# Long Term FTR Modeling

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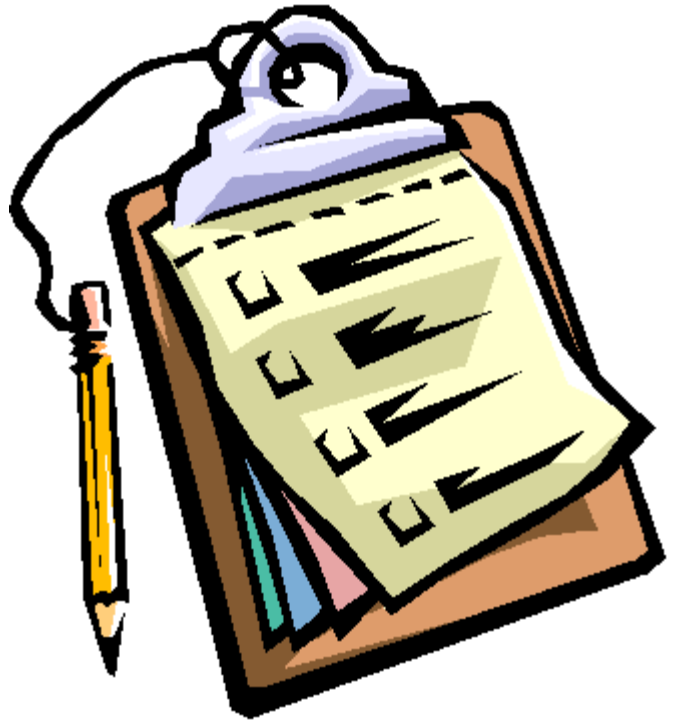
# Agenda

Background

Model setup

Long-term model specifics & limitations



# Background

- PJM conducts a long-term FTR auction for the three consecutive Planning Periods immediately subsequent to the Planning Period during which the long-term FTR auction is conducted
- The capacity offered for sale in long-term Financial Transmission Rights auctions is the residual system capability after the Annual Auction Revenue Rights allocations
  - Auction Revenue Rights allocated in the immediately prior annual Auction Revenue Rights allocation process are self-scheduled into Financial Transmission Rights, which are modeled as fixed injections and withdrawals in the long-term Financial Transmission Rights auction

# Model Importance

- The ARR/FTR market model is constructed and maintained for each Annual ARR allocation and FTR Auction to help ensure that FTR revenue adequacy can be achieved, as required per PJM Tariff.

- FTR revenue adequacy is achieved when there are sufficient revenues from Transmission Congestion Charges to satisfy all FTR obligations and when there are sufficient revenues from the FTR Auctions to satisfy all ARR obligations.

# Base Market Model

- The Base Market Model and supporting files are posted on the PJM FTR Web Page
  - Based on the day-ahead market dispatch model of the transmission system in use at the beginning of a relevant planning period
  - Is adjusted to reflect expected market capability over the relevant (next) planning year, to accommodate Stage 1A rights and to align expected FTR total target allocations with expected congestion

http://www.pjm.com/markets-and-operations/ftr.aspx

# Long Term Model

- The base topology utilized for the Long Term model is based on the latest model available
  - Round 1 in June will utilize the Summer Model build
  - Round 2 in September will utilize the Summer Model build
  - Round 3 in December will utilize the Fall Model build

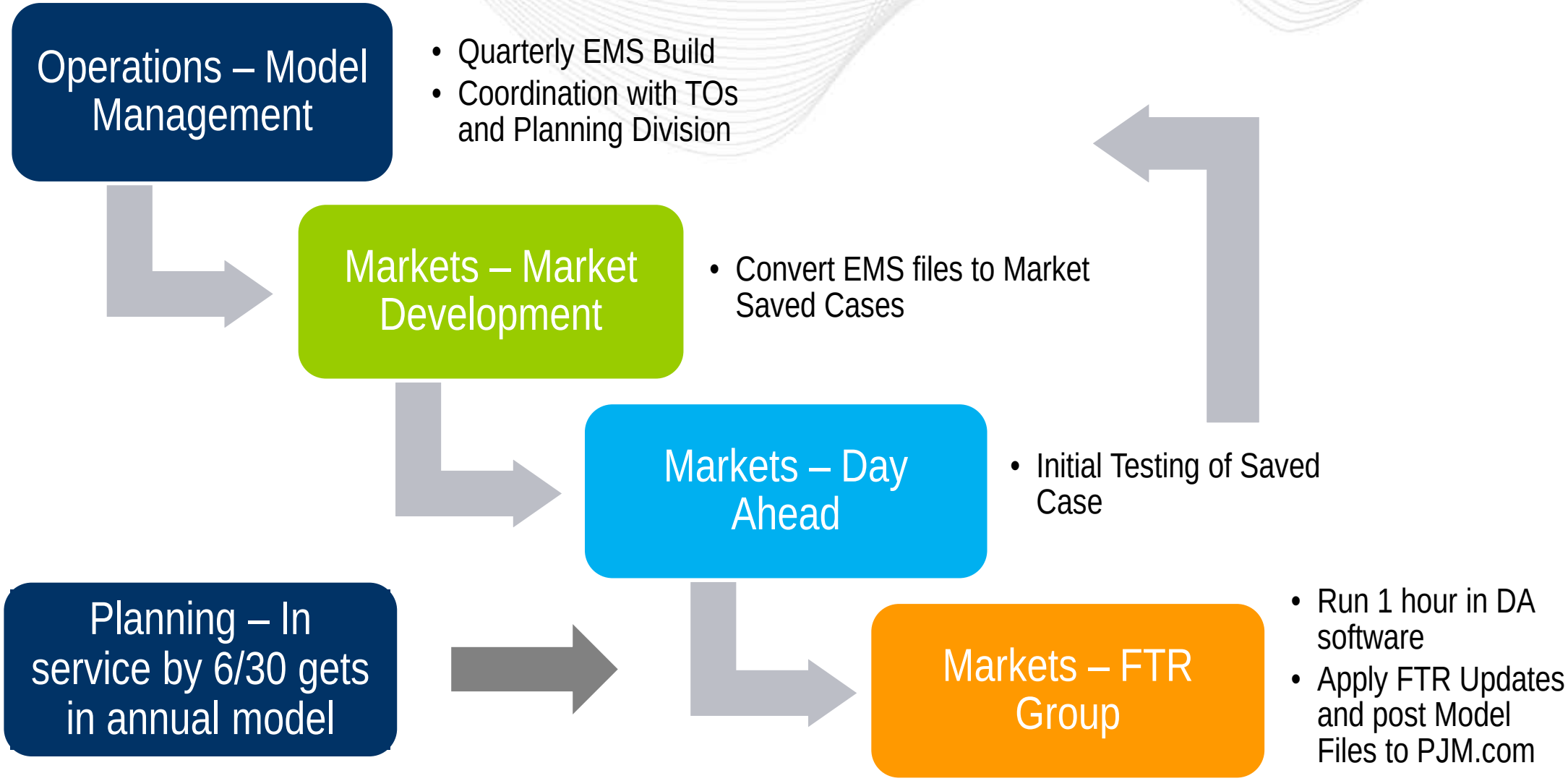
- Each auction round model will have the latest set of outages, breaker configuration and contingencies included

# Current long term modeling limitations

- Lack of information/detail needed to model in EMS and therefore Markets
  - Uncertain in-service dates for future transmission upgrades
  - Very limited outages modeled 2-3 years out

# Appendix

# Steps the model takes to get to FTR



# FTR model file creation

- FTR runs a one-hour DA case to capture base topology for all model files posted to PJM.com

- The model files are created via export from DA software to PSSE case by the FTR Group each model build to be used for power flow tool simulation

**Long-Term & Monthly FTR Auction Process Details on the Network Model Used**

- 500kV Mapping CSV
- Aggregate Definitions CSV
- B1 - B2 - B3 Power System Simulator for Engineering (PSSE) Mapping File CSV
- Load Apportionment Zones Hubs CSV
- Phase Angle Regulator (PAR) Data CSV
- PJM Interface Definitions Limits CSV
- Power System Simulator for Engineering (PSSE) Branch Mapping File CSV
- Uncompensated Parallel Flow CSV
- Contingency Flowgate List (XLS) Model CEII Data - request access for this content
- Contingency List Power System Simulator for Engineering (PSSE) Compatible (TXT) Model CEII Data - request access for this content
- PJM Network Model (RAW) Model CEII Data - request access for this content
- Network Model Saved Case (SAV) Model CEII Data - request access for this content

# Key Inputs to FTR Model

- Existing ARR/FTR Flow
  - Modeled as injections and withdrawals
- Uncompensated Power Flow
  - Loop flow external to PJM based on historical flows from neighbors
- External Flowgate Data
  - ARR/FTR flow must honor entitlements/limits for revenue adequacy
- Reactive Interfaces
  - Limits used are derived from previous year's average values
- Transmission Topology
  - Market Limits, Outages and breaker configurations

# FTR updates to model

- Like the DA group, the FTR group tests each new save case to ensure the software will solve with a reasonable objective
- FTR group will make various updates to the model each build if needed:
  - Modify status of a circuit breaker/disconnect
  - Make a new pnode private/unbiddable
  - Remap FTR source/sinks points that were deleted to closest electrically equivalent pnodes
- Each Auction the FTR group compares ratings, breaker configuration and contingencies to DA to ensure maximum model alignment