

FTR Credit Requirements

Prevailing Flow Paths Affected by Transmission System Upgrades



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- FTR credit requirements for prevailing paths are currently based on the weighted historical congestion on those paths for the past three years.
- Transmission system upgrades may decrease future congestion thus decreasing the value of primarily prevailing flow FTRs in the vicinity of the transmission system upgrade.
- PJM's FTR bid and cleared credit requirements should incorporate consideration of the projected congestion impact to FTRs of major transmission system upgrades, in order to mitigate the associated default exposure to PJM's members.

PJM is proposing to use results from PJM's PROMOD model simulations of major transmission system upgrades, applied to historical path congestion amounts, to establish FTR bid and cleared credit requirements for paths whose congestion levels are projected to be negatively impacted by modeled transmission system changes effective for any portion of the FTR's term.

The Credit Subcommittee has endorsed the proposal with 72% in support and 68% indicating preference for the proposal over the status quo. 117 Members representing all sectors participated in the poll.

- The fundamental credit calculation framework would not change.
- FTR credit requirements would continue to be based on FTR price, historical path congestion amounts, and any applicable undiversified adder(s) for all FTRs on both prevailing flow and counterflow paths
 - FTRs that are not negatively affected by a modeled transmission system change would continue to utilize actual historical values
 - FTRs that are negatively affected by a modeled transmission system change would utilize an adjusted historical value in the calculation
 - The historical congestion value used for each path would be the actual historic value adjusted for any PROMOD-calculated reduction in congestion value

- Criterion for upgrades for which PROMOD congestion simulations would be run:
 - Transmission upgrades, individually or as a cluster, having 10% or more impact on the congestion on any individual constraint or cluster of constraints with current congestion of \$5MM or more (“low frequency-high impact”)
- For 2017/2018, only 3 of the 22 transmission system upgrades met this criterion
 - Rebuild existing Graceton-Bagley 230kV single line to double circuit 230kV line
 - Rebuild existing Bagley-Raphael Road 230kV single line to double circuit 230kV line
 - Construct a new Byron-Wayne 345kV circuit

Example – Paths Affected by Sample Upgrade

| Affected Paths | Actual Historical Congestion (A) | PROMOD Congestion Change (B) | Adjusted Congestion From Simulation C = (A - B) | Adjusted Congestion Used in New Credit Requirement D = lower of A or C |
|----------------|----------------------------------|------------------------------|---|--|
| Path A | \$16,548 | (\$9,930) | \$6,618 | \$6,618 |
| Path B | (\$17,430) | \$2,209 | (\$15,521) ⁽¹⁾ | (\$17,430) ⁽¹⁾ |
| Path C | \$89,157 | (\$16,362) | \$72,795 | \$72,795 |
| Path D | (\$882) | (\$7,722) | (\$8,604) | (\$8,604) |

(1) Adjusted congestion is only used if it is less than actual historical congestion; otherwise, actual historical congestion is used

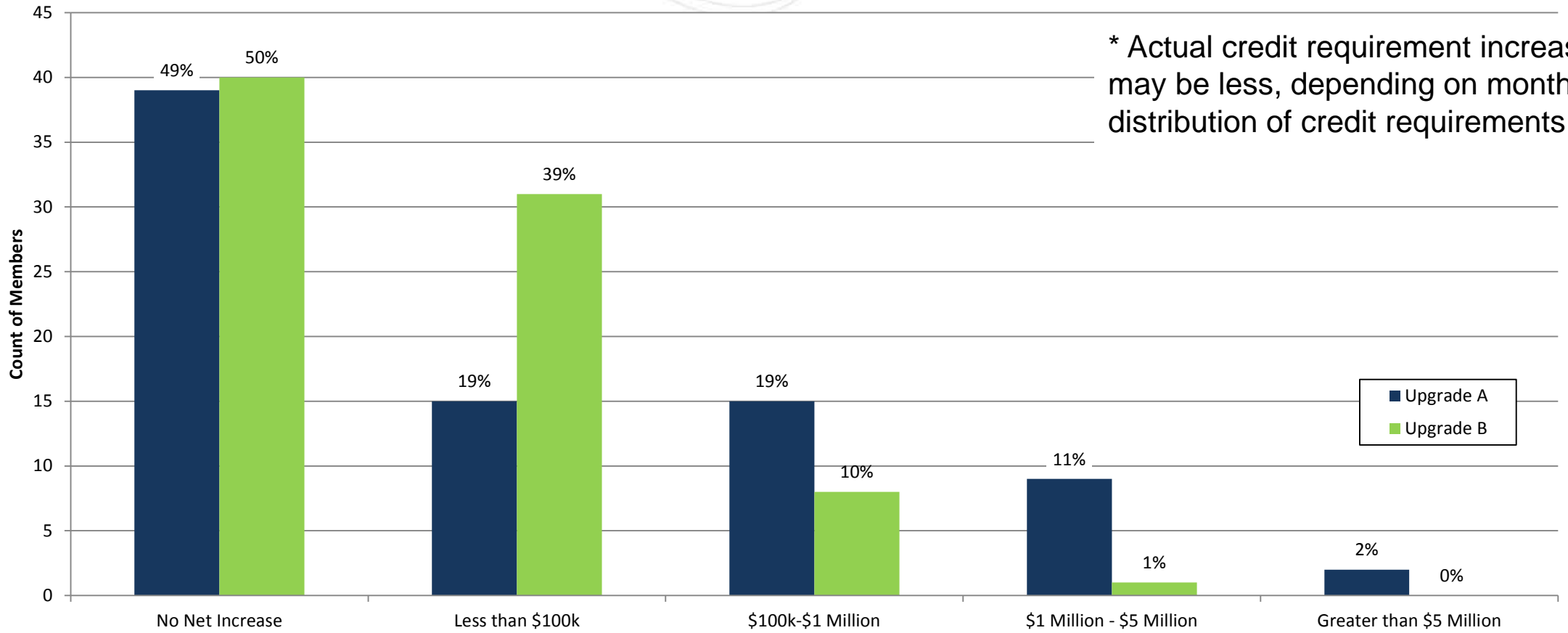
| FTR | Adjusted Congestion Used in New Credit Requirement (D) | 17/20 LTFTR Auction Clearing Price (E) | Profit (Loss) With Projected Congestion $F = (D - E)$ | Original Credit Requirement $G = E - (0.9 \times A)$ | New Credit Requirement $H = E - (0.9 \times D)$ |
|--------|--|--|--|---|--|
| Path A | \$6,618 | \$10,751 | (\$4,133) | - ⁽¹⁾ | \$4,795 ⁽²⁾ |
| Path B | (\$17,430) | (\$12,347) | (\$2,875) | \$6,826 ⁽³⁾ | \$6,826 ⁽³⁾ |
| Path C | \$72,795 | \$61,628 | \$11,167 | - ⁽¹⁾ | - ⁽¹⁾ |
| Path D | (\$8,604) | (\$1,596) | (\$7,008) | - ⁽¹⁾ | \$7,868 ⁽²⁾ |

(1) Individual FTR credit requirements can be negative, but whole month credit requirement cannot be less than zero

(2) Adjusted congestion is used because it is less than actual historical congestion; therefore, the credit requirement increases

(3) Adjusted congestion is not used because it is not less than actual historical congestion; therefore, the credit requirement does not change

Maximum Change in Credit Requirement 15/18, 16/19, and 17/20 Long Term FTRs Upgrade A and B



* Actual credit requirement increase may be less, depending on monthly distribution of credit requirements

- Proposed implementation time: Spring 2018
 - Coincident with the annual historical value update
 - Historical values to be updated annually thereafter, and may also be adjusted for newly-identified significant transmission changes
- Effective for 2018-2019 annual FTR auction and all subsequent auctions
 - Long-term, annual, balance-of-planning-period (monthly)
- Applied to existing positions at the time of the annual update of historical prices
 - Special transition plan would mitigate impact to members

- Members with credit shortfall upon implementation will be restricted in their FTR transaction ability during a transitional cure period
 - Shortfall in FTR credit allocation will not be an event of default during transitional cure period
 - Transitional cure period will be 12 months in duration
 - Members will only be permitted to enter into FTR transactions that reduce credit requirements
 - e.g. sale of an FTR, if sale would reduce credit requirements
 - All other credit-screened transactions prohibited
 - INC, DEC, Up-to congestion, Export, and RPM transactions
- Collateral returns not allowed until credit shortfall is cured
- Members may cure their shortfall at any time through provision of sufficient collateral
 - Full transaction rights would be restored upon cure

- Target stakeholder timeline:
 - Credit Subcommittee: Endorsement October 2017
 - Market Implementation Committee: First read October 11, 2017;
Endorsement November 8, 2017
 - Markets and Reliability Committee: First read October 26, 2017;
Endorsement December 7, 2017
 - Members Committee: Endorsement December 7, 2017
 - FERC Filing: December 2017

Appendix

Credit Subcommittee Poll Results PROMOD Background and Simulation Reasonableness



- 117 members from all sectors participated in the Credit Subcommittee poll
- 72% support the proposal
- 68% prefer the proposal over the status quo
- 73% support posting the credit calculator before the auctions
 - The calculator would include the PROMOD-adjusted historical values used in credit calculations
- 89% support applying the proposed new rules to existing FTRs and utilizing the transition plan for portfolios with a credit shortfall
- 84% support freezing all credit-screened transactions for members with credit shortfall during the transition period
 - Including all INC, DEC, up-to-congestion, and export transactions

Inputs

- Generation data
- Demand & energy
- Fuel forecasts
- Environmental costs
- Power flow case
- Monitored flowgates
- Other information:
reserve requirement,
market territory, etc.



Outputs

- Hourly LMP of buses and hubs, include energy, loss and congestion components
- Hourly unit generation and production cost
- Hourly binding constraints and shadow prices
- Hourly line flows
- Hourly company purchase/sale
- Environmental emissions
- Fuel consumption

PROMOD SCED Simulation

Generation Expansion Plan (ISA/FSA)

Demand Response Forecast

Intermittent resource hourly shapes

Transmission Topology (As-Is, RTEP)

Fuel Price Forecast: Natural Gas, Coal, Oil-H, Oil-L

Topology Mapping: Bus-Area, BusLoad-Demand, Gen-Bus (As-Is, RTEP)

Emissions Price Forecast: CO2 (National, RGGI), SO2, Nox (seasonal, annual)

Reactive Interface PV Analysis

Demand Forecast: Annual Peak Load and Energy, Hourly shapes

Monitored lines and contingencies, interfaces and nomograms, PARs

Interregional Inputs

MISO and NY Updates: GenExp, load forecast, wind profiles, major upgrades, flowgates, transactions with SPP/MRO, imports Canada

Pool Interaction Modeling: M2M flowgates, pseudo-ties, DC schedules, hurdle rates, import/export limits, inactive pools

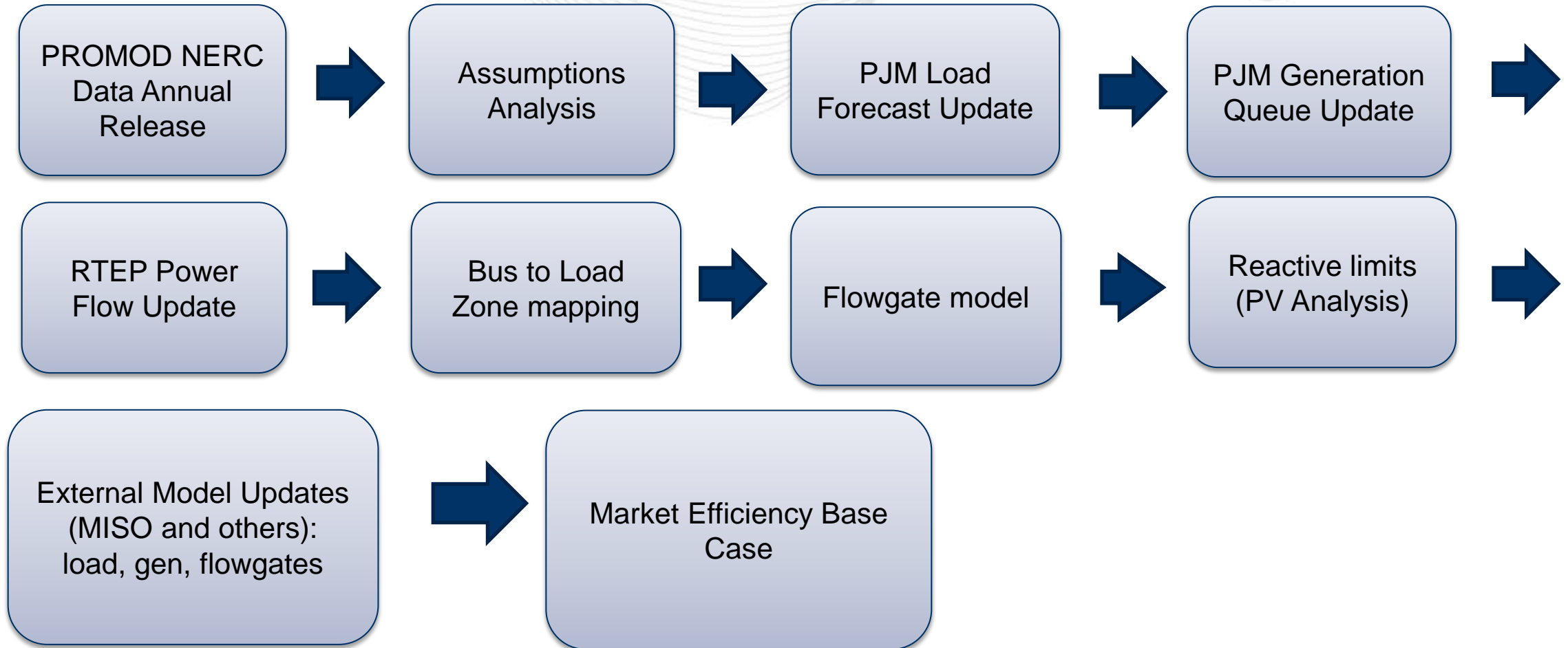
Reporting Inputs

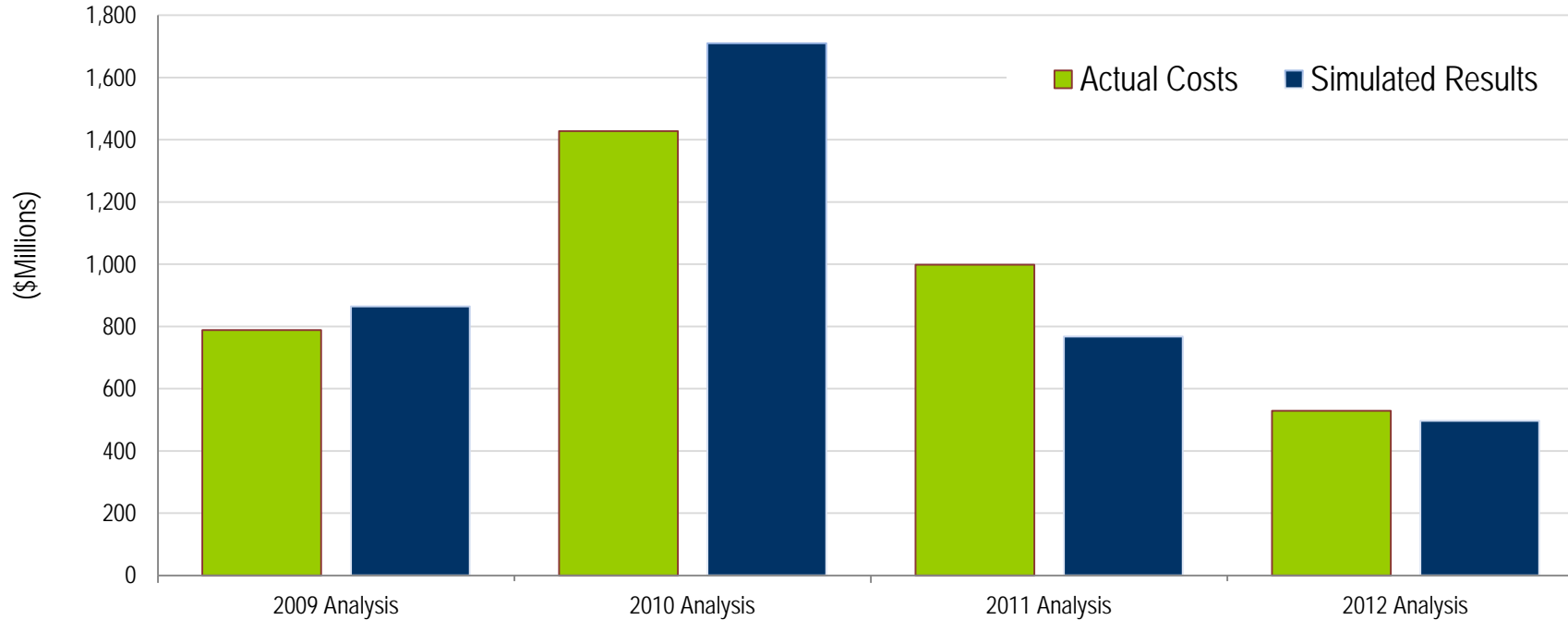
RTO Weighted Average Cost of Capital

RTO Fixed Carrying Charge Rate

ARR Source Sink Paths and Cleared MW

Project Cost and ISD





System-wide Congestion Convergence Metrics

- Historical - 90% convergence (on average)
- Recent – 87% convergence

| 2017 PROMOD (Jan - Aug) | 2017 Actual Total Congestion (Jan - Aug) |
|-------------------------|--|
| \$ 311 MM | \$ 356.5 MM |

| FTR Path | | Impacted by RTEP? | Historical Value (50/30/20) | PROMOD Value | FTR Market Price |
|----------|------|-------------------|-----------------------------|--------------|------------------|
| Source | Sink | | | | |
| WHUB | BGE | Y | \$ 71,394 | \$ 24,090 | \$ 24,440 |
| COMED | BGE | Y | \$ 116,508 | \$ 39,157 | \$ 47,304 |
| DOM | BGE | Y | \$ 42,048 | \$ 17,782 | \$ 18,133 |
| PPL | RECO | N | \$ 14,716 | \$ 14,016 | \$ 12,789 |
| PECO | PPL | N | \$ 3,066 | \$ 3,153 | \$ 2,978 |

| Paths | Historical Value to FTR Market Price Ratio | PROMOD to FTR Market Price Ratio |
|----------------------|--|----------------------------------|
| Impacted by RTEP | 257% | 93% |
| Not impacted by RTEP | 113% | 109% |