Market Efficiency Update

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Transmission Expansion Advisory Committee
January 9, 2024

Outline

- 2022/23 Market Efficiency Cycle
- 2023 Acceleration Analysis of RTEP Reliability Projects - Second Read
- 2023 Annual Re-evaluation of RTEP Market Efficiency Projects
- 2024/25 Market Efficiency Cycle

2022/23 Market Efficiency Cycle

2022/23 Long-Term Window Status

- Back in January 2023, PJM posted a preliminary ME Base Case:
  - Included the reliability upgrades from the 2022 Window 1 and 2022 Multi-Driver Window.
  - Preliminary case was posted on the ME secure page.
- Updated Market Efficiency Assumptions whitepaper were posted at the July TEAC materials.
- ME Base Case updated with the 2022W3 solution approved at the December 2023 Board meeting.
  - Updated ME Base Case to be posted in the following weeks.
- PJM delayed the opening of the 2022/2023 Long-Term Window to Q1 2024.

2022/2023 ME Base Case Assumptions

- Topology based on the 2028 powerflow posted for the reliability window 2023W1
  - Updated with the 2022W3 solution approved at the December 2023 Board meeting.
- Updated Summer/Winter reactive interface limits.
- Updated PROMOD Summer/Winter seasonal definitions to closer match the markets:
  - Summer season (May-Oct); Winter season (Nov-Apr).
- Generator Status updated as of November 8, 2023.
- The rest of the assumptions as in the July TEAC ME whitepaper:
  - PJM Load forecast (January 2023 vintage).
  - Fuel/Emissions forecasts provided by Hitachi (Spring 2023 vintage).

- The potential congestion drivers that were present in the ME Base Case posted at January 2023 TEAC are now mitigated in the updated ME Base Case (simulated year 2028):
  - Reactive interfaces: Bed-Bla, BC-PEPCO, AP South, and AEP-DOM
  - Thermal constraints:
    - Yorkana-Brunner Island 230 kV (METED-PPL)
    - Five Forks-Rock Ridge 115 kV (BGE)
    - Graceton-Bagley 230 kV (BGE)
    - Face Rock 115/69 kV (PPL)
    - Hunterstown-Lincoln 115 kV (METED)
    - Smith Mountain-Museville 138 kV (AEP)
- The congestion results for the 2028 simulated year are shown on the next slides.
  - Included flowgates with hr bindings > 25 hrs. and annual simulated congestion > $1 million.

Congestion Results (2028 Simulated Year)

Constraint [2)]	Congested Area	Type	2028 Annual Congestion ME Base Case After 2022 Window 3 Upgrades	2028 Annual Hours Binding ME Base Case After 2022 Window 3 Upgrades
Clifford-Boxwood 138 kV	AEP	Line	$ 48,494,165	2,013
Oyster Creek-Manitou 230 kV	JCPL	Line	$ 17,142,183	384
Bremo-Scottsville 138 kV	DOM-AEP	Line	$ 11,372,270	1,144
Enbridge-DeKalb-Waterman 138 kV	COMED	Line	$ 7,513,761	417
Crescent Ridge-Corbin 138 kV	COMED-AMIL	Line, M2M	$ 7,277,187	515
Haumesser Rd-W De Kalb 138 kV	COMED	Line	$ 6,582,203	276
Ashtabula-Sanborn 138 kV	FE-ATSI	Line	$ 5,930,137	1,392
Green Acres-Olive 345 kV	COMED-AEP	Line	$ 4,766,562	84
Bremo-Fork Union 115 kV	DOM	Line	$ 4,411,072	376
Mittal Steel-Putnam 138 kV	AMIL	Line, M2M	$ 3,647,341	121
Morgan-Cherry Run 138 kV	APS	Line	$ 2,126,902	114
Chesterfield-Basin 230 kV	DOM	Line	$ 1,845,737	47
Stillwell 345/138 kV	NIPSCO	XFMR, M2M	$ 1,762,600	649
Westvaco-Mt Zion 138 kV	APS	Line	$ 1,704,211	61
Bremo 230/115 kV	DOM	Line	$ 1,655,259	129

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

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

Congestion Results (2028 Simulated Year)

Constraint [2)]	Congested Area	Type	2028 Annual Congestion ME Base Case After 2022 Window 3 Upgrades	2028 Annual Hours Binding ME Base Case After 2022 Window 3 Upgrades
Kyger-Sporn 345 kV	OVEC-AEP	Line	$ 1,452,828	271
Charlottesville-Proffit Rd 230 kV	DOM	Line	$ 1,196,533	60

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

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

Next Steps

- Post updated ME Base Case (2028 simulated year).
- Identify potential congestion drivers for the 2022/23 ME Window.
- Present findings at the February TEAC.

2023 Acceleration Analysis of RTEP Reliability Projects Second Read

- First Read presented at the December 2023 TEAC.
- Baseline reliability upgrades selected for acceleration:
  - Project B3729 - a $0.26 million project to increase the Maximum Operating Temperature of DPL Circuit 22088 (Colora - Conowingo 230 kV), will be accelerated to June 2026 at no additional cost.
  - Project B3694.8 - a $25.6 million project to rebuild 10.34 miles of 230 kV line #249 Carson-Locks will be accelerated to June 2025 at no additional cost.

DPL: Acceleration of Reliability Project B3729

Process Stage: Second Read

Criteria: Market Efficiency - Acceleration Analysis

Assumptions Reference: 2023 Market Efficiency Assumptions with Dominion Load from 2022 Forecast

Problem Statement:

Simulated congestion on DPL Circuit 22088 (Colora-Conowingo 230 kV) line without the B3729 project

Proposed Solution:

Accelerate the expected in service date of the reliability project B3729 from 6/1/2027 to 6/1/2026

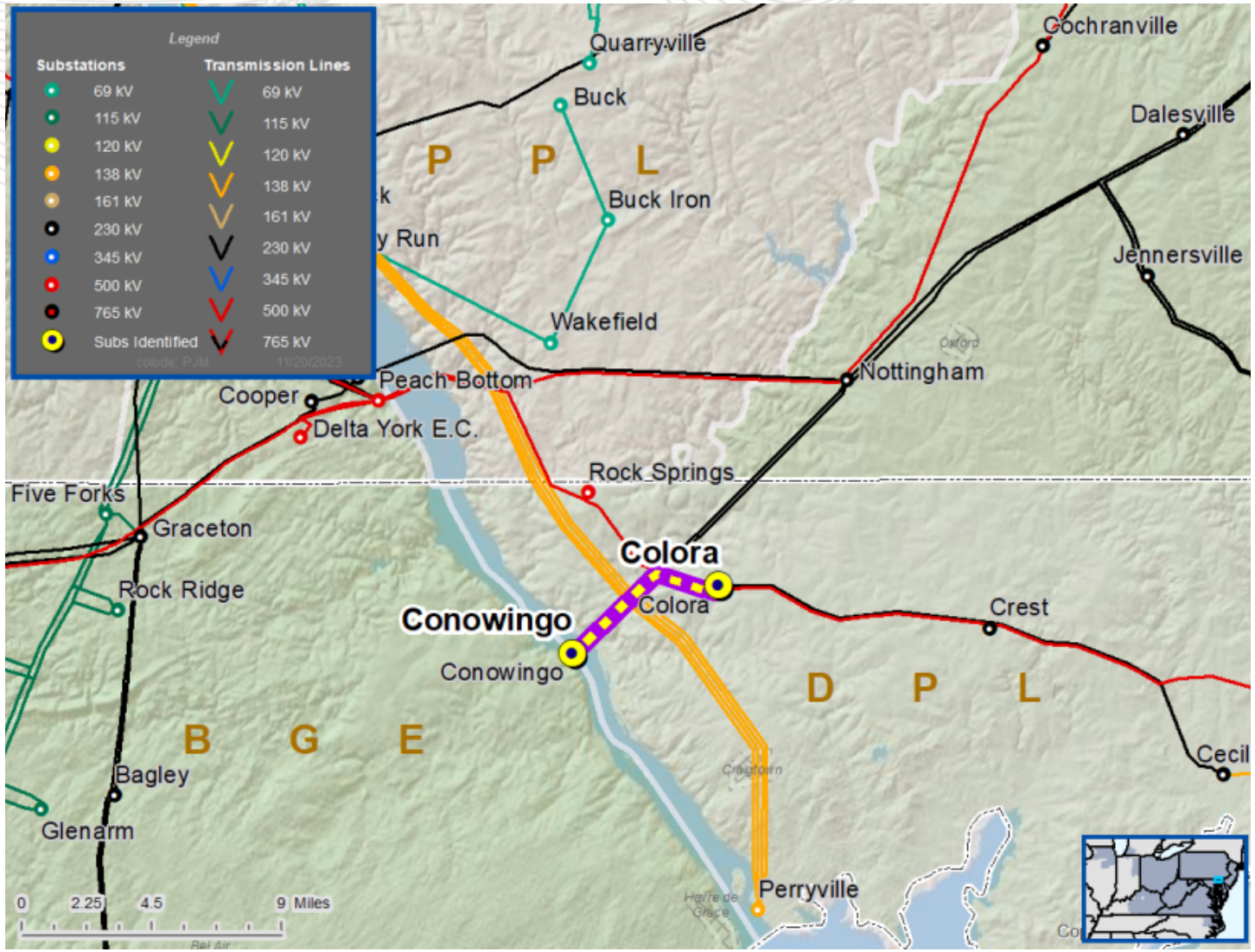
Project Description:

Increase of the Maximum Operating Temperature of DPL Circuit 22088 (Colora-Conowingo 230 kV), install cable shunts on each phase, on each side of four (4) dead-end structures and replace existing insulator bells.

Cost/Benefit Analysis:

- **Acceleration Cost**: $0
- **Estimated Annual Congestion Benefit**: $ .8 M

New Expected In-Service: 6/1/2026



DOM: Acceleration of Reliability Project B3694.8

Process Stage: Second Read

Criteria: Market Efficiency - Acceleration Analysis

Assumptions Reference: 2023 Market Efficiency Assumptions with Dominion Load from 2022 Forecast

Problem Statement:

Simulated congestion on DOM Circuit 249B (Carson-Chaparral Tap 230 kV) line without the B3694.8 project

Proposed Solution:

Accelerate the expected in service date of the reliability project B3694.8 from 6/1/2026 to 6/30/2025

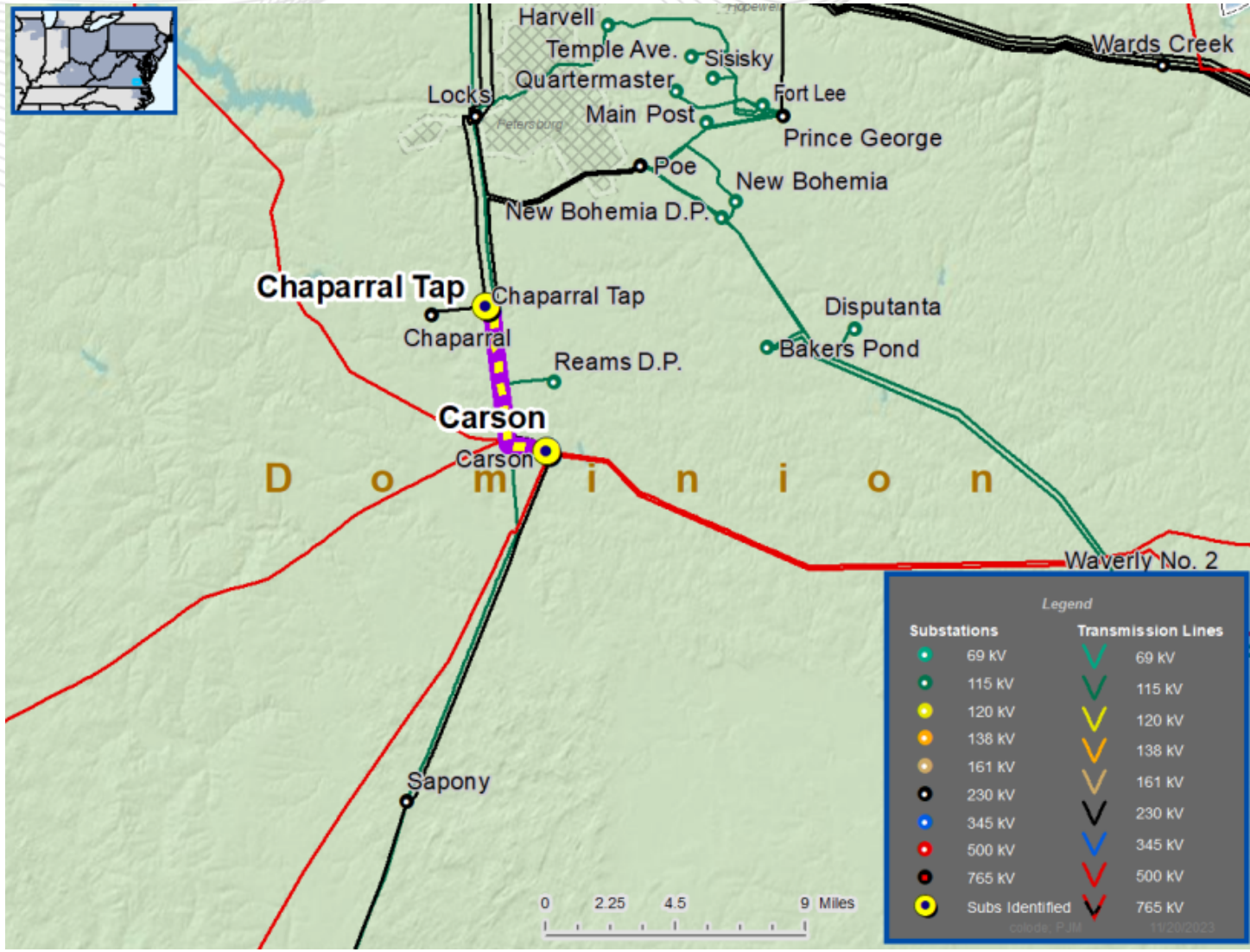
Project Description:

Partial wreck and rebuild 10.34 miles of 230 kV line #249 Carson-Locks to achieve a minimum summer emergency rating of 1047 MVA. Upgrade terminal equipment at Carson and Locks to not limit the new conductor rating.

Cost/Benefit Analysis:

- **Acceleration Cost**: $0
- **Estimated Annual Congestion Benefit**: $ 1.8 M

New Expected In-Service: 6/30/2025



2023 Annual Re-evaluation of RTEP Market Efficiency Projects

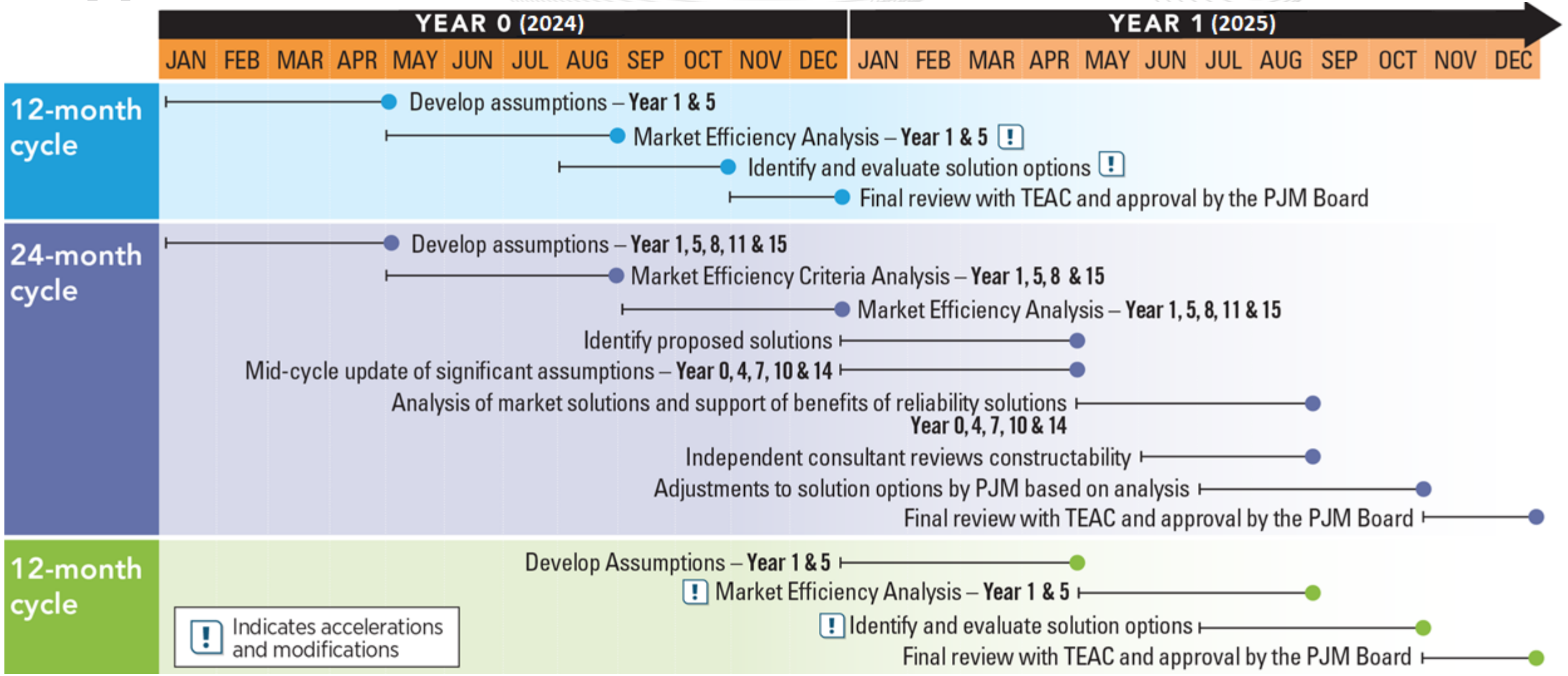
Re-evaluation Overview

- PJM is required by Schedule 6 of the Operating Agreement (OA) to "annually review the cost and benefits" of Board-approved market efficiency projects that meet certain criteria to assure that a project continues to be cost beneficial.
  - The annual re-evaluation is not required for projects already in-service, that have commenced construction, or have received state siting approval.
- On Nov. 21, 2023, PJM filed with FERC a request for a waiver of the timing requirement associated with the 2023 Annual Reevaluation Analysis to permit PJM time to update the market efficiency model to include the Board-approved 2022 RTEP Window #3 projects.

  PC Informational Posting: FERC Waiver of Timing Requirement for Annual Market Efficiency Reevaluation
- On December 21, 2023, FERC issued an order granting the waiver request.
  - FERC directed that the analysis be completed by June 30th, 2024.
- Re-evaluation of Projects with EP* Status and Capital Cost < $20 Million presented at the December 2023 TEAC.

2024/25 Market Efficiency Cycle

2024/25 Market Efficiency Timeline



2024 Market Efficiency Assumptions

- Hitachi Energy PROMOD Database – Spring 2024.
- Powerflow consistent with the 2028 RTEP powerflow.
- Load Forecast and Demand Response based on PJM 2024 Load Forecast Report.
- Generation Expansion consistent with the Planning RTEP Powerflow.
- Fuel/Emissions Price forecasts provided by Hitachi Energy (Spring 2024 vintage).
- Financial parameters, Discount Rate and Carrying Charge, based on the Transmission Cost Information Center spreadsheet.

2024/25 Market Efficiency 24-Month Cycle

Step	Tentative Target Date
Develop Base Case Assumptions	May 2024
Post Preliminary Base Case	July 2024
Stakeholders Feedback	September 2024
Identify Congestion Drivers	September – November 2024
Post Final Base Case and Target Congestion Drivers	January 2025
Long Term Proposal Window	January - May 2025
Analysis of Proposed Solutions	May – September 2025
TEAC Reviews and Board Approval	October - December 2025

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Market Efficiency Update

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Revision History

- V1 – 1/4/2024 – Original slides posted
- V2 – 1/8/2024 – Reposted with the following changes:
  - Added slide 2, Outline
  - Updated slide 4 to reflect that 2022/23 ME Base Case update has been completed
  - Added slides 6, 7, 8 with the congestion results for the 2028 simulated year
  - Added slide 9, Next Steps

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