# Market Efficiency Update

Nick Dumitriu
Sr. Lead Engineer, Market Simulation
Transmission Expansion Advisory Committee
December 1, 2020

# 20/21 Long Term Window

# 20/21 Long-Term Window Overview

- 20/21 Market Efficiency Analysis Assumptions whitepaper
- Market Efficiency Training, available here completed October 20th
- Materials posted on the Market Efficiency page
  - PROMOD 11.3 Test Case Results and B/C Ratio Example Workbook
  - ARR spreadsheet
- Retooled Market Efficiency Base Case and Sensitivities XML (PROMOD 11.3)
  - To be posted in the following days
- 20/21 Market Efficiency Long-Term Window to open January 11, 2020 (120 days)
  - Final ME Window Congestion Drivers, ME Window Base Case, and Sensitivity scenarios to be posted before start of 20/21 Long-Term Window

# 20/21 Retooled Base Case

- Retooled model includes MISO data update
  - Updated PJM Generation Expansion (ISA/FSA status, retirements)
  - Updated topology using the retooled 2025 powerflow from Transmission Planning
    - Also updated PJM line ratings and contingency definitions
  - ABB-Hitachi PROMOD data updates (heat rates, generator outages, some solar profiles)
  - Input data corrections based on the feedback received from the stakeholders
  - Updated PROMOD setup and reporting switches

- Updated Demand Forecast and Gas Price Forecast to account for COVID-19 impact

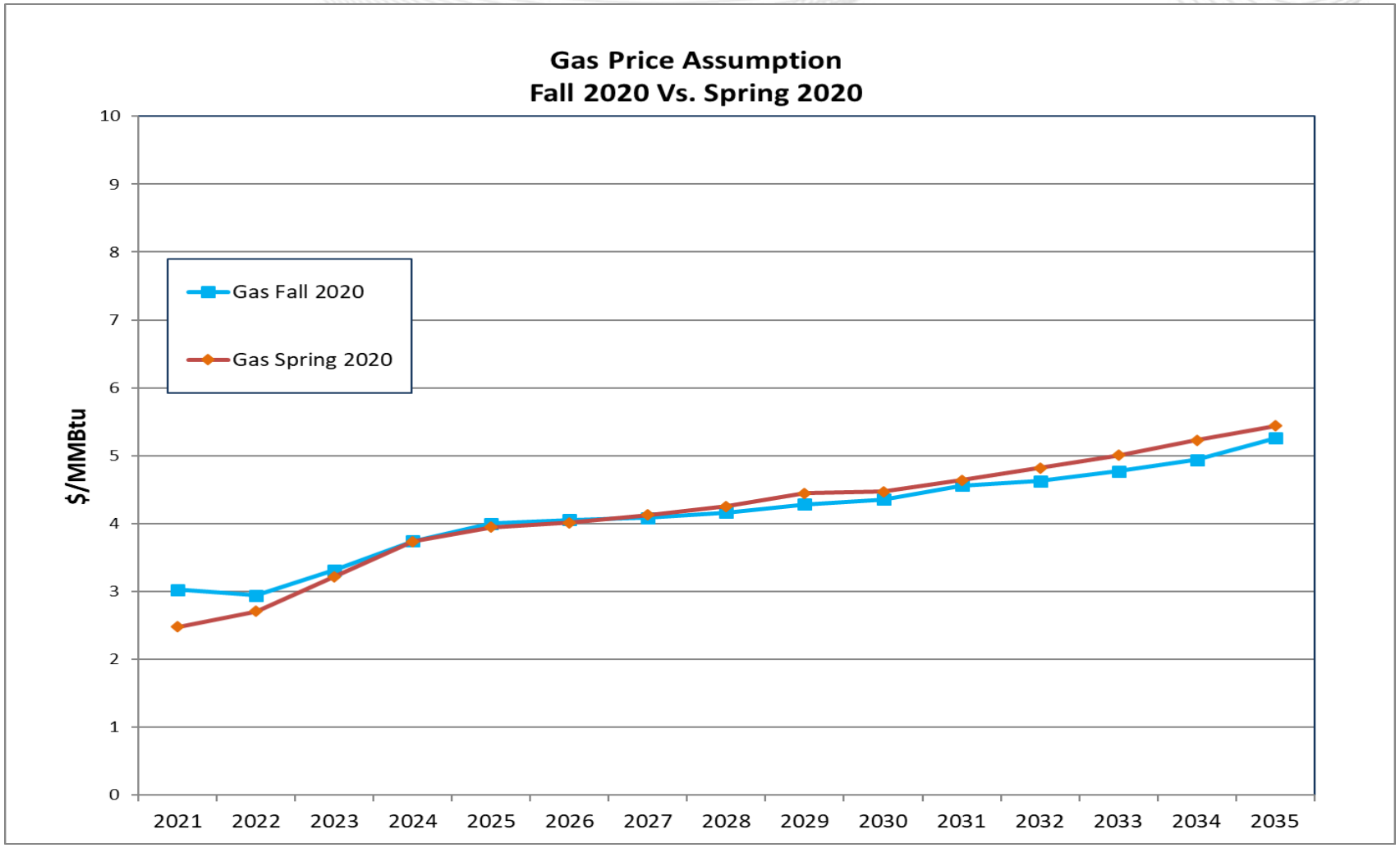
# PJM Peak Demand and Energy Forecast

| Load Forecast | 2021 | 2025 | 2028 | 2031 | 2035 |
|---|---|---|---|---|---|
| Peak (MW) | 149,616 | 153,315 | 156,014 | 157,637 | 159,868 |
| Energy (GWh) | 789,236 | 817,966 | 834,225 | 843,471 | 857,016 |

*Notes:*

1. *Peak and energy values for 2025 onward are from the PJM Load Forecast Report Table B-1 and Table E-1, respectively.*
2. *Peak and energy values for 2021 are from the July 2020 Load Forecast Update.*
3. *Model inputs are at the zonal level. To the extent zonal load shapes create different diversity, modeled PJM peak load may vary.*

# Gas Price Forecast Update




*Note:* *Gas – Annual average Henry Hub price*

# Base Case Updated Preliminary Results - PROMOD Simulated Congestion [1]

| Group** | Correlated Historical Constraints[2] | Congested Area | Type | Historical 2019 Day Ahead Congestion | Historical 2020 Day Ahead Congestion | Simulated 2025 Congestion | Simulated 2028 Congestion |
|---|---|---|---|---|---|---|---|
| 1 | Harwood to Susquehanna 230 kV | PPL[3] (Susq. Group) | Line | $ 6,054,821 | $ 19,448,223 | $ 20,388,443 | $ 16,470,054 |
| 2 | Cumberland to Juniata 230 kV | PPL[3] (Juniata group) | Line | $ 3,516,896 | $ 6,368,984 | $ 6,368,984 | $ 6,368,984 |
| 2 | Dauphin to Juniata 230 kV | | Line | $ - | $ 472,479 | $ - | $ - |
| 2 | Juniata 500/230 kV | | XFRM | $ - | $ 2,883,545 | $ - | $ - |
| 3 | Plymouth Meeting to Whitpain 230 kV | PECO | Line | $ 2,511,244 | $ 3,759,112 | $ 5,767,262 | $ 6,394,857 |
| 4 | Cherry Run to Morgan 138 kV | APS | Line | $ 883,588 | $ - | $ 3,463,430 | $ 4,115,481 |
| 4 | Jct. to French's Mill 138 kV | | Line | $ 116,952 | $ 345,506 | $ 4,966,217 | $ 5,891,888 |
| 4 | Gore to Stonewall 138 kV | | Line | $ 818,902 | $ 177,599 | $ 25,066,669 | $ 35,000,841 |
| 4 | Messick Road to Morgan 138 kV | | Line | $ 263,290 | $ - | $ - | $ - |
| 4 | Messick Road to Ridgeley 138 kV | | Line | $ 1,704,272 | $ 462,027 | $ - | $ - |
| 5 | Kammer North to Natrium 138 kV | AEP | Line | $ 178,984 | $ 36,523 | $ 2,540,399 | $ 12,215,076 |
| 6 | Quad Cities to Rock Creek 345 kV | CE-ALTW | M2M | $ 896,048 | $ 427,688 | $ 6,347,712 | $ 9,005,279 |
| 7 | Muskingum River to Beverly 345 kV | AEP | Line | $ - | $ - | $ 1,086,660 | $ 2,185,014 |
| 8 | Muskingum River to Waterford 345 kV | AEP | Line | $ - | $ - | $ 1,131,018 | $ 1,182,204 |

*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 2025 PROMOD simulated congestion in the same area/group.*

*3) Cumberland – Juniata and Harwood – Susquehanna Congestion drivers may be impacted by DLR (Dynamic Link Rating) projects (expected in-service date 06/01/2021)*

# Base Case Updated Preliminary Results - PROMOD Simulated Congestion [1]

| Group** | Correlated Historical Constraints[2] | Congested Area | Type | Historical 2019 Day Ahead Congestion | Historical 2020 Day Ahead Congestion | Simulated 2025 Congestion | Simulated 2028 Congestion |
|---|---|---|---|---|---|---|---|
| 9 | Maliszewski Transformer 765/138 kV | AEP | Line | $ - | $ - | $ 4,024,754 | $ 5,639,132 |
| 10 | Charlottesville to Proffit Rd Del Pt 230 kV | DOM | Line | $ - | $ 441,875 | $ 2,795,987 | $ 2,920,445 |
| 11 | Brambleton to Evergreen Mills 230 kV | DOM | Line | $ 390,310 | $ - | $ 1,403,659 | $ 7,736,793 |

*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 2025 PROMOD simulated congestion in the same area/group.*

# 2020 Annual Reevaluation of Market Efficiency Projects

# Reevaluation 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 reevaluation is not required for projects that have commenced construction or have received state siting approval.
  - See Appendix A for list of projects with status of In-Service, Under Construction or Cancelled.

- Analysis will utilize the most recent Market Efficiency case available

# Update on Interregional Market Efficiency Project

- The PJM Board approved project b3142 (BT-481), the rebuild of Michigan City to Trail Creek to Bosserman138kV lines, December 3, 2019
  - The approval was conditional on MISO approval of same project

- MISO Project (P18585) approved by MISO Board of Directors on September 17, 2020
  - Project approval was pending the approval of MISO regional cost allocation by FERC, which occurred on July 28, 2020
  - Project Status: **Under Construction**
    - NIPSCO to provide quarterly status reports consistent with MISO Tariff requirements, which will be posted here

# Reevaluation Status and Next Steps

- Reevaluation of projects b2697, b2976, b3145 has been completed
  - All projects pass the 1.25 threshold
  - Results included in Appendix B

- Reevaluation process for 201415_1-9A (b2743.2-8, b2752.1-9) to be completed and results posted by end of the year.

# 2020 Acceleration Analysis

# Acceleration Analysis Process

- Scope
  - Determine which previously approved Reliability upgrades, if any, have an economic benefit if accelerated or modified
- Study Years
  - 2021 and 2025 set of economic input assumptions used to study impacts of approved RTEP projects
- Process
  - Compare market congestion for near term vs. future topology
  - Estimate economic impact of accelerating planned reliability upgrades

# Acceleration Analysis Status

- Work completed
  - Finalized PROMOD modeling for AS-IS and RTEP topology cases
  - Compiled the list of potential candidates from previously approved reliability upgrades
- Complete PROMOD simulations
  - 2021 and 2025 study years with 2021 Topology (AS-IS Topology)
  - 2021 and 2025 study years with 2025 Topology (RTEP Topology)
- Acceleration analysis to be completed by December 2020 and results posted by the end of the year.

# 20/21 Long-Term Window Next Steps

| Step | Timeline |
|---|---|
| Post Preliminary Congestion Drivers | November 2020 |
| Finalize 2020 Reevaluation Analysis | December 2020 |
| Finalize 2020 Acceleration Analysis | December 2020 |
| Post Final Base Case and Target Congestion Drivers | December 2020 |
| Long Term Proposal Window (120 Days) | Opens January 11th 2021 |
| Mid-Cycle Update | February – April 2021 |
| Analysis of Proposed Solutions | May – September 2021 |
| TEAC Reviews and Board Approval | October – December 2021 |

# Dynamic Line Ratings
# Market Efficiency Modeling

DLR technology does not modify the physical characteristics of a line, but rather provides a means for determining instant line ratings more precisely by using specialized sensors that provide a more precise indication of the current ratings.

# DLR Modeling – Market Efficiency

- **Market efficiency base case** uses planning seasonal ratings
  - Summer Normal & Emergency, Winter Normal & Emergency

- **Accounting for DLR in market efficiency base case:**
  - Ratings for lines equipped with DLR devices will be modeled using a *DLR Hourly Rating Modifier* on top of the Planning seasonal ratings
  - The DLR *Hourly Rating Modifier* will be calculated as the forecasted hourly difference between forecasted DLR ratings and ambient-ratings for the DLR line

# Next Steps

- Further information to be shared at future TEAC (Transmission Expansion Advisory Committee) meetings.
- PJM to update congestion drivers as applicable.
- Modeling document to-be posted.

# Appendix A
# Market Efficiency Projects
# In-Service, Under Construction or Cancelled

# In-Service, Under Construction or Cancelled Projects

| PJM Window Project ID | Baseline# | Type | Area | Constraint | Status | ISD | Description |
|---|---|---|---|---|---|---|---|
| 201415_1-2B | b2691 | Upgrade | ME/PPL | Brunner Island to Yorkana 230 kV | IS | 6/12/2017 | Reconductor three spans limiting Brunner Island - Yorkana 230 kV line, add 1 breaker to Brunner Island switchyard, upgrade associated terminal equipment |
| 201415_1-4J | b2698 | Upgrade | AEP | Jacksons Ferry to Cloverdale 765 KV | IS | 12/8/2017 | Replace relays at Cloverdale and Jackson's Ferry substations |
| 201415_1-10B | b2693 | Upgrade | COMED | Wayne to South Elgin 138 kV | IS | 11/1/2018 | Replace L7915 B phase line trap at Wayne substation |
| 201415_1-10D | b2728 | Upgrade | COMED | Loretto to Wilton 345 kV (RPM) | IS | 12/22/2017 | Mitigate sag limitations on Loretto - Wilton Center 345 kV Line and replace station conductor at Wilton Center |
| 201415_1-12A | b2689.1-3 | Upgrade | DUQ | Dravosburg to West Mifflin 138 kV | IS | 1: 3/2/2018<br>2: 6/8/2018<br>3: 12/6/2017 | Reconductor ~7 miles of the Woodville - Peters 138 kV circuit. Reconfigure West Mifflin-USS Clairton 138 kV circuit. Upgrade terminal equipment |
| 201415_1-13E | b2695 | Upgrade | DPL | Worcester to Ocean Pines (I) 69 kV | IS | 12/31/2017 | Rebuild Worcester - Ocean Pine 69 kV ckt. 1 |
| 201415_1-18G | b2688.1-3 | Upgrade | APS | Taneytown to Carroll 138 kV | IS | 1: 10/5/2018<br>2: 4/18/2018<br>3: 5/25/2018 | Upgrade terminal equipment on the Lincoln - Carroll 115/138kV path. |
| 201415_1-2A | b2690 | Upgrade | PPL/BGE | Safe Harbor to Graceton 230 kV | IS | 10/18/2017 | Reconductor two spans of the Graceton - Safe Harbor 230 kV transmission line |
| 201415_1-18I | b2696 | Upgrade | APS/ATSI | Krendale to Shanor Manor 138 kV | IS | 12/10/2018 | Upgrade 138 kV substation equipment at Butler, Shanor Manor and Krendale substations |
| 201415_1-10J | b2692.1-2 | Upgrade | COMED | Cordova to Nelson 345 kV | IS | 5/8/2019 | Replace station equipment at Nelson, ESS H-471 and Quad Cities. Upgrade conductor ratings of Cordova - Nelson, Quad Cities - ESS H-471 and ESS H-471 - Nelson 345 kV lines and mitigating sag limitations |

# In-Service, Under Construction or Cancelled Projects, cont.

| PJM Window Project ID | Baseline# | Type | Area | Constraint | Status | ISD | Description |
|---|---|---|---|---|---|---|---|
| 201415_1-11H | b2694 | Upgrade | PECO | Peach Bottom 500 kV | IS | 4/1/2019 | Increase ratings of Peach Bottom 500/230 kV transformer |
| Optimal Caps | b2729 | Upgrade | DOM | AP-South | IS | 1/30/2020 | New capacitor banks at Brambleton, Ashburn, Shelhorn and Liberty substations |
| 201617_1-3A | b2930 AC1-223 | Upgrade | COMED | E. Frankfort to University Park 345 kV | CANC | Cancelled | Upgrade capacity on E. Frankford-University Park 345kV |
| 201617_1-3B | b2931 (RPM) | Upgrade | COMED | Pontiac to Brokaw 345 kV | UC | 6/1/2021 | Upgrade substation equipment at Pontiac Midpoint station |
| 201617_1-5E | b2992.1-4 | Upgrade | BGE | Conastone - Graceton - Bagley 230 kV | UC | 6/1/2021 | Reconductor the Conastone to Graceton 230 kV 2323 & 2324 circuits. Add Bundle conductor on the Graceton-Bagley-Raphael Road 2305 & 2313 230kV circuits. Reconductor Raphael Road - Northeast 2315 & 2337 circuits. |
| 201819_BT_481 | b3142 | Upgrade | NIPSCO | Michigan City – Trail Creek - Bosserman 138 kV | UC | 01/01/2023 | Rebuild Michigan City-Trail Creek - Bosserman 138 kV (10.7 mi) |

IS – In-service
UC – Under Construction
CANC - Canceled

# Appendix B
# 2020 Reevaluation Results
# Proposals b2697, b2976, b3145

# Reevaluation Results b2697, b2976, b3145

- Overview
  - Projects with capital cost under $20 million are reevaluated using the original benefits* and updated capital costs.
- 2020 Reevaluation B/C ratios for b2697, b2976, b3145

| PJM Window Project ID | Baseline# | Type | Area | Constraint | Initial Capital Cost ($ million) | Initial B/C Ratio | Current Status | Projected ISD | Updated Capital Cost** | 2020 Reevaluation B/C Ratio |
|---|---|---|---|---|---|---|---|---|---|---|
| 201415_1-4I | b2697.1-2 | Upgrade | AEP | Fieldale to Thornton 138 kV | $0.75 | 101.19 | EP | 1: 10/01/2020<br>2: 06/03/2021 | $2.70 | 28.11 |
| 201617_1A_RPM_DEOK | b2976 | Upgrade | DEOK | Tanners Creek to Dearborn 345 kV | $0.60 | 151.61 | EP | 3/4/2021 | $0.60 | 151.61 |
| 201819_HL_622 | b3145 | Upgrade | METED | Hunterstown to Lincoln 115 kV | $7.21 | 59.45 | EP | 6/1/2023 | $7.21 | 59.45 |

*Original benefits are the benefits that were determined when the projects were initially approved
**Capital costs updated as of 11/23/2020

# Contact

Facilitator:
Sue Glatz,
Suzanne.Glatz@pjm.com

Secretary:
Ilyana Dropkin,
Ilyana.Dropkin@pjm.com

SME/Presenter:
Nick Dumitriu,
Nicolae.Dumitriu@pjm.com

**Market Efficiency Update**

Member Hotline

(610) 666 – 8980

(866) 400 – 8980

custsvc@pjm.com

# Revision History

- V1 – 11/25/2020 – Original slides posted