



Phasor Measurement Unit (PMU) Placement Plan in RTEP Planning Process

Planning Committee
July 2020

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Vision: Full Synchrophasor observability of all EHV equipment 100 kV and above

Benefits:

- Ability to detect high-speed grid disturbances (oscillations, equipment failures)
- Innovative post-event analysis including dynamic model validation

Risk of unobservable grid events:

- Widespread installation of Synchrophasors was a recommendation following the 2003 blackout, which lasted 4 days, affected 50 Million people, with an estimated cost of \$6 billion.

PJM feels that the identified benefits and added observability well outweigh the additional installation costs.

Prospective RTEP requirement to include the installation of Synchrophasor devices. The requirement will be carried out by new M14B and M01 language.

Costs:

- Substation Costs - costs to make a substation “PMU Ready”
 - Estimated total: ~120k
- Project Costs - costs to install a single PMU
 - Estimated total: ~10k

Yearly Installations:

- Estimated yearly installation: ~80 PMUs
- Estimated yearly cost: ~\$8M

- Synchrophasors are a form of metering, implementing a placement requirement should follow the same documented process used by traditional SCADA.
- Because synchrophasors are a form of metering, the following CTOA section applies to both traditional SCADA and Phasor Measurement Units.

CTOA Section 4.9: Data, Information and Metering: The Parties shall comply with the data, information and metering requirements established by PJM, as reflected in the PJM Manuals including but not limited to posting notices as required by Section 4.8.

- PJM feels that the manual language in the solution proposal is sufficient to implement the PMU placement requirement, and that no additional language is needed in the Tariff or Operating Agreement.

The Planning Committee (PC) will **approve** the following modifications to M14B:

- **Additional language to M14B Appendix B as follows:**

The 5-year plan will specify the level of budget commitments which must be made in order to meet scheduled in-service dates. The commitment may include facility engineering and design, siting and permitting of facilities, **installation or modification of metering system(s) required by Manual 01**, or arrangements to construct transmission enhancements or expansions.

Refer **recommended** M01 language to Operating Committee to set prospective placement requirement.

1. Additional language to M01 Section 3.6:

Required Synchrophasor Data*:

For substations with three or more non-radial transmission lines at 100 kV or above, Synchrophasor measurement signals are required for the following equipment locations:

- Bus voltages at 100 kV and above
- Line-terminal voltage and current values for transmission lines at 100 kV and above
- High-side / low-side voltage and current values for transformers at 100kV and above
- Dynamic reactive device power output (SVC, STATCOM, Synchronous Condenser, etc.)

* These requirements shall only apply to new baseline and supplemental projects presented to the Transmission Expansion Advisory Committee (TEAC) and/or the Sub Regional RTEP Committees (SRRTEP) for inclusion in the RTEP after June 1, 2021. In situations where the installation of a Synchrophasor device would cause technical challenges resulting in unusually high installation costs, PJM may approve on a case-by-case basis an alternative Synchrophasor device installation plan proposed by the Transmission Owner or Designated Entity.

- PJM will review the costs and efficacy of M14B and M01 PMU placement language on a 5-year basis.
- PJM will update the [Synchrophasor Technical Guidelines Document](#) to include guidance for new transmission-level Synchrophasor devices.

