



Long-Term FTR Modeling

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All PJM Risk – Model everything

- Revenue Adequacy concerns for late projects
- Heavy reliance on data external to Markets
- Creation of special LT FTR case very long road

All Member Risk – Model nothing

- Status Quo
- Credit risks for membership
- Lack of transparency of Future Transmission System

Shared Risk – Model likely upgrades and increase credit requirements

- Conservative approach to revenue adequacy
- Increase credit requirements only in significant areas
- Achievable in near-term

Determine likely upgrades for 1-year out



Utilize credit enhancements based on future expected congestion for 2-3 years out



Post all modeled upgrades on the FTR web page for increased transparency

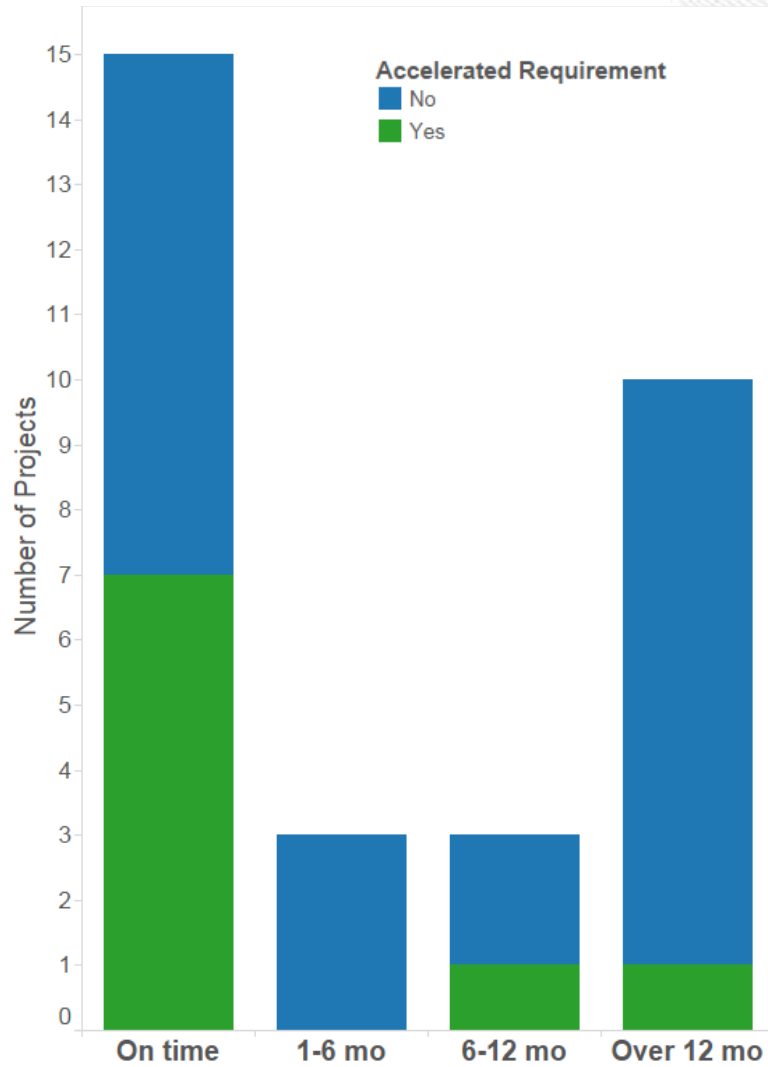
- Execute before and after PROMOD studies to account for all scheduled upgrades scheduled to be in service one year out
 - E.g. 18/19 for the 18/21 Long Term Auction performed in 2017
- For any upgrades impacting congestion LMPs by more than 10%, confirm with Planning those will be in service by June 30th
- For those upgrades passing the first two steps, confirm they are in the EMS/Markets model

- Adjust FTR Long Term markets model to account for these upgrades only but, carve out capability created in order to preserve transmission congestion priority rights of ARR holders
- Post modeled upgrades on the FTR website prior to opening of bidding window



- In-service timing is usually uncertain for over 1 year out
- Different levels of detail are either not ready or likely to change between Planning and Markets models
- Risk vs. Reward
 - What are we gaining? Price discovery
 - What are we risking? Revenue Adequacy





- Baseline projects that went in-service between 7/1/2016 & 6/30/2017
- 230 kV and above
- Substations, Transmission Lines and Transformers
- 10 of 31 projects were over 1 year late

Baselines	Volta..	EquipmentName	REq'd Date	Actual In Service Date	
b0210.1	230	Transmission Line	5/31/2015	12/31/2016	Abc
b1032.1	345	Substation	6/1/2014	12/1/2016	Abc
b1465.5	765	Substation	6/1/2015	4/13/2017	Abc
b1659	765	Transformer	6/1/2015	12/22/2016	Abc
b1659.13	765	Substation	6/1/2015	11/11/2016	Abc
b1659.14	765	Transmission Line	6/1/2015	11/11/2016	Abc
b1819	345	Transmission Line	6/1/2015	11/14/2016	Abc
b1900	230	Transmission Line	6/1/2015	6/8/2017	Abc
b2276.1	230	Transmission Line	6/1/2015	8/8/2016	Abc
b2637.1	230	Transmission Line	6/1/2015	5/31/2017	Abc

- PROMOD Studies with and without transmission upgrades to identify changes in congestion at the bus level
- Apply those deltas to historical congestion prices and utilize those new values, i.e. “forecasted” values in the FTR Credit calculations
- The end result will require a higher FTR Credit requirement for paths that have little or no future value (congestion) based on PROMOD simulations

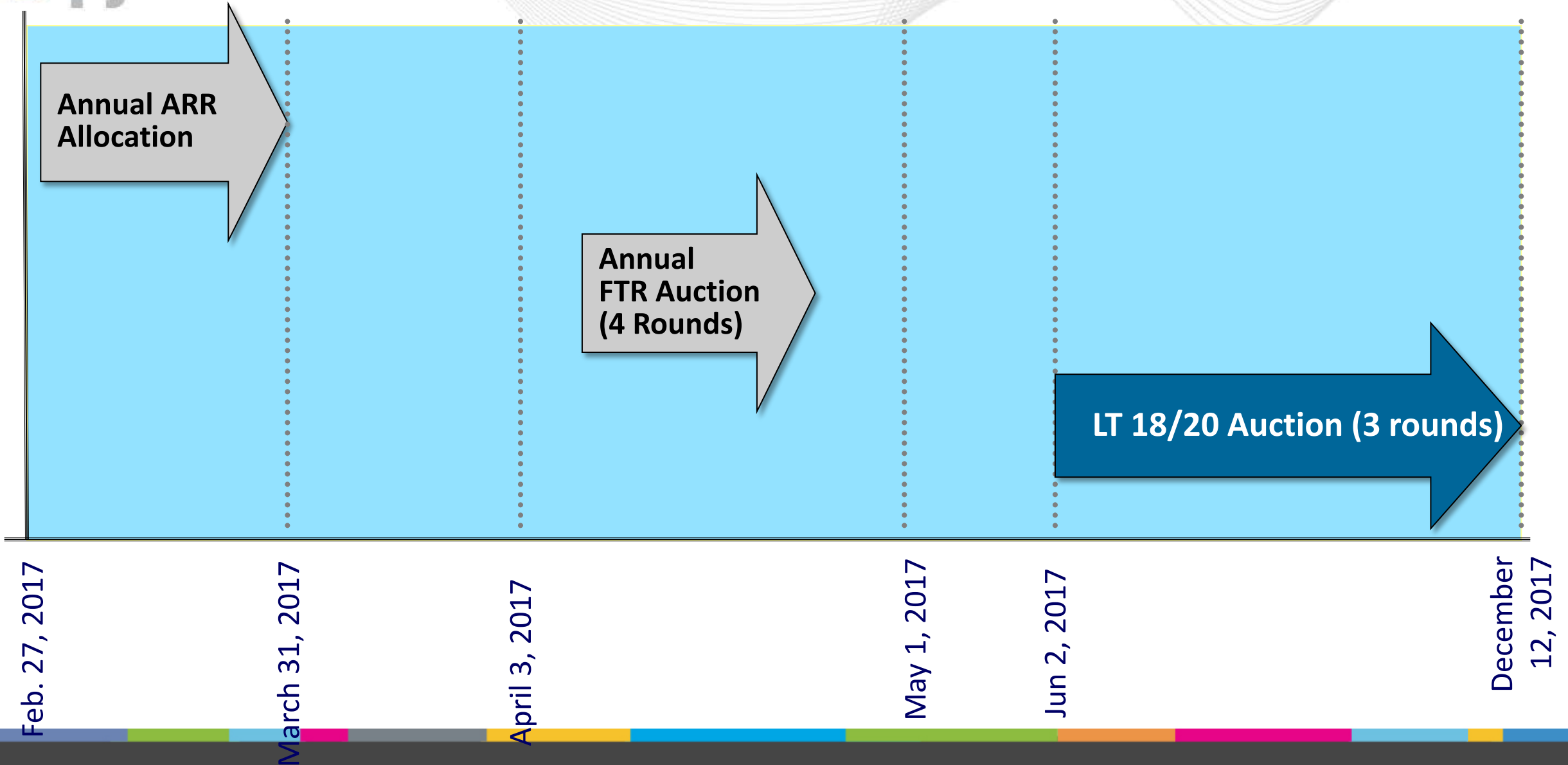
*Currently being pursued through the
Credit Subcommittee*

- Increased transparency of future transmission system
- Better alignment of expected future transmission system and credit requirements
- Conservative approach to preserve revenue adequacy
- Can be implemented!



Appendix





- Annual Allocation and Auction are performed in March/April
 - Annual Allocation is entire transmission system capability, minus loop flow
 - LT FTRs are carved out of Annual Auction- modeled as injections and withdrawals
 - ARRs are not modeled in FTR auctions and FTRs are not modeled in ARR allocations
- All cleared ARRs are presumed to self-schedule and that FTR capability is carved out of the LT Auction, performed in June

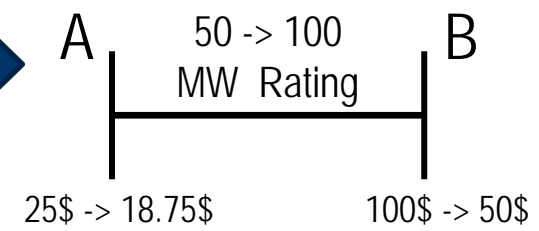


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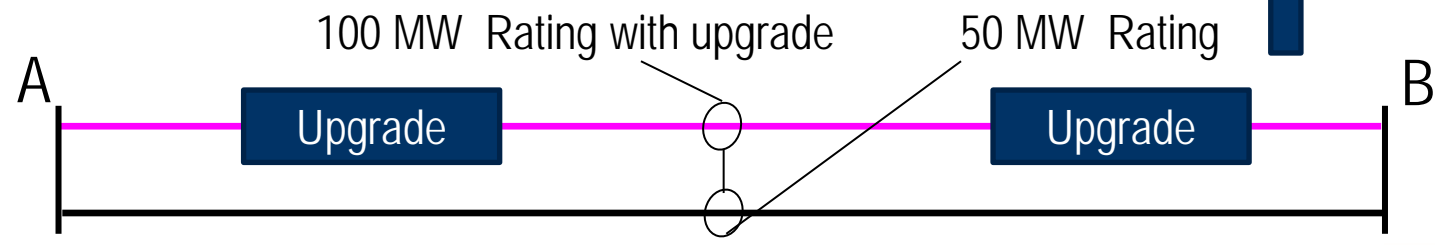
PROMOD Studies: Run simulation with and without identified transmission upgrades for future period

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Apply A and B % bus deltas to Historical Average CLMPs



-25%
After A CLMP = 15\$
Before A CLMP = 20\$



After B CLMP = 45\$
Before B CLMP = 90\$
-50%

2

Result: PJM Identifies changes in congestion LMP at the bus level and applies that percentage change to historical congestion LMPs



- Due to the increased transmission capability and resulting reduction in expected congestion, the revenue offset portion of the FTR credit calculation is decreased
- This will result in a higher credit requirement, unless bids change to reflect the reduced congestion expectations

$$\begin{aligned} \text{FTR Credit Req.} &= \text{FTR Price} - \text{Revenue Offset} \\ \text{Before Upgrade Simulation} &= 100\$ - 75\$ = 25\$ \\ \text{After Upgrade Simulation} &= 100\$ - 31.25\$ = 68.75\$ \end{aligned}$$