The ARR/FTR Model

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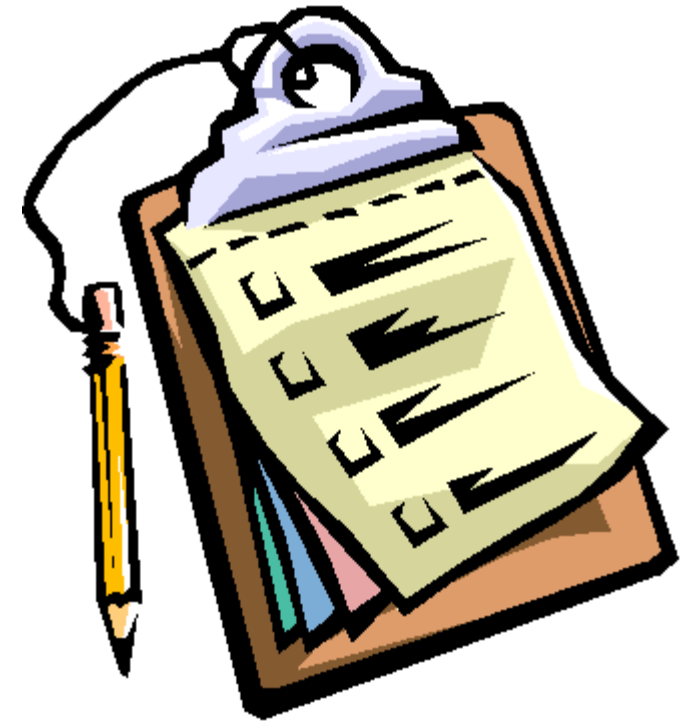
Special MIC – FTRMPS

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Overview

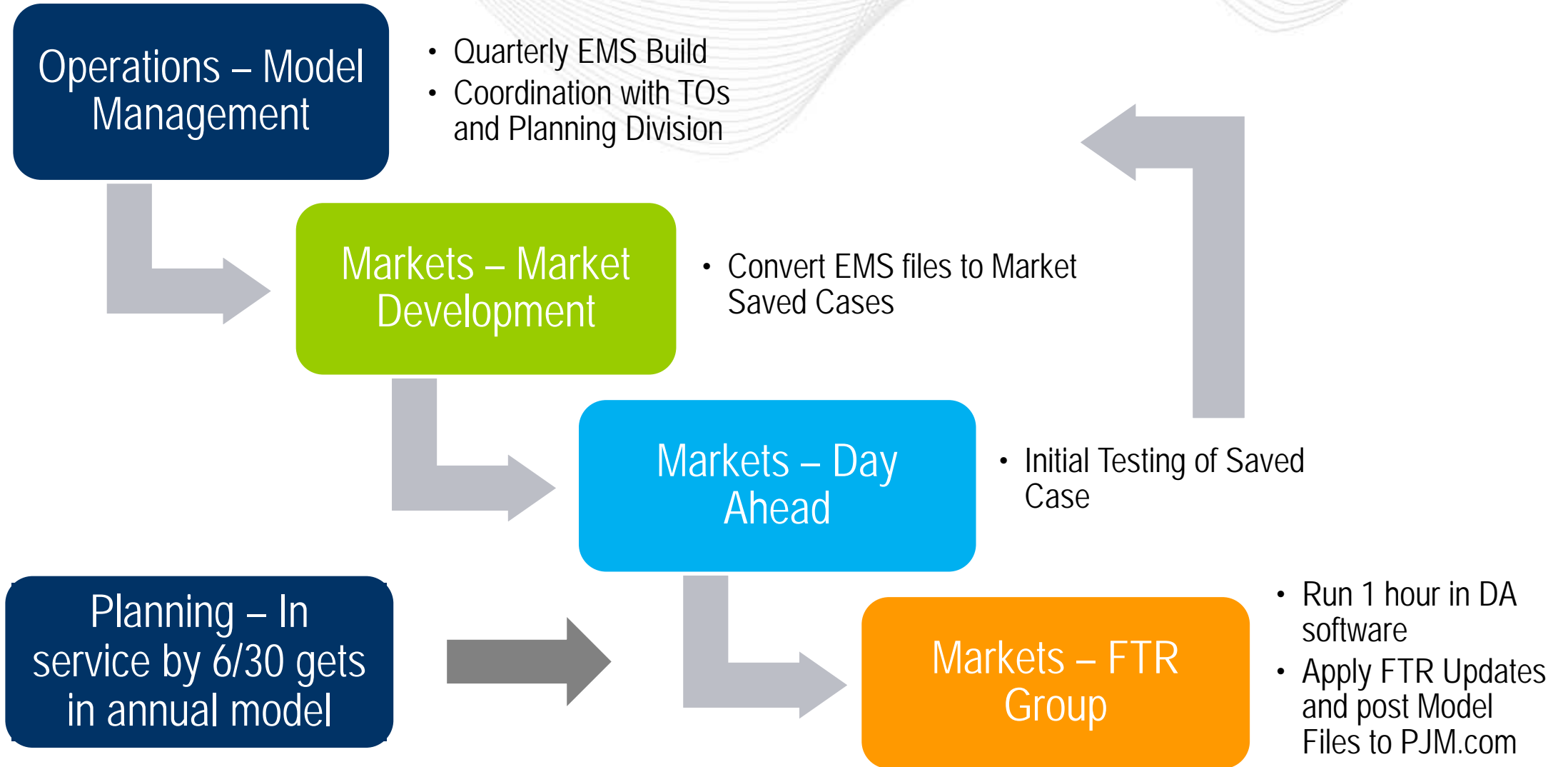Model setup

FTR model maintenance

Software features

Long-term model specifics

- 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.

- The Base Market Model, along with supporting files, is posted on the PJM FTR Web Page, and…

  - Is 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

Operations – Model Management

- Quarterly EMS Build
- Coordination with TOs and Planning Division

Markets – Market Development

- Convert EMS files to Market Saved Cases

Markets – Day Ahead

- Initial Testing of Saved Case

Planning – In service by 6/30 gets in annual model

Markets – FTR Group

- Run 1 hour in DA software
- Apply FTR Updates and post Model Files to PJM.com

- 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

- 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

- 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

EMS

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Markets
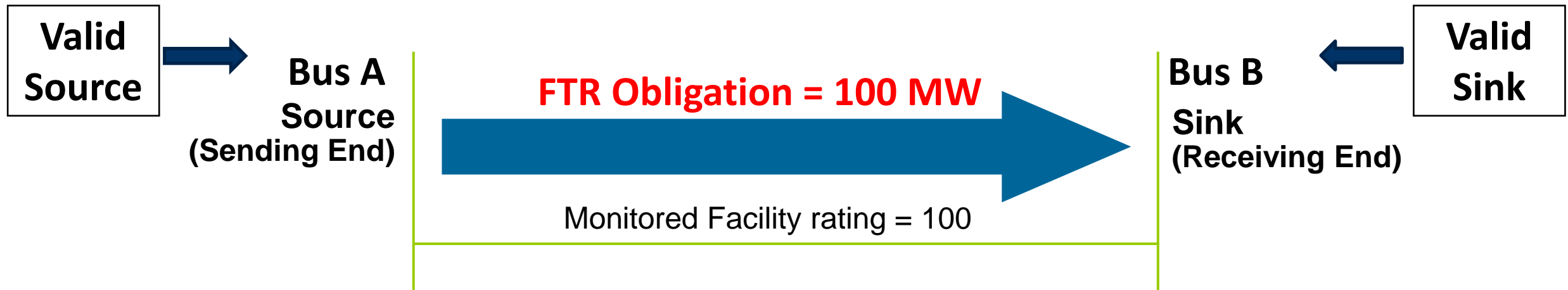
- Device-breaker model representation
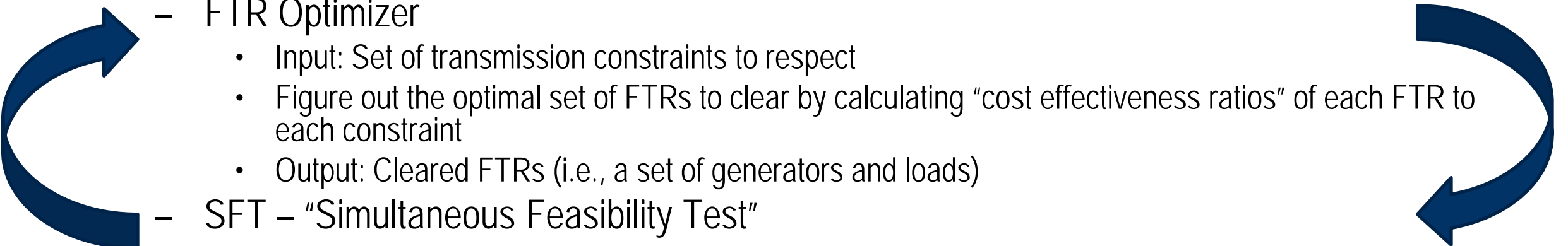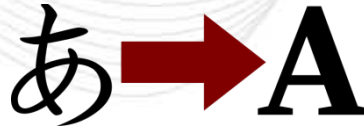
- Branch-bus model representation

GE FTR Software Conversion

Power flow model is based on a branch-bus description of the transmission network. Transformation of the device-breaker model to the branch-bus model is performed by FTR software.

- FTRs are modeled as injections and withdrawals at biddable pnodes that are mapped to busses by the GE software

- Flow across any monitored facility is defined by a "from" and "to" bus

  – This mapping is posted on pjm.com

Valid Source → **Bus A Source (Sending End)**

FTR Obligation = 100 MW →

Bus B Sink (Receiving End) ← **Valid Sink**

Monitored Facility rating = 100

- Fundamentally an optimization problem
  - Objective function: Maximize bid-based revenue (i.e., revenue to ARR holders)
  - Subject to: Transmission constraints (N-1)
- Solution Mechanism
  - FTR Optimizer
    - Input: Set of transmission constraints to respect
    - Figure out the optimal set of FTRs to clear by calculating "cost effectiveness ratios" of each FTR to each constraint
    - Output: Cleared FTRs (i.e., a set of generators and loads)
  - SFT – "Simultaneous Feasibility Test"
    - Input: Set of generators and loads
    - Figure out which constraints are violated (do N-1)
    - Output: Updated set of transmission constraints to respect

2021

- Long-term Auctions look 1 to 3 years out
- Run on latest available model builds
  - Rounds occur in June, September and December
- Current limitations to modeling for 3 years out
  - Uncertain in-service dates
  - Lack of information/detail needed to model in EMS and therefore Markets
  - Translation issues between planning and markets models
    - No bus-branch mapping between FTR power flow case and planning MMWG case