

Transmission Expansion Advisory Committee Meeting

2014 Market Efficiency Analysis Input Assumptions

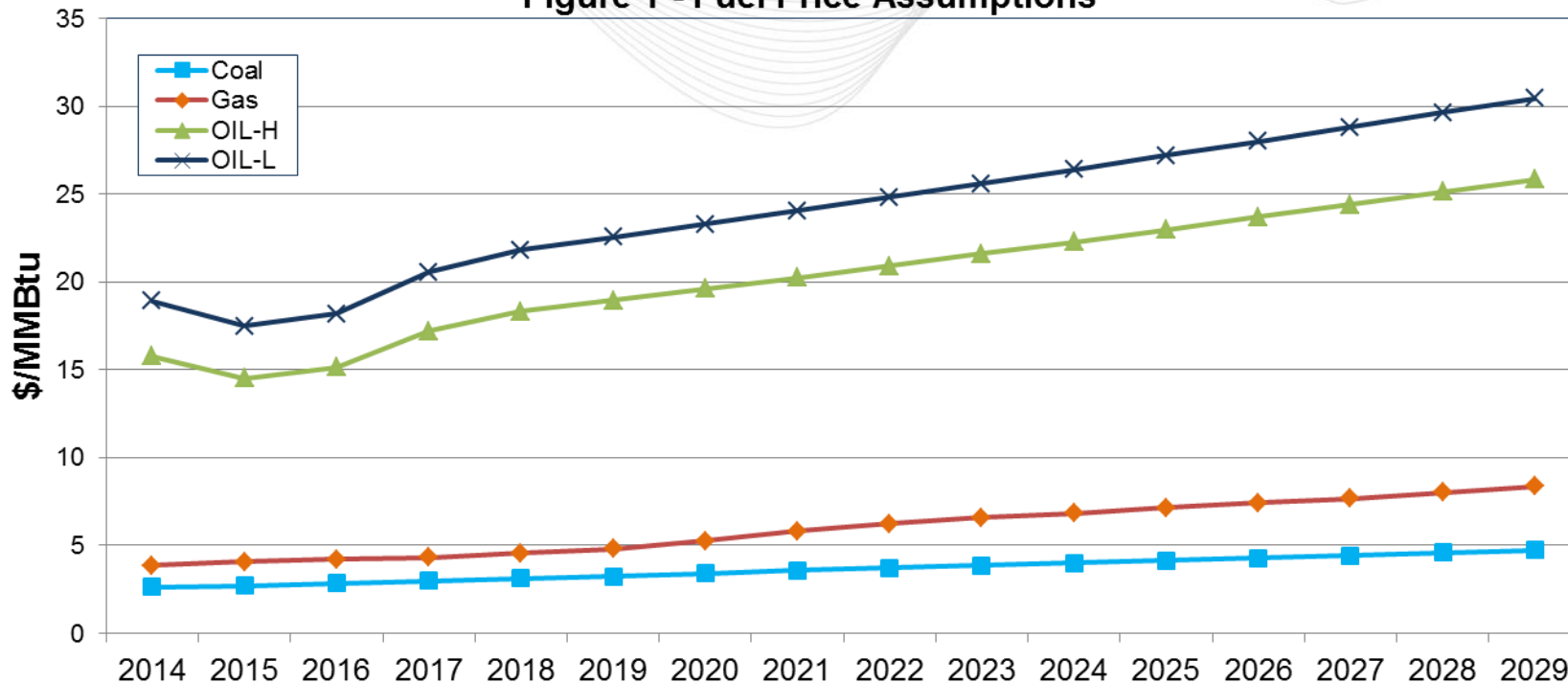
April 10, 2014

- Study Years
 - 2015 and 2019 to study approved RTEP projects for accelerations and modifications
 - 2015, 2019, 2022, 2025, and 2029 to study new system enhancements
 - Underlying input data based on February 2014 NERC 9.7 PROMOD IV Powerbase Data Release
 - 2014 update to loads, generation, demand resources, emissions, and fuels
 - Simulations performed using PROMOD IV v11.1 engine

- Power flow Models
 - 2014/2015 PJM and external world topology based on the 2015 summer peak case from the 2013 ERAG MMWG series
 - Any significant upgrades will be included/excluded based on simulation year
 - 2019 and later PJM topology will be based on the 2014 RTEP 2019 Summer Topology case
 - External World representation will be developed in coordination with the Interregional Planning group
 - PJM Topology will include all upgrades through February 2014 PJM board approvals

- Fuel prices
- Load and energy
- Demand resource
- Future generation
- Emissions price
- Transmission constraints
- Carrying charge rate and discount rate

Figure 1 - Fuel Price Assumptions



- PJM zonal peak and zonal energy forecast from 2014 Load Forecast Report – February Revision

Table 1 - PJM Peak Load and Energy Forecast

| Load | 2014 | 2015 | 2019 | 2022 | 2025 | 2029 |
|--------------|---------|---------|---------|---------|---------|---------|
| Peak (MW) | 156,757 | 159,574 | 165,982 | 170,299 | 174,164 | 179,099 |
| Energy (GWh) | 814,051 | 827,267 | 851,634 | 872,650 | 884,557 | 902,890 |

Notes: 1.) Unrestricted peak load and energy reduced by energy efficiency.

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

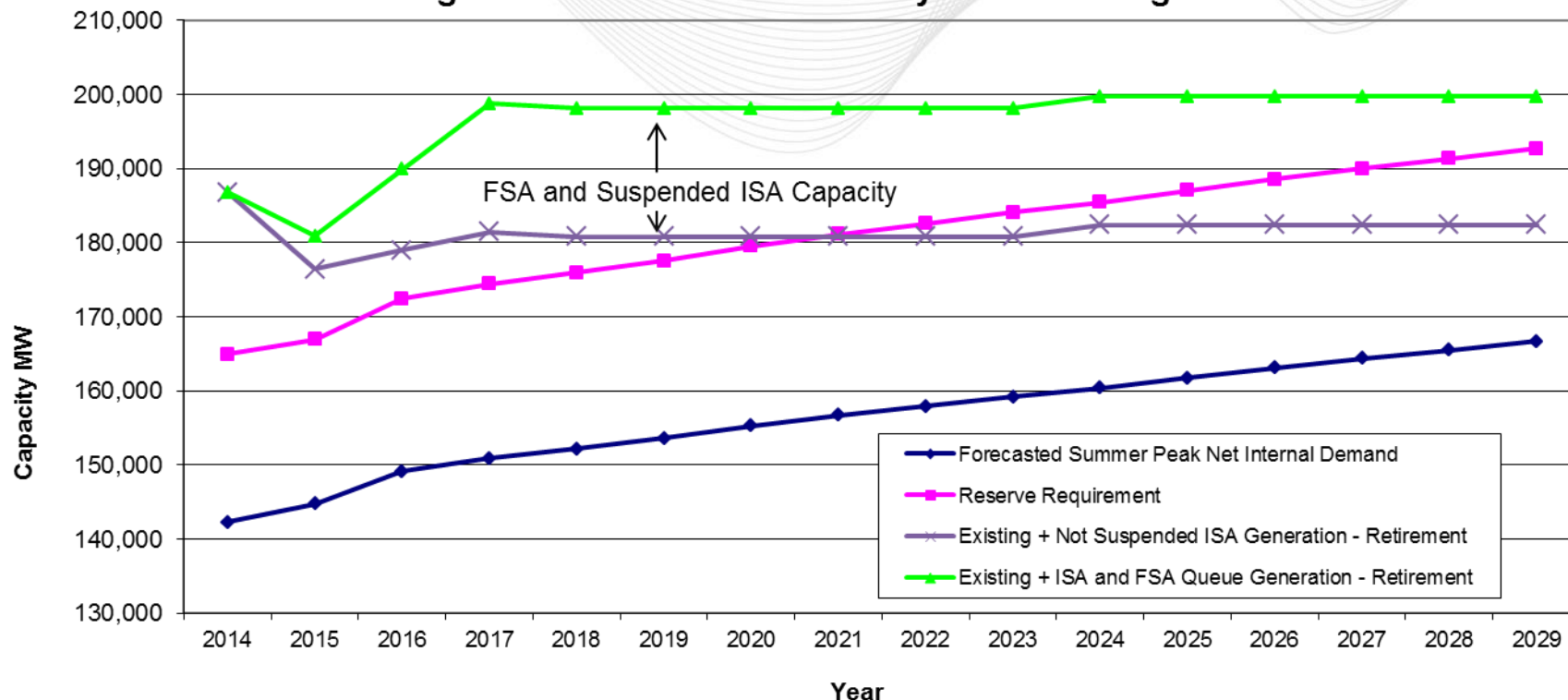
3.) Unrestricted energy values from Load Forecast Report Table E-1a.

- Model zonal demand resources consistent with Table B-7 of the 2014 Load Forecast Report.

Table 2 - Forecast PJM Demand Resources

| | 2014 | 2015 | 2019 | 2022 | 2025 | 2029 |
|----------------------|--------|--------|--------|--------|--------|--------|
| Demand Resource (MW) | 14,442 | 14,812 | 12,402 | 12,402 | 12,402 | 12,402 |

Figure 2 - PJM Market Efficiency Reserve Margin



- Generation included in Market Efficiency models include all ISAs and FSAs
- Machine list posted at February TEAC
 - <http://www.pjm.com/~media/committees-groups/committees/teac/20140206/20140206-2014-rtep-machine-list.ashx>
- Future generation not included is the same as reliability as described at February TEAC

- SO₂ emission price set to zero for all study years
 - CSAPR vacated in 2012.
 - CAIR rules in place, less stringent requirement
- Annual and Seasonal NO_x prices
 - CAIR rules in place, less stringent requirement
 - See Figure 3
- National CO₂ emission price set to zero for all study years
 - Reflects the stalled federal legislation regarding greenhouse gases and CO₂
- RGGI State (MD, DE) CO₂ emission price non-zero for all study years
 - See Figure 4

Figure 3 - NOx Emission Price Assumptions

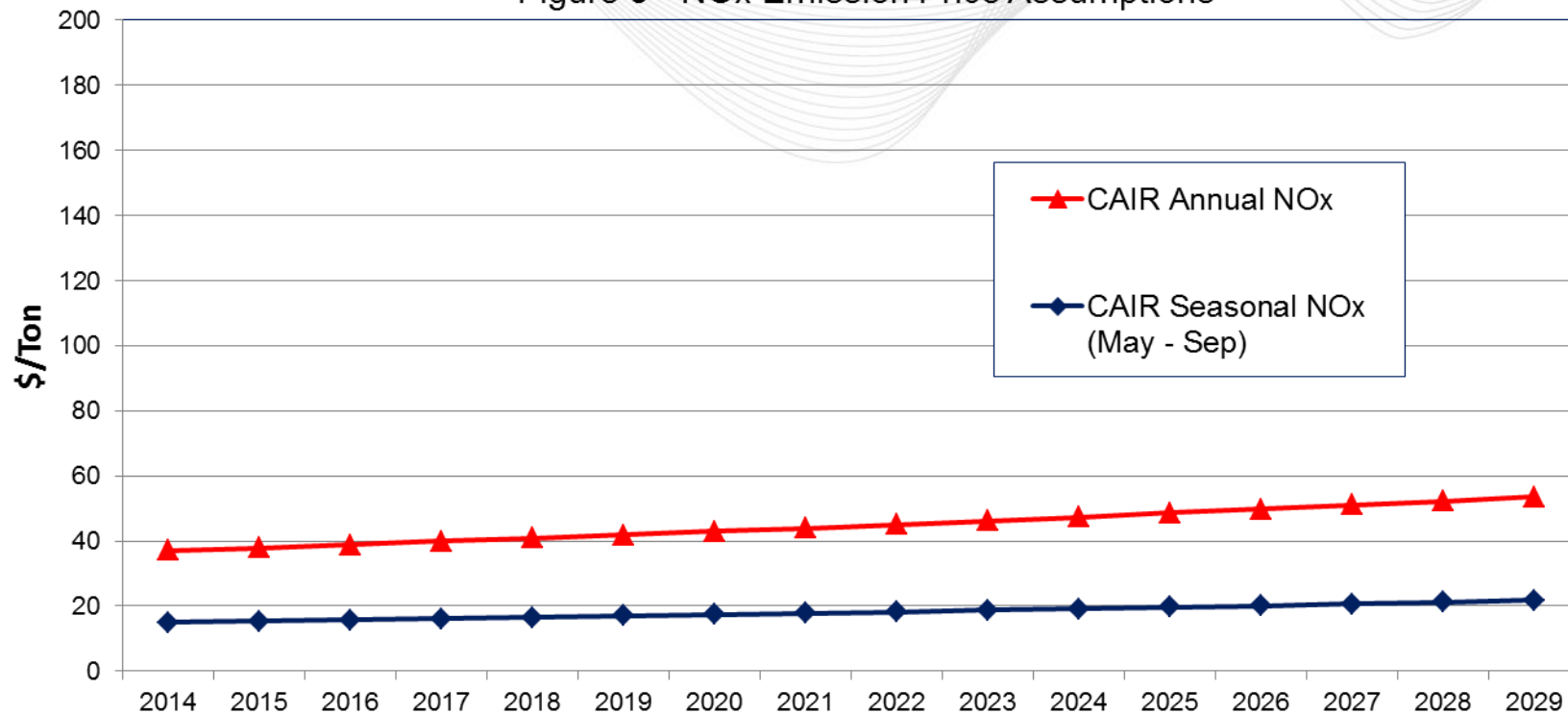
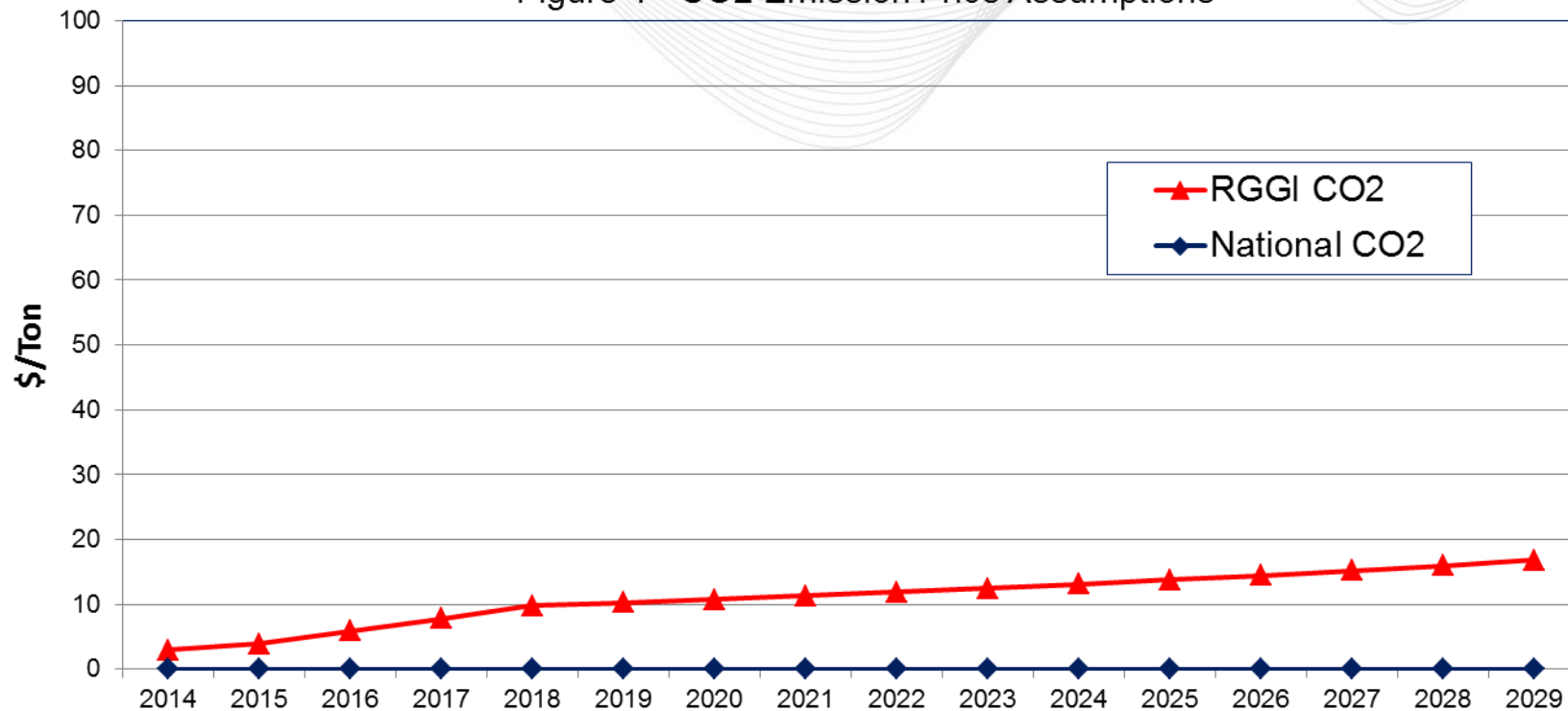


Figure 4 - CO2 Emission Price Assumptions



- Thermal Constraints
 - NERC Book of Flowgates
 - Planning study results for monitored facilities and monitored/contingency pair facilities
 - Historical PJM congestion events
- Voltage Constraints
 - PJM reactive interface limits
 - MW limits based on historical values and voltage stability analysis
 - RTEP upgrades impact future reactive interface limits

- 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 ^[2]
Discount rate = 7.8%
- Levelized annual carrying charge rate based on weighted average net plant carrying charge levelized over an assumed 45 year life of project ^[3]
Levelized Annual Carrying Charge Rate = 16.2%

[1] <http://pjm.com/markets-and-operations/transmission-service/formula-rates.aspx>

[2] Average weighted by TO total capitalization

[3] Average weighted by Total Transmission Plant In service included in PJM Tariff

Market Efficiency Training:

- Discuss Market Efficiency process/timeline
- Benefit/Cost Calculation

April 17 (10am-2pm)

Board Review of Market Efficiency Input Assumptions

May

Market Efficiency Preliminary Results:

- Stakeholder feedback on model:
- PJM review for acceleration candidates:
- Proposal window opens:

June

June-September

June-September

November