



# PJM Tie Line Definitions & Metering Requirements

Generation Department  
Operations Support  
PJM Interconnection

- PJM defines a Tie Line as a circuit connecting two or more Control Areas or systems of an electric system.
- A Tie Line between control areas or systems may be represented by an actual physical transmission line, series device (SD) or a transformer or may be virtual.
- PJM considers the accurate modeling and data acquisition for Tie Lines as particularly significant due to their impact on network model connectivity, Automatic Generation Control (AGC) parameter calculations, and market settlements calculations.

PJM recognizes two main categories of Tie Lines for operational and settlements purposes, which will be further defined in this presentation:

- **External Tie Lines**
- **Internal Tie Lines**

**Dynamic Transfers** will also be defined in this presentation due to their similar impact on the PJM Area Control Error (ACE) Equation.

**External Tie Lines** are circuits that connect the PJM Balancing Authority (BA) Control Area with an adjacent BA Area. They are a direct input into the Actual Net Interchange ( $NI_A$ ) component of the PJM ACE equation.

External Tie Lines are either:

- **Physical Tie Lines:** An actual physical circuit (line, SD, or transformer) that connects the PJM BA with an external BA. This category matches NERC Tie Line definition.
- **Pseudo-Ties:** A virtual tie between the PJM BA and an external BA. Further defined in the Dynamic Transfer slides in this presentation. Treated similarly as a Physical Tie Line in the PJM ACE equation.

**Dynamic Transfers** are defined by NERC as the provision of the real-time monitoring, telemetering, computer software, hardware, communications, engineering, energy accounting (including inadvertent interchange), and administration required to electronically move all or a portion of the real energy services associated with a **generator** or **load** out of one BA area into another.

There are two categories of Dynamic Transfers:

**Pseudo-Ties:** A virtual tie between the PJM BA and an external BA. Defined as a time-varying energy transfer that is updated in Real-time and included in the Actual Net Interchange component ( $NI_A$ ) in the same manner as a Tie Line in the affected BA's control ACE equations.

**Dynamic Schedules:** Defined as a time-varying energy transfer that is updated in Real-time and included in the Scheduled Net Interchange ( $NI_S$ ) term in the same manner as an Interchange Schedule in the affected BA's control ACE equations

**Internal Tie Lines** are circuits that connect zones or systems within the PJM Balancing Authority Control Area. They do not directly affect the PJM ACE equation, but are significant for internal PJM modeling, AGC and other operational parameter calculations, and market settlements calculations.

PJM recognizes the following categories of Internal Tie Lines:

- **Control Zone Tie Line:** Defined as a circuit connecting two or more Control Zones within the PJM RTO. A Control Zone is defined as a subset of a control area that has a separate regulation and spinning reserve requirement based on NERC criteria.

- **Transmission Zone Tie Line:** Defined as a circuit connecting two or more Transmission Zones within the PJM RTO. A Transmission Zone is defined as zone encompassing all the facilities owned by a recognized PJM Transmission Owner. Mid-Atlantic Control Zone may be subdivided into multiple transmission zones.
- **Fully Metered EDC Ties:** Defined as a circuit connecting two or more fully Metered Electric Distribution Companies (EDCs) within PJM. EDC is defined as a PJM Member that owns or leases electric distribution facilities that are used to provide electric distribution service to electric load within the PJM Control Area.

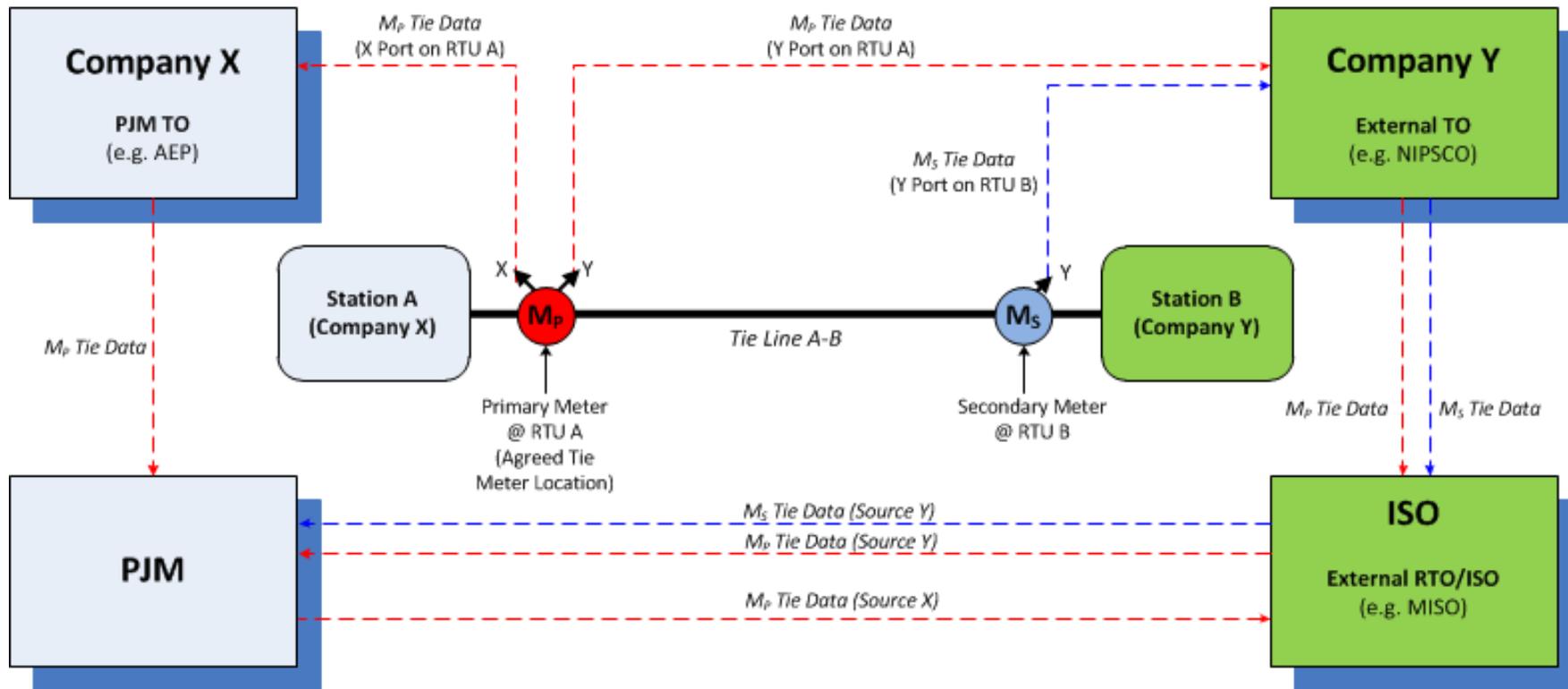
- **East EHV Tie Line:** Defined as a circuit connecting the PJM East EHV 500 kV network with the remaining bulk electric system. It exists as a result of the joint ownership by multiple PJM Transmission Owners of the PJM East 500 kV network.



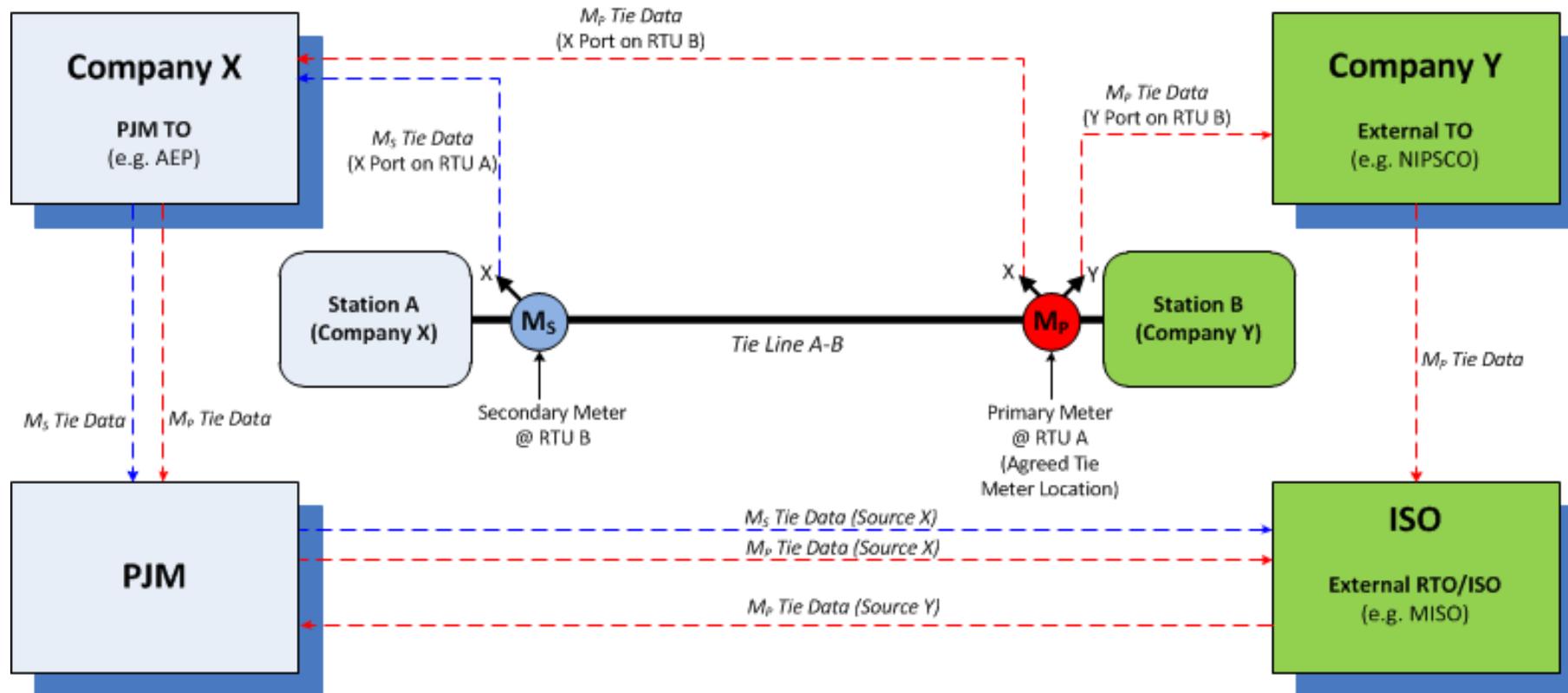
# Tie Line Metering Requirements

		Accuracy	Min Scan Freq	Metering Data Required
<b>External Tie Lines</b>				
	Physical Tie	+/- 2%	4 sec	Primary Tie Data & Backup Primary or Secondary Tie Data Required. All 3 preferred.
<b>Dynamic Transfers</b>				
	Pseudo-Tie	+/- 2%	4 sec	Primary & Backup Primary Tie Data Required.
	Dynamic Schedule	+/- 2%	4 sec	Primary & Backup Primary Tie Data Required.
<b>Internal Tie Lines</b>				
	Control Zone Tie	+/- 2%	4 sec	Primary Tie Data & Secondary or Backup Primary Tie Data Required.
	Transmission Zone Tie	+/- 2%	4 sec	Primary Tie Data Required. Secondary & Backup Primary Tie Data Optional.
	Fully-Metered EDC Tie	+/- 2%	4 sec	Primary Tie Data Required. Secondary & Backup Primary Tie Data Optional.
	East EHV Tie	+/- 2%	4 sec	Primary Tie Data Required. Backup Primary Tie Data Optional.
<b>Special Case</b>				
	Transformer Tie	+/- 2%	4 sec	Primary & Backup Primary Tie Data on High/Low Side of xfmr Required.

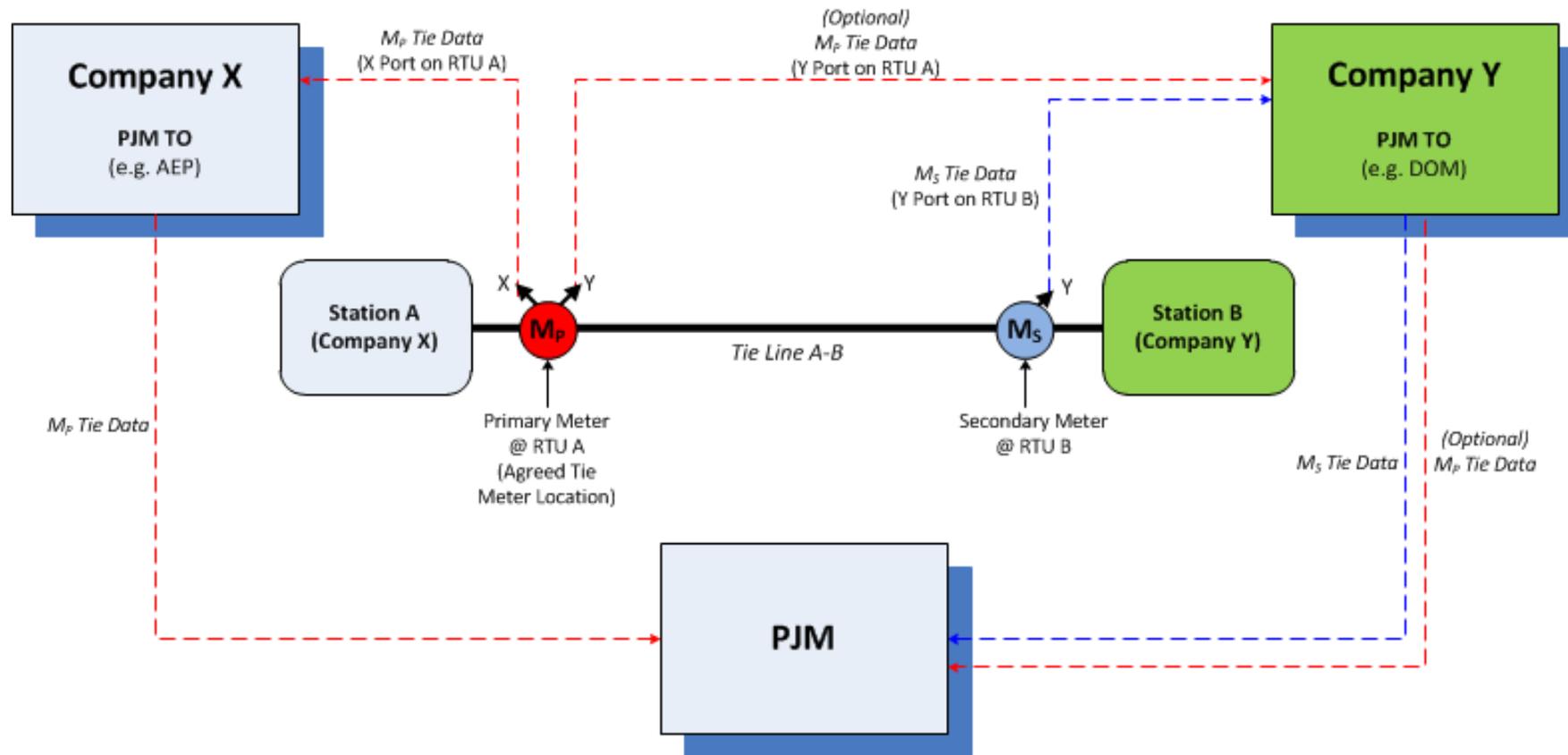
## External Tie Line Metering Primary Metering at PJM End of Tie Line



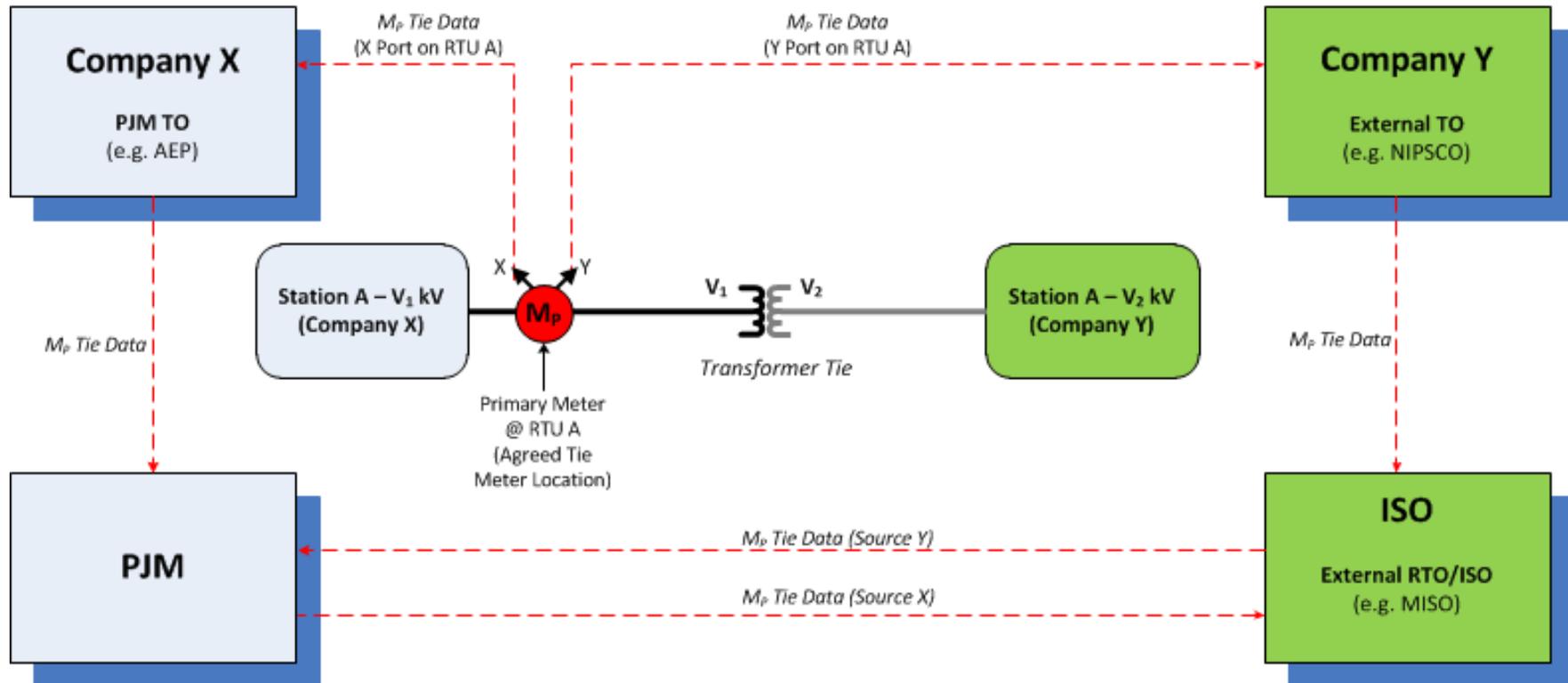
## External Tie Line Metering Primary Metering at External End of Tie Line



## Internal Tie Line Metering



## External Tie Line Metering Transformer Tie



## External Tie Line Metering Pseudo Tie/Dynamic Schedule

