Transmission Expansion Advisory Committee
Market Efficiency Update

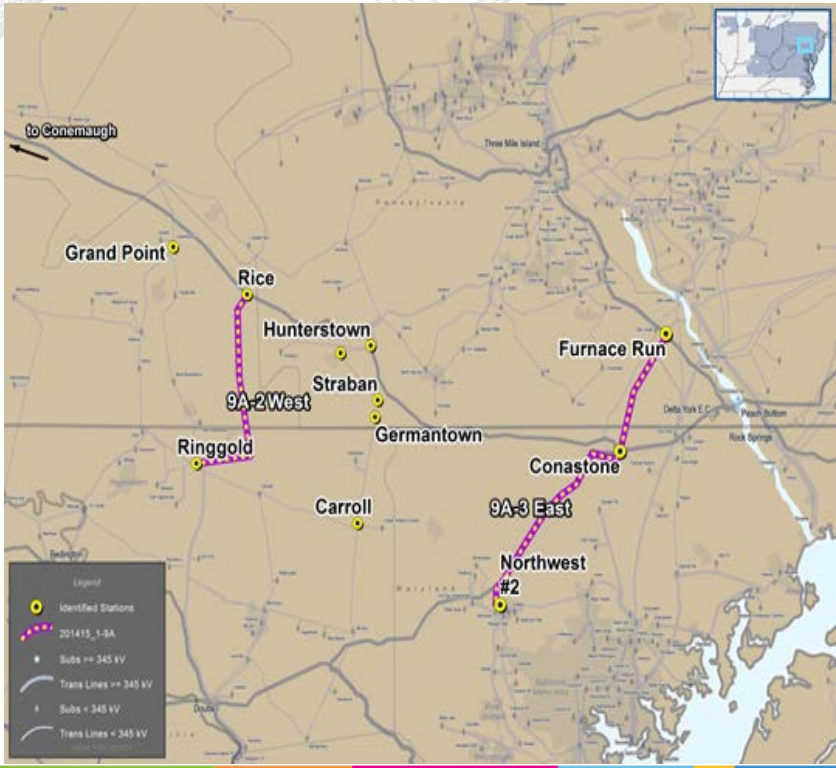
June 09, 2016

Market Efficiency 2014/15 Long Term Proposal Window Update

Final ApSouth Market Efficiency Project Recommendation

Project 9A (Without Capacitors)

- Tap the Conemaugh - Hunterstown 500 kV line and build new 230 kV double circuit line between Rice and Ringgold.
- Build new 230 kV double circuit line between Furnace Run and Conastone.
- Rebuild of the Conastone - Northwest 230 kV line.
- Replace the Ringgold #3 and #4 transformers with 230/138 kV autotransformers
- Ringgold bus reconfiguration
- Reconductor of Ringgold-Catoctin 138 kV.
- Cost ($M): $340.6
- IS Date: 2020
- Recommendation at August PJM Board meeting



Recommended Project Designated Entities

Component Description	Designated Entity
Project 9A (Without Capacitors)	
Tap the Conemaugh - Hunterstown 500 kV line & create new Rice 500 kV & 230 kV stations. Install two 500/230 kV transformers.	Transource Energy, LLC
Build new 230 kV double circuit line between Rice and Ringgold.	Transource Energy, LLC
Tap the Peach Bottom – TMI 500 kV line & create new Furnace Run 500 kV & 230 kV stations. Install two 500/230 kV transformers.	Transource Energy, LLC
Build new 230 kV double circuit line between Furnace Run and Conastone.	Transource Energy, LLC
Rebuild the Conastone - Northwest 230 kV line.	Baltimore Gas & Electric
Additional Reliability Upgrades	
Replace the Ringgold #3 and #4 230/138 kV transformers.	Allegheny Power
Ringgold bus reconfiguration.	Allegheny Power
Rebuild/reconductor the Ringgold-Catoctin 138 kV & replace terminal equipment at both ends of the circuit.	Allegheny Power

Additional Analysis from ApSouth studies

- Additional sensitivity on project 9A using lower gas prices (-$2)
  - B/C ratio= 4.9
  - 9A project continues to provide significant ApSouth congestion savings.
- Additional incremental simulations conducted with project 9A included in base case
  - Competitive projects no longer passed B/C test

Market Efficiency 2016/17 Long Term Proposal Window Update

2015 Historical Market Congestion

- Total market congestion for 2015 about $1385.3 million
- Top 20 congestion causing events account for about 53.4% of total congestion
- Future RTEP upgrades will help reduce congestion associated with most 2015 historical constraints

2015 Historical Market Congestion – Top 20 Congestion Causing Constraints

Rank	Constraint	Type	Location	Approximate total Market Congestion ($)*	% of Total Congestion*	Comment
1	Conastone - Northwest	Line	BGE	$108.80	7.9%	RTEP upgrades expected to reduce congestion (B0497, B1016, B1251). Partial congestion is outage related (work on BAGLEY-GRACETON).
2	Bagley - Graceton	Line	BGE	$107.90	7.8%	RTEP upgrades expected to reduce congestion (B0497, B1016, B1251).
3	5004/5005 Interface	Interface	500	$89.00	6.4%	West - East Transfers.
4	Bedington - Black Oak	Interface	500	$87.60	6.3%	West - East Transfers.; Future reactive upgrades expected to reduce congestion.
5	Cherry Valley TX	Flowgate	MISO	$79.60	5.7%	Market to Market Congestion. Partial congestion is outage related (work on 156 CHERRY 45TR81 CT).
6	AP South	Interface	500	$56.20	4.1%	West - East Transfers; Future reactive upgrades expected to reduce congestion
7	AEP - DOM	Interface	500	$52.40	3.8%	West - East Transfers; Future reactive upgrades expected to reduce congestion.
8	Joshua Falls	Transformer	AEP	$44.00	3.2%	
9	Bergen - New Milford	Line	PSEG	($43.50)	-3.10%	Congestion is outage related (work on ESSEX-KEARNY, BERGEN-SADDLEBR). Existing PSEG upgrades expected to alleviate future congestion.
10	Person - Halifax	Flowgate	MISO	$40.00	2.9%	Market to Market Congestion.

**Data from 2015 Market Analytics State of Market Report*

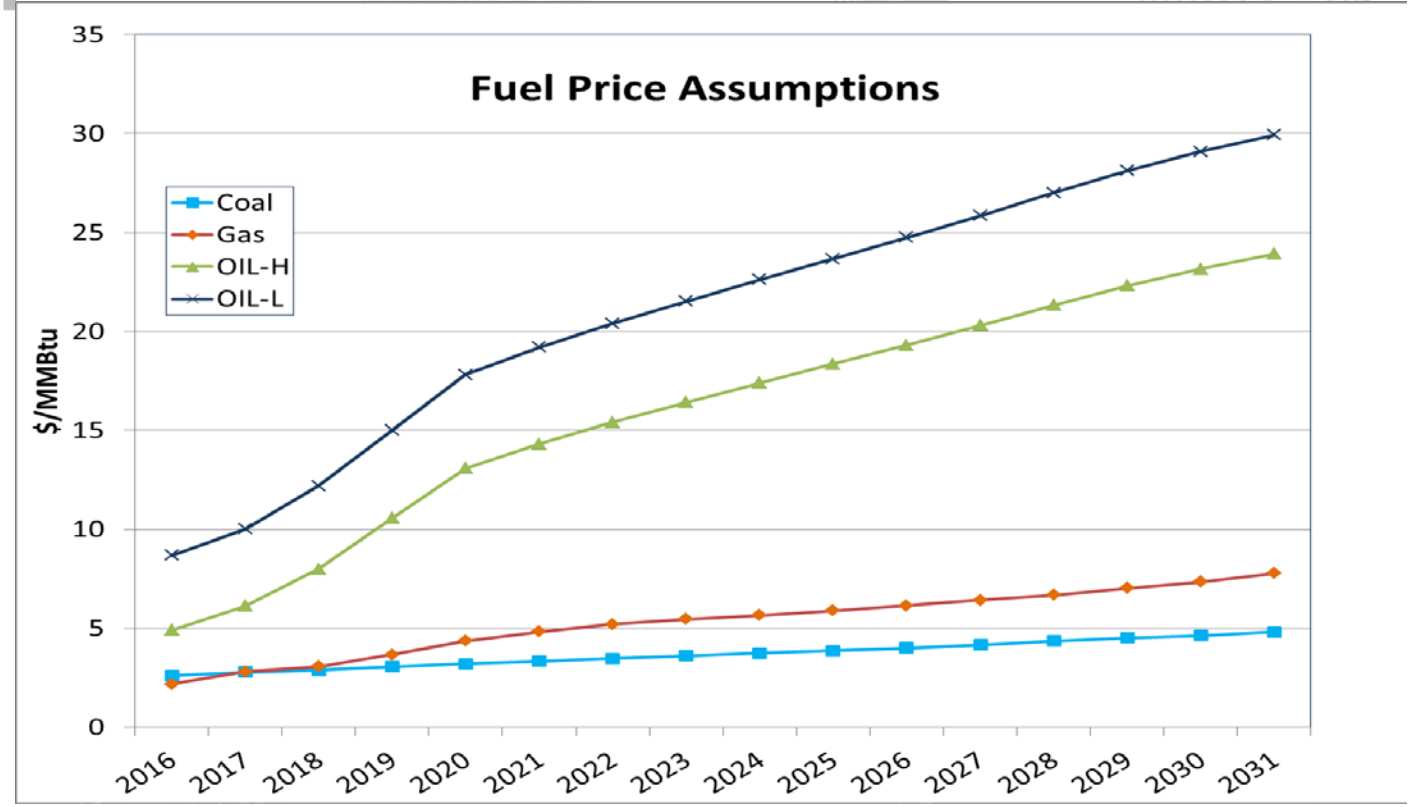
2015 Historical Market Congestion – Top 20 Congestion Causing Constraints

Rank	Constraint	Type	Location	Approximate total Market Congestion ($)*	% of Total Congestion*	Comment
11	Maywood - Saddlebrook	Line	PSEG	($23.40)	-1.70%	Congestion is outage related (work on BERGEN-SADDLEBR). Existing PSEG upgrades expected to alleviate future congestion.
12	East	Interface	500	$22.60	1.6%	West - East Transfers.
13	Easton	Transformer	DPL	$21.90	1.6%	Congestion is outage related (work on IBCORN-PRICE).
14	Glenarm - Windy Edge	Line	BGE	$20.50	1.5%	
15	Oak Grove - Galesburg	Flowgate	MISO	$19.70	1.4%	Market to Market Congestion.
16	Mahans Lane - Tidd	Line	AEP	$19.60	1.4%	Partial congestion is outage related (work on COLLIER-TIDD). RTEP upgrade expected to reduce future congestion (b2445).
17	East Danville - Banister	Line	AEP	$19.10	1.4%	RTEP upgrade expected to reduce congestion (b2375).
18	49th Street - Hoboken	Line	PSEG	($18.80)	-1.40%	Congestion is outage related (work on ESSEX-KEARNY, BERGEN-SADDLEBR). Existing PSEG upgrades expected to alleviate future congestion.
19	BCPEP	Interface	Pepco	$18.40	1.3%	RTEP upgrades expected to reduce future congestion (B2443, B2443.3).
20	Braidwood - East Frankfort	Line	ComEd	$18.10	1.3%	Market to Market Congestion. Partial congestion is outage related (work on CHERRY 45TR81 CT).

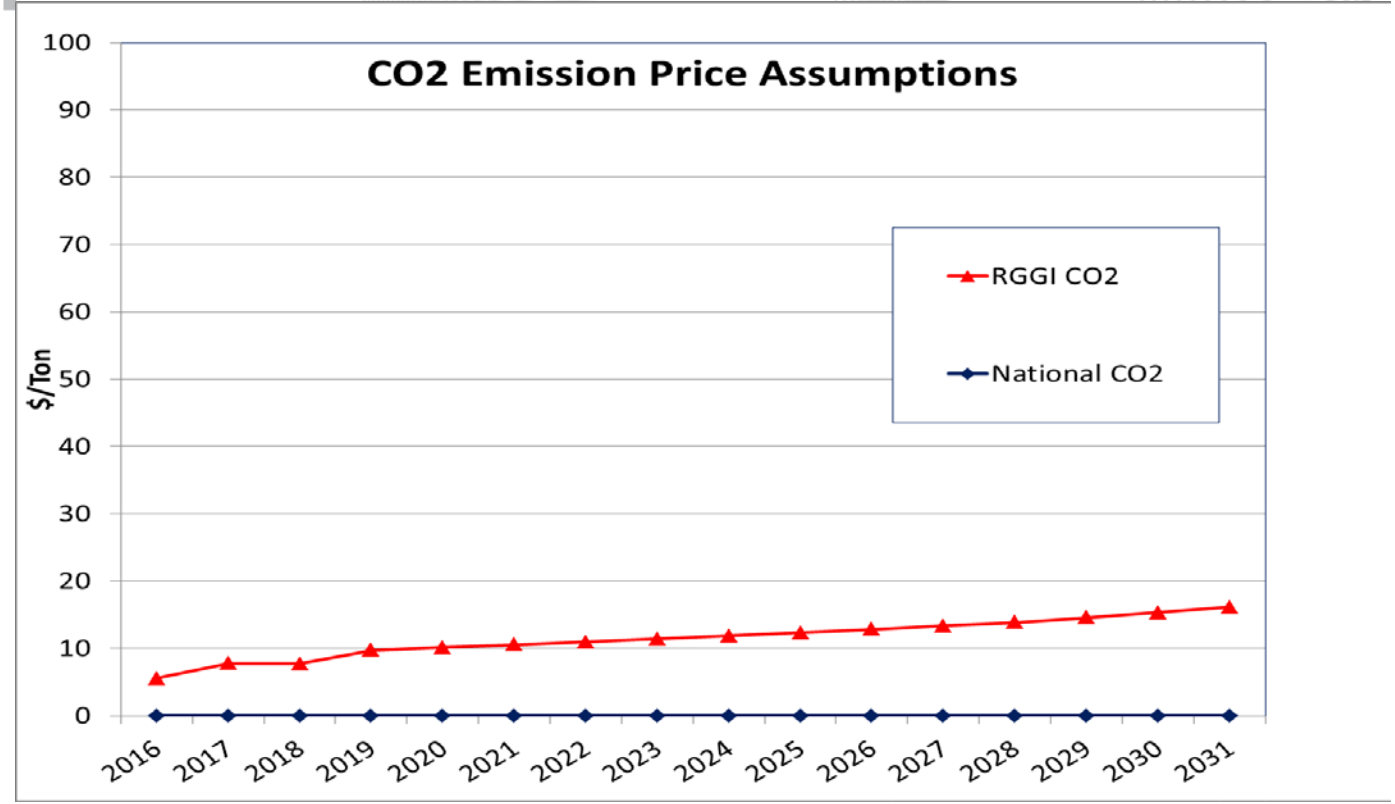
Top 20	$739.70
Total Congestion	$1,385.3

**Data from 2015 Market Monitor*

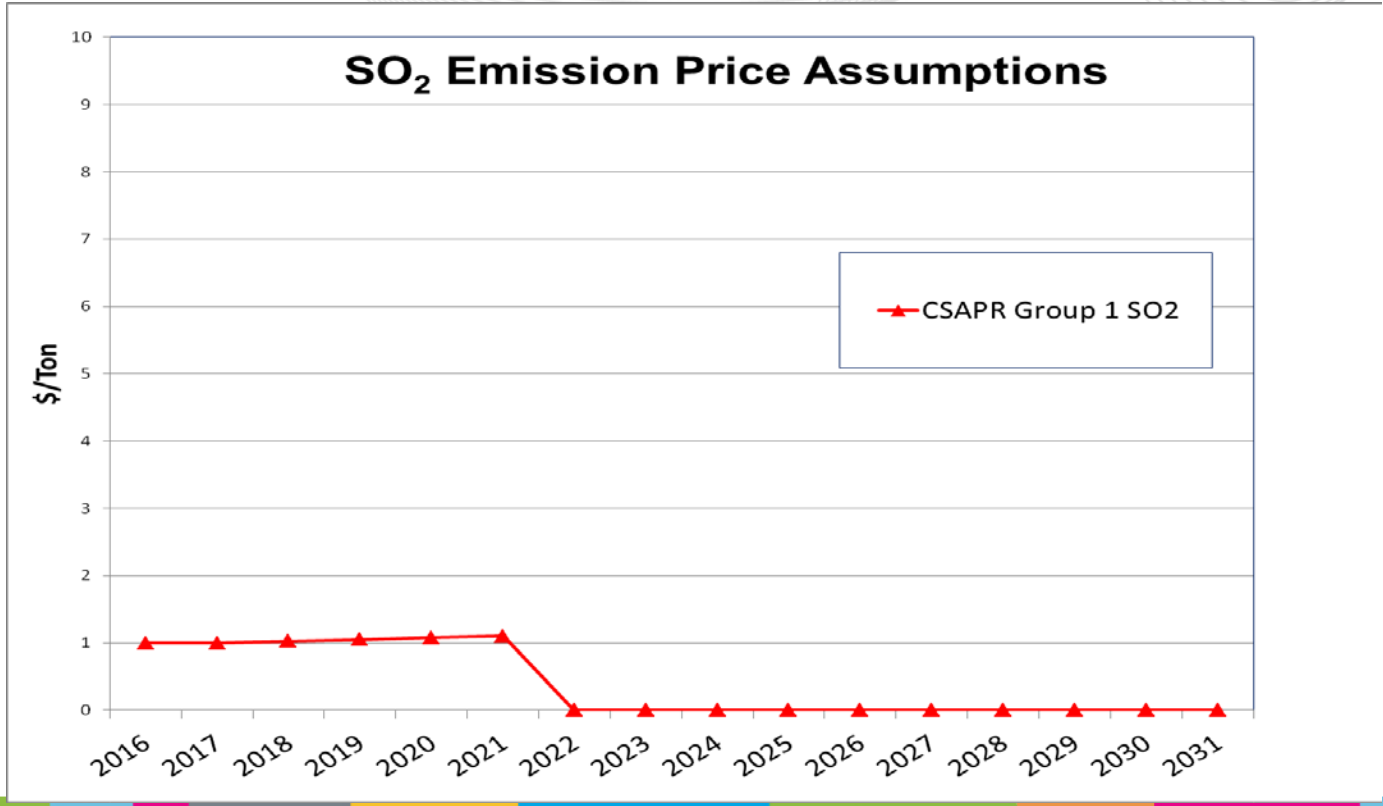
Fuel Price Assumptions



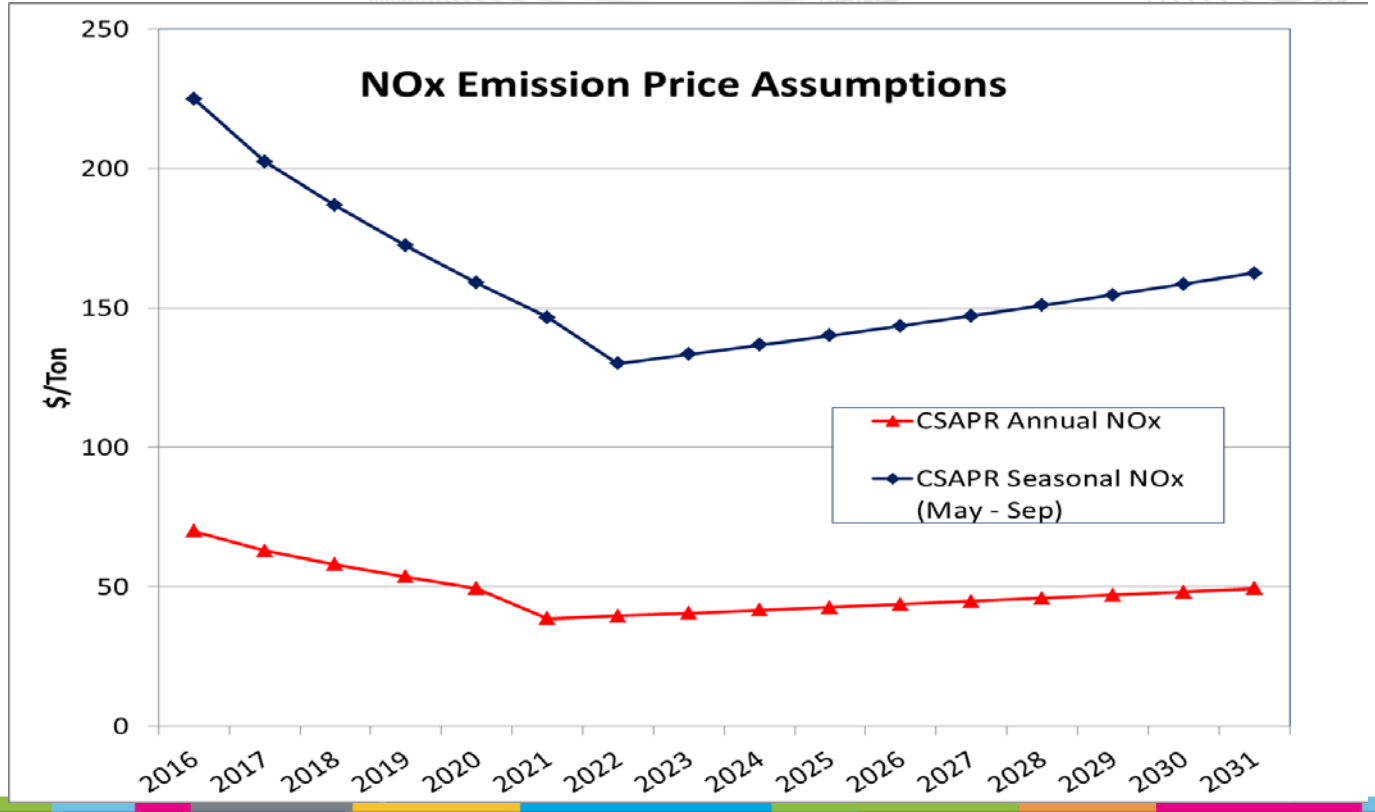
Emission Price Assumptions – CO2



Emission Price Assumptions – SO2



Emission Price Assumptions – NOx



Load & Energy Input Data

2016 PJM Peak Load and Energy Forecast

Load	2017	2021	2024	2027	2031
Peak (MW)	154,149	157,358	159,991	162,988	167,469
Energy (GWh)	821,812	843,262	862,838	879,605	906,168

Notes: 1.) Peak and energy values from PJM Load Forecast Report Table B-1 and Table E-1, respectively.

2.) Model inputs are at the zonal level, to the extent zonal load shapes create different diversity - modeled PJM peak load may vary.

Demand Resource Input Data

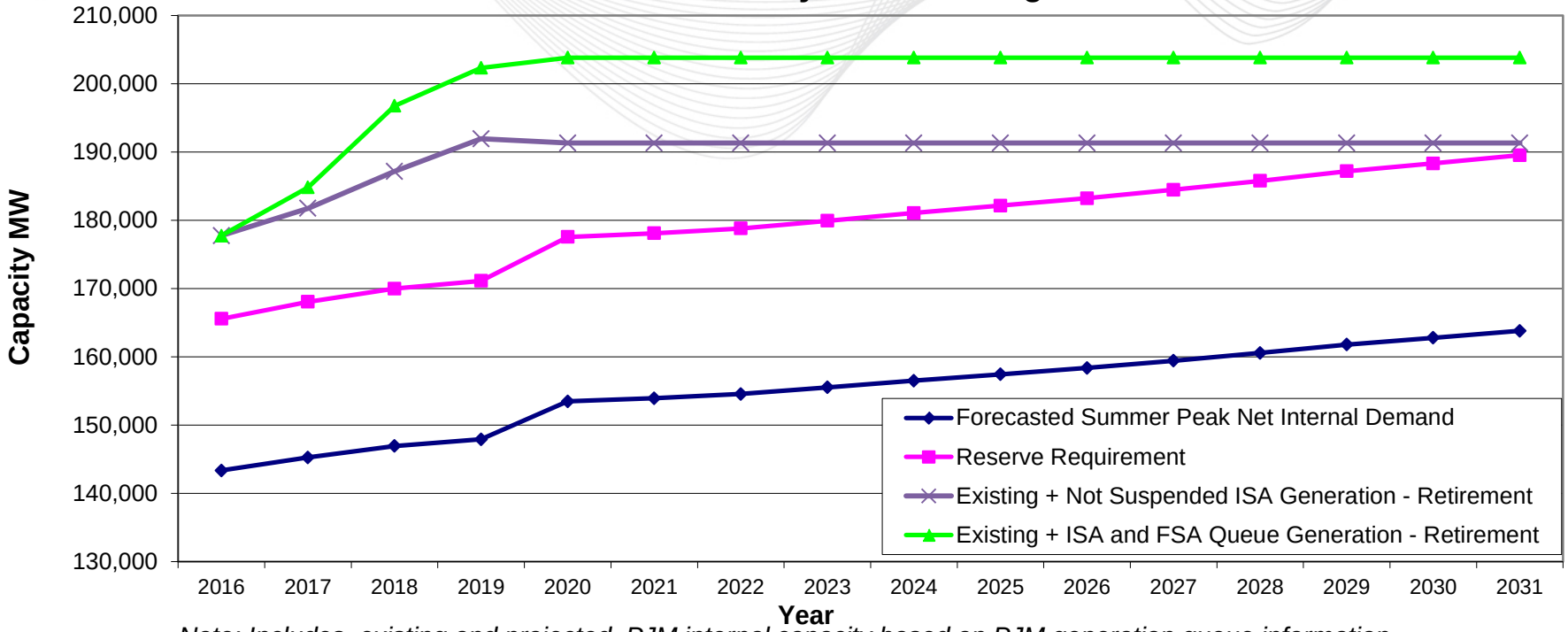
Model zonal demand resources consistent with Table B-7 of the 2016 Load Forecast Report.

2016 PJM Demand Resource Forecast

	2017	2021	2024	2027	2031
Demand Resource (MW)	8,883	3,424	3,478	3,543	3,651

Future Generation

PJM Market Efficiency Reserve Margin



Note: Includes existing and projected PJM internal capacity based on PJM generation queue information. Model informed by 2021 RTEP machines list.

Carrying Charge Rate and Discount Rate

- Discount rate and levelized carrying charge rate developed using information contained in TO Formula Rate sheets (Attachment H) [1]

- Discount rate based on weighted average after-tax embedded cost of capital

  Discount rate = 7.4%

- Levelized annual carrying charge rate based on weighted average net plant carrying charge levelized over an assumed 45 year life of project

  Levelized Annual Carrying Charge Rate = 15.3%

[1] http://www.pjm.com/markets-and-operations/billing-settlements-and-credit/formula-rates.aspx

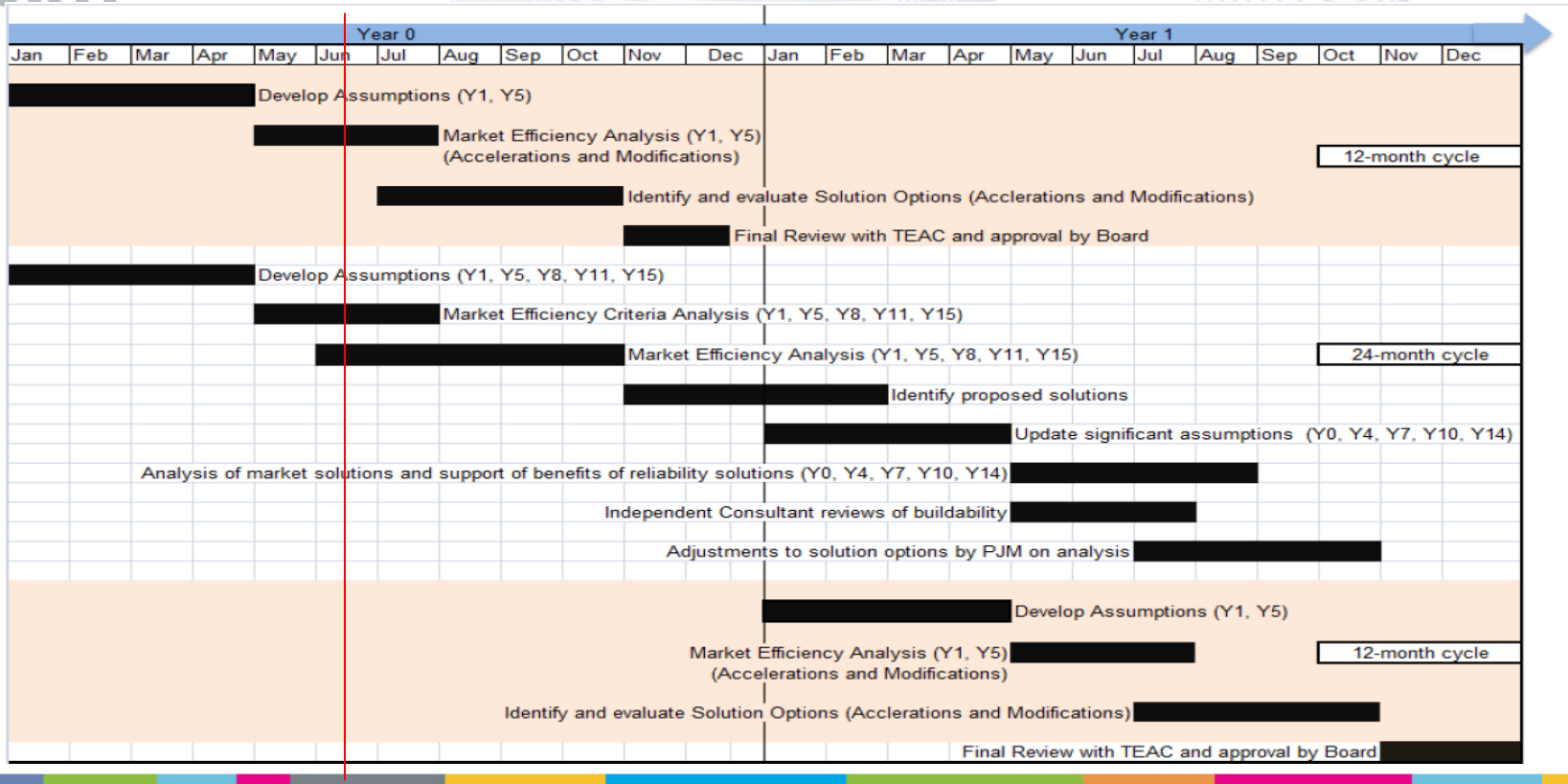
Market Efficiency Data Posting

- Market Efficiency Web Page located at
  http://www.pjm.com/planning/rtep-development/market-efficiency.aspx

- PJM will post Market Efficiency Case Files for all study years
  - Access requires CEII confirmation (PJM and MISO)
  - Access requires Vendor (Ventyx) confirmation
  - No confidential data provided or used in analysis (i.e. actual bid data)
  - XML Format

- Reference Files
  - Input Assumptions Summary
  - Updated Modeling Document will provide details of setup and modeling methods

Market Efficiency Timeline



2016-2017 24-Month Market Efficiency Cycle Timeline

- Long Term proposal window: November 2016 - February 2017
- Analysis of proposed solutions: March 2017 - November 2017
- Determination of Final projects: December 2017

Next Steps

Finalize Market Efficiency Inputs	June
Market Efficiency Preliminary Results:	July
Post Market Efficiency Base Scenarios:	July
Stakeholder feedback on model:	August-September
PJM review for acceleration candidates:	August-October
Proposal window opens:	November

Questions?

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