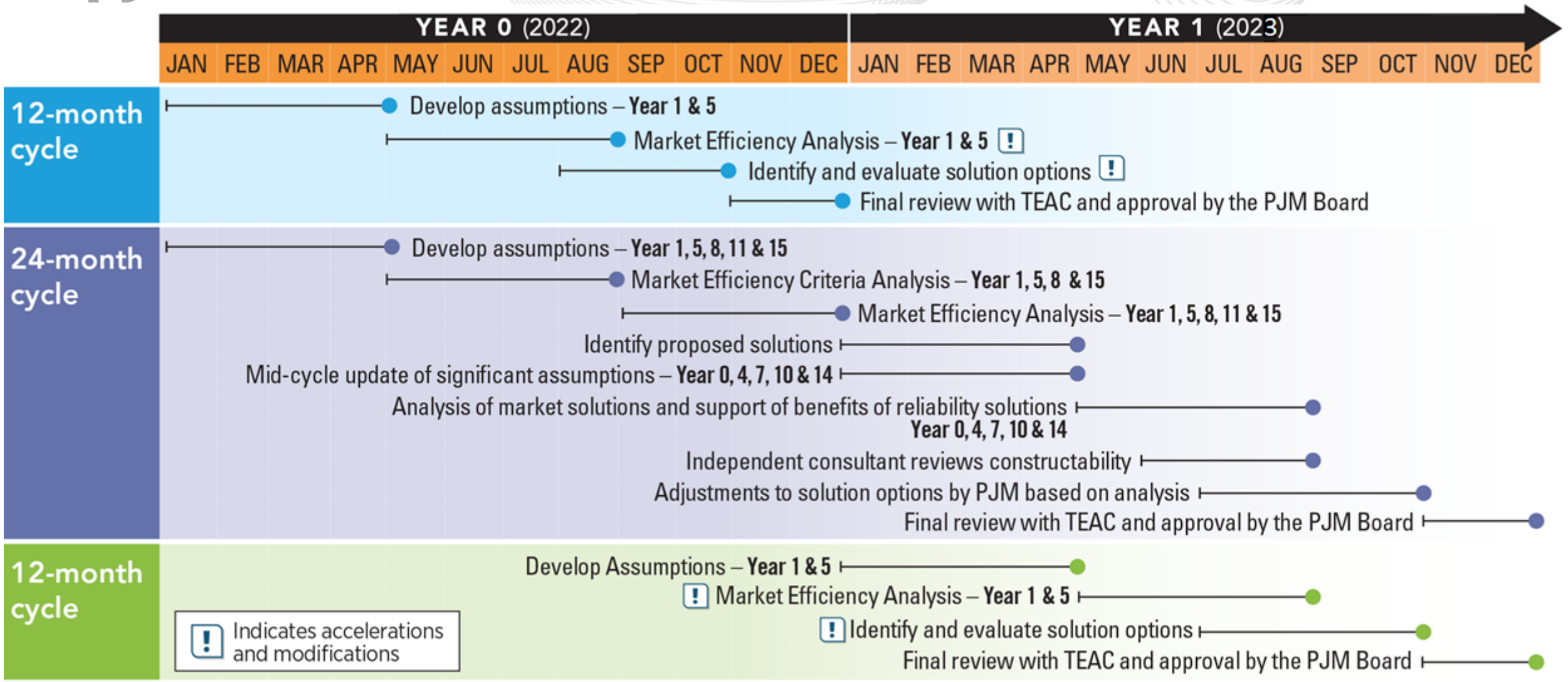
Unit Name	Fuel Type	Transmission Zone	Actual Deactivation Date	PJM Reliability Status
Jenkins CT1 & CT2 (27.6 MW)	Oil	PPL	5/31/2022	Reliability analysis complete; no impacts identified
Lock Haven CT 1 (14 MW)	Coal	PPL	5/31/2022	Reliability analysis complete and upgrades expected to be completed in time for unit to deactivate as scheduled.
West Shore CT1 & CT2 (28 MW)	Battery	PPL	5/31/2022	Reliability analysis complete and upgrades expected to be completed in time for unit to deactivate as scheduled.
Williamsport-Lycoming CT1 & CT2 (26.6 MW)	Battery	PPL	4/29/2022	Reliability analysis complete; no impacts identified

Generation Deactivation link:
https://www.pjm.com/planning/services-requests/gen-deactivations

PJM Market Efficiency Update

Nick Dumitriu
Principal Engineer, PJM Market Simulation

2022/23 Market Efficiency Timeline



- Market Efficiency Assumptions
  - Hitachi Energy PROMOD Database – Spring 2022.
  - Powerflow consistent with the current 2027 RTEP powerflow.
  - Load Forecast and Demand Response from PJM 2022 Load Forecast Report.
  - Generation Expansion consistent with the machine list from the RTEP powerflow.
    - Includes announced retirements as of August 2022.
  - Fuel and Emissions Price forecasts provided by Hitachi Energy.

- Market Efficiency Base Case has been posted (PROMOD 11.4 XML format).

- Market Efficiency Training scheduled for November 29, 2022.

- Final Market Efficiency Base Case and Congestion Drivers to be posted before the start of 2022/23 Long-Term Window.

Base Case Preliminary Results - Simulated Congestion [1]

Constraint [3]	Congested Area	Type	Historical 2021 Day Ahead Congestion	Historical 2022 (through Sep) Day Ahead Congestion	Simulated 2027 Congestion	Simulated 2030 Congestion	Comment
Black Oak-Bedington Interface		Inter	$ -	$ 72,436,702	$ 54,119,278	$ 97,404,855	2022 Reliability Window 1 – Black Oak 500kV Voltage Drop
BC-PEPCO Interface		Inter	$ 4,065	$ 262,743	$ 27,128,125	$ 1,488,360	-
Safe Harbor-Graceton 230 kV	PPL-BGE	Line	$ 25,862,337	$ 18,926,344	$ 23,435,336	$ 16,239,930	2022 Reliability Window 1
Messick Road to Morgan 138 kV	APS	Line	$ -	$ -	$ 19,167,071	$ 36,863,712	2022 Reliability Window 1
Dumont-Stillwell 345 kV	AEP-NIPS	M2M	$ 2,034,732	$ 2,381,596	$ 11,568,222	$ 13,427,287	2022 Multi-Driver Window 1
AP South Interface		Inter	$ 465,361	$ 55,483,098	$ 7,885,910	$ 19,389,792	-
AEP-DOM Interface		Inter	$ 323,916	$ 23,390,296	$ 7,393,603	$ 30,019,220	-
Olive-University Park 345 kV	AEP-CE	M2M	$ -	$ 75,167	$ 4,918,360	$ 12,482,576	2022 Multi-Driver Window 1
Lincoln-Straban 138 kV	METED	Line	$ 375,627	$ 2,033,549	$ 3,194,140	$ 8,875,815	2022 Reliability Window 1
Germantown-Straban 138 kV	METED	Line	$ 323,093	$ 2,856,930	$ 2,935,052	$ 10,166,810	2022 Reliability Window 1

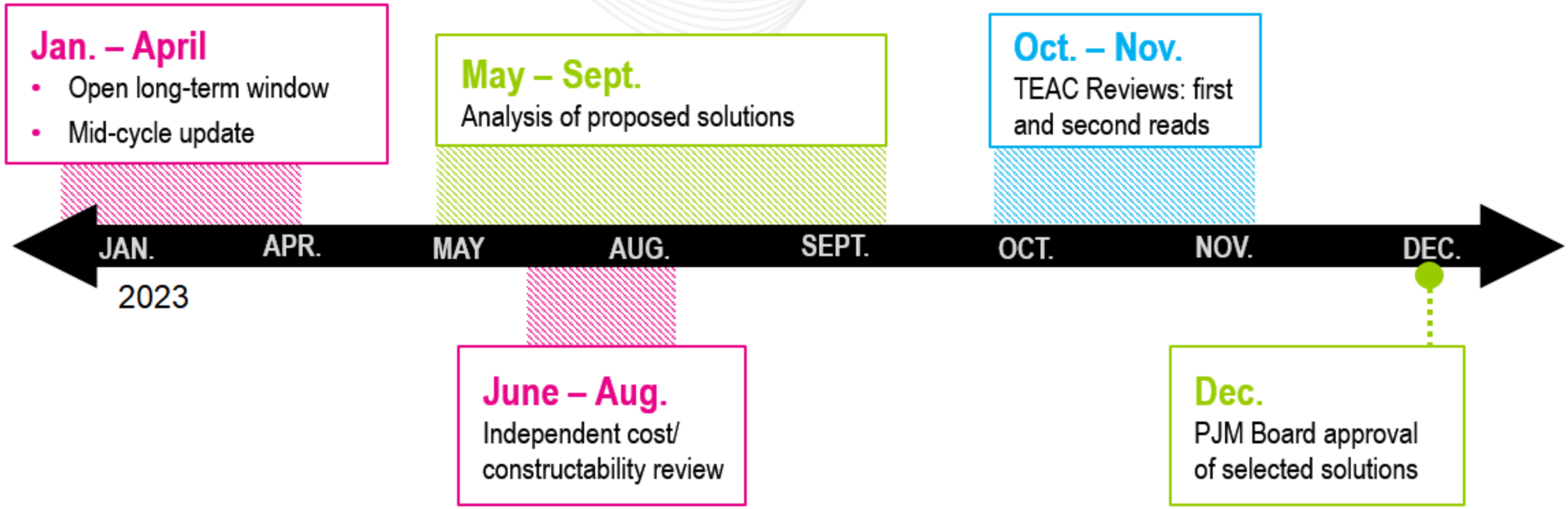
Notes:

1) Preliminary results, not final congestion drivers. List of constraints and congested areas may change in the final base case.

2) Table identifies correlated historical constraints with 2027 PROMOD simulated congestion in the same area/group.

3) Included only flowgates with hr bindings > 25 hrs. and annual simulated congestion > $1 million.

2022/23 Long-Term Window – Timeline



Questions?