

FTR Credit Requirements

Prevailing Flow Paths Affected by Transmission System Upgrades

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Credit Subcommittee

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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 low frequency-high impact future 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 low frequency-high impact 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 impacted by modeled transmission system changes effective for any portion of the FTR's term.

- The fundamental credit calculation framework would not change.
 - Credit requirements would continue to be based on historical path congestion amounts plus any applicable undiversified adder(s) for all prevailing flow and counterflow paths that are not affected by a modeled transmission system change during the FTR's term.
 - Credit requirements for paths whose value is reduced by a modeled transmission system change would be calculated in the same manner as other paths but 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

- Criteria for upgrades for which PROMOD congestion simulations would be run:
 - Upgrade significance: those transmission upgrades having 10% or more impact on the congestion on any constraint with current congestion of \$5MM or more (“low frequency-high impact”)
- Only 3 of the 22 transmission system upgrades placed in service for 2017/2018 had greater than 10% impact on any of the 32 constraints with more than \$5 million of congestion
 - 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

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

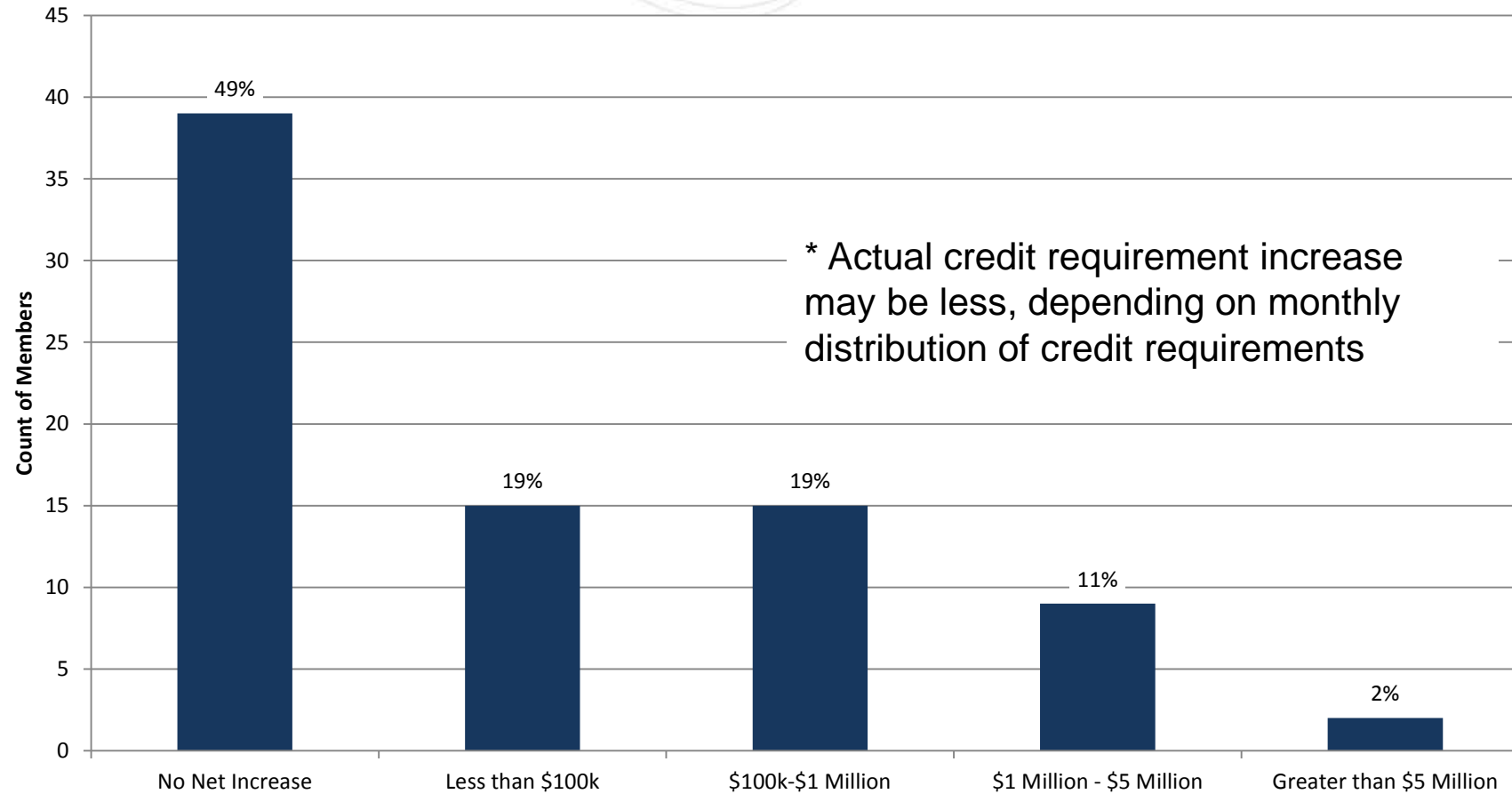
FTR	Adjusted Congestion Used in New Credit Requirement (D)	17/20 LTFTR Auction Clearing Price (E)	Profit (Loss) With Projected Congestion $F = (D - E)$	Original Credit Requirement $G = E - (0.9 \times A)$	New Credit Requirement $H = E - (0.9 \times D)$
Path A	\$6,618	\$10,751	(\$4,133)	(0) ⁽¹⁾	\$4,795 ⁽²⁾
Path B	(\$17,430)	(\$12,347)	(\$2,875)	\$6,826 ⁽³⁾	\$6,826 ⁽³⁾
Path C	\$72,795	\$61,628	\$11,167	(0) ⁽¹⁾	(0) ⁽¹⁾
Path D	(\$8,604)	(\$1,596)	(\$7,008)	(0) ⁽¹⁾	\$7,868 ⁽²⁾

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

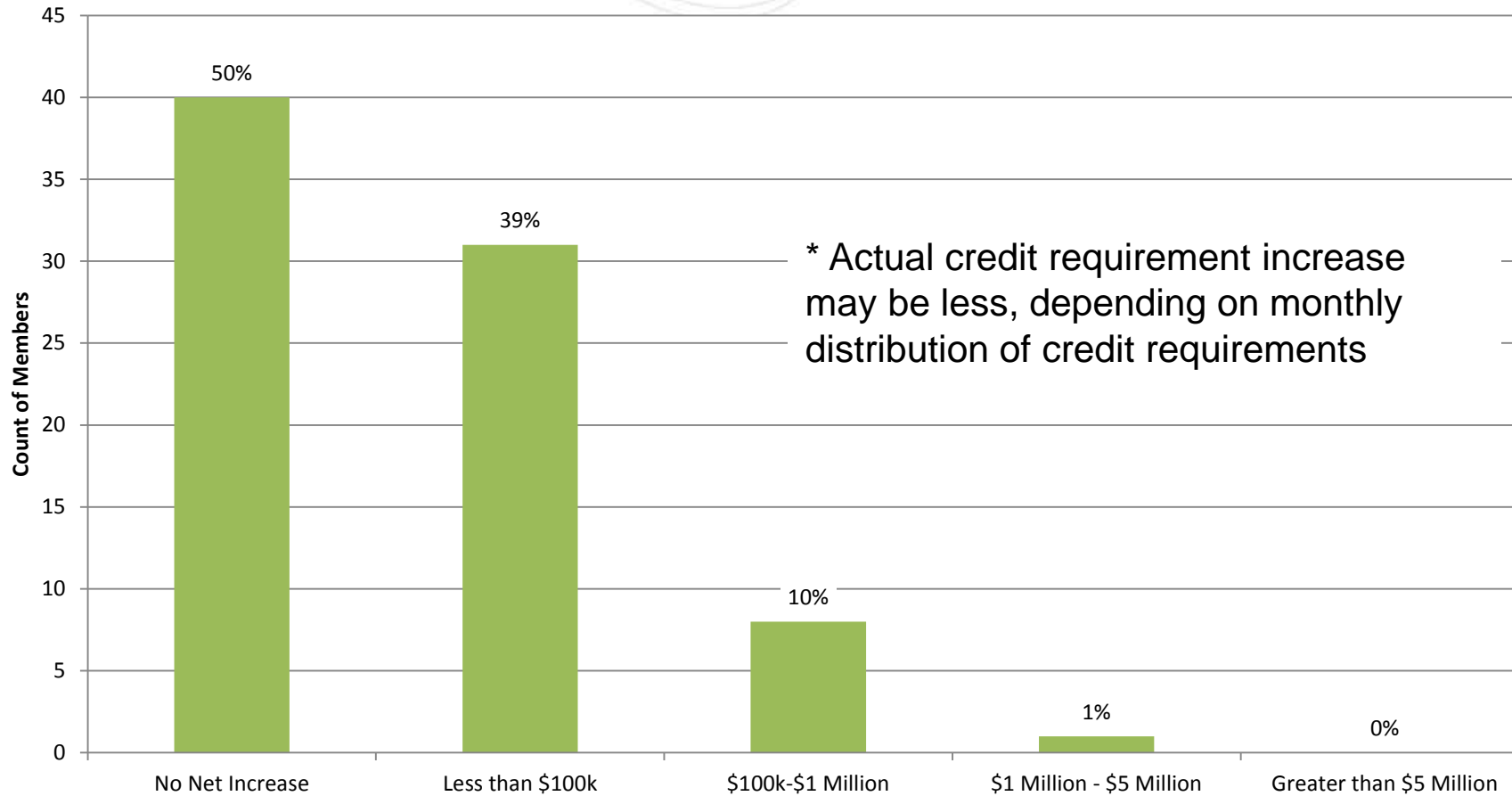
(2) Adjusted congestion is used because it is less than actual historical congestion; therefore, the credit requirement increases

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

Simulated Maximum* Increase in Credit Requirement 15/18, 16/19, and 17/20 Long Term FTRs Upgrade A



Simulated Maximum* Increase in Credit Requirement 15/18, 16/19, and 17/20 Long Term FTRs Upgrade B



- FTR credit requirements are most effective in risk mitigation when applied before a member's FTR positions are cleared.
- PJM and most members have articulated a preference for transparency in FTR credit requirements via the existing FTR credit calculator.
- Some members have expressed concerns that PJM updating FTR credit requirements for its projected congestion changes from transmission system upgrades is more akin to PJM providing "market intelligence" than just transparency.

- Incorporate PJM’s simulation impacts on FTR credit requirements in the FTR credit calculator available to all members prior to FTR bid windows (PJM preference)
 - Provides high level of transparency of credit requirements as members prepare their bids
 - Eliminates risk of an incremental collateral call after an FTR bid window closes
 - Makes limited* PROMOD simulation information public, which some may consider “market intelligence” (* only nodal congestion difference information – no energy costs, LMPs or other PROMOD data)
- Establish a process for incremental collateral calls to be issued between the close of each FTR bid window and publication of the cleared auction results (similar to the current undiversified adder process)
 - Avoids making PROMOD simulation results public, which some may consider “market intelligence”
 - Does not provide transparency to members of credit requirements when submitting bids
 - Could require posting of additional collateral in as little as one day between an FTR auction window closing and the FTR auction results being finalized; lack of posting additional collateral would result in all of that member’s bids being removed from the FTR auction

- PJM will simulate the congestion impact of low frequency-high impact transmission upgrades meeting the following criteria:
 - Upgrade significance: those transmission upgrades having 10% or more impact on the congestion on any constraint with current congestion of \$5MM or more
 - For each FTR path owned by each participant, and for which the simulation shows a decrease in congestion value, PJM will adjust the historical value used in the credit calculation by the dollar amount of change from the simulation
 - Historical LMP values (both actual and adjusted) used in credit calculations would be posted prior to auctions to allow members to calculate their own FTR credit requirements

- Historical values are currently adjusted once each spring
 - Timing of annual adjustment would not change
 - Historical values may also be adjusted for newly-identified significant transmission changes
- Proposed implementation in Spring 2018
 - 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
 - Transitional cure period will be 12 months in duration
 - During the transitional cure period, members will only be permitted to enter into transactions that reduce credit requirements
 - e.g. sale of an FTR, if sale would reduce credit requirements
 - Shortfall in FTR credit allocation will not be an event of default until transitional cure period expires
- 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 – PROMOD Background and Simulation Reasonableness



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

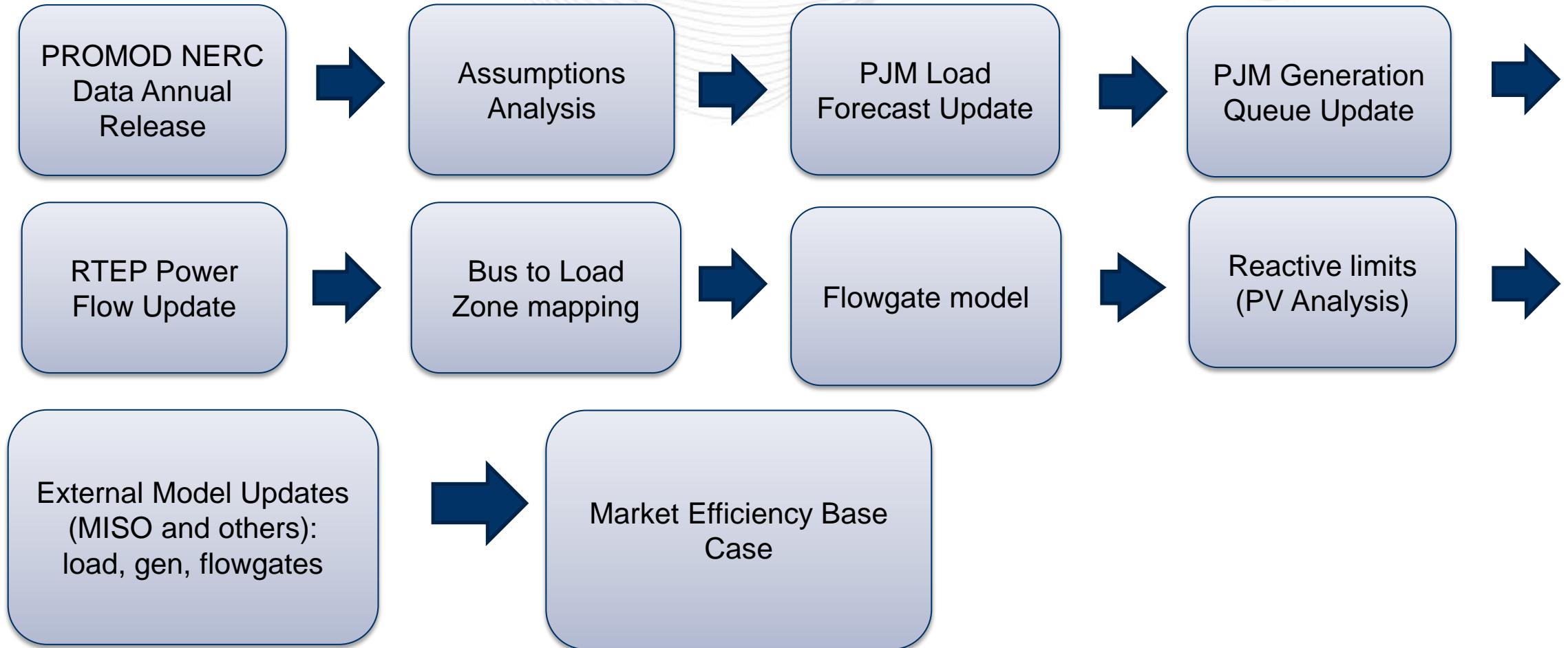
Reporting Inputs

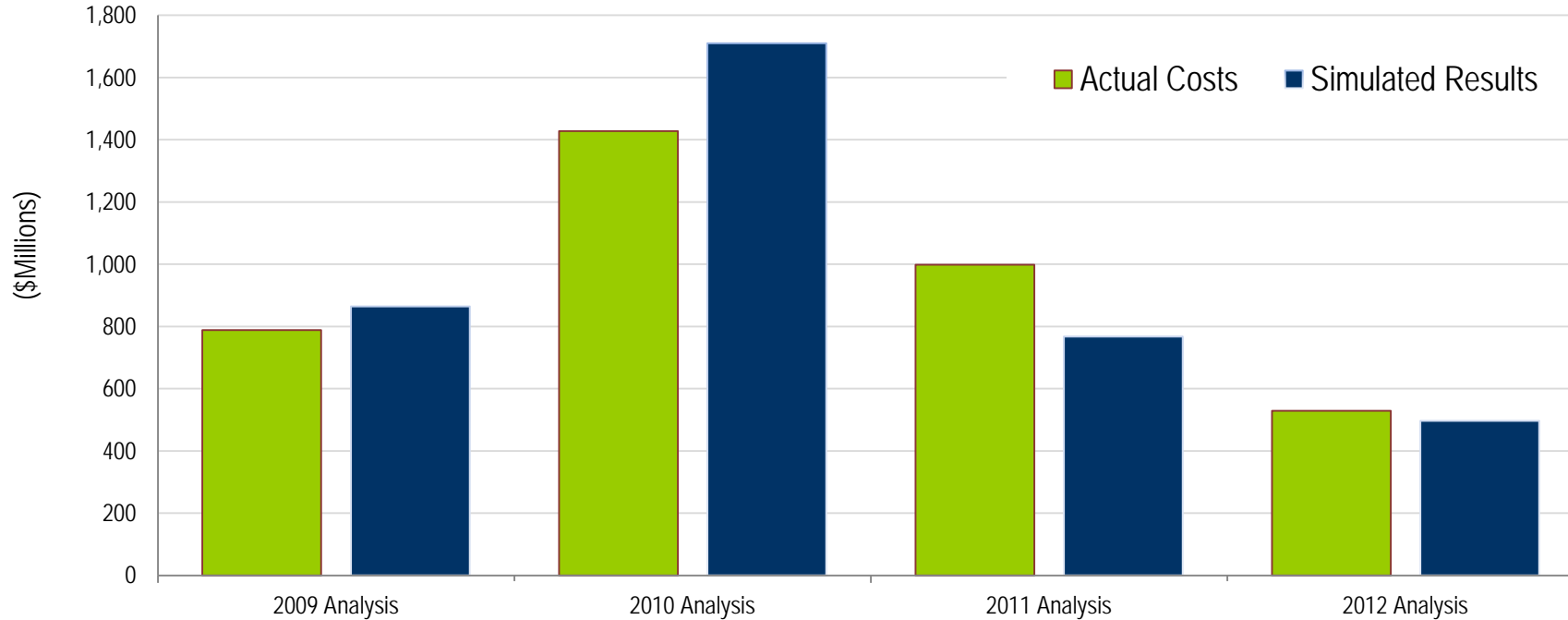
RTO Weighted Average Cost of Capital

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%