



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

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Markets & Reliability Committee
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Background

- In March, the Operating Committee requested that the Planning Committee investigate a means to include PMU Placement in the RTEP Plan
- PJM conducted outreach to stakeholders to gauge appropriateness of Quick Fix solution approach provided for in Manual 34.
- PC Special Session held in May to provide detailed education on the operation and use of Synchrophasor data at PJM.
- M14B and M01 language were developed and presented via the Quick Fix. Proposed manual language was modified based on stakeholder feedback.
- M14B and M01 language was endorsed by the PC and OC.
- Based on feedback at the August 20 MRC first read, PJM legal presented at the September PC and OC summarizing PJM's authority to require PMU data.

Benefits of adding PMUs:

- Ability to detect high-speed grid disturbances (oscillations, equipment failures)
- Expanded Linear State Estimation
- Assist PJM in meeting its NERC reliability obligations: BAL-003-1.1, IRO-008-2, TOP-001-4, MOD-032-1/033-1

Risk of Not adding PMUs:

- Inability to detect or correct dynamic grid events, leading to cascading outages, equipment damage, and regulatory penalties.

The Planning Committee (PC) endorsed the following modification to M14B Appendix B, Section B.3:

RTEP Deliverables

- A 5-year plan, which includes recommended regional transmission enhancements, including alternatives if applicable, that address the transmission needs for which commitments need to be made in the near term in order to meet scheduled in-service dates
- The 5-year plan will include planning level cost estimates and construction schedules.
- 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.
- The 15-year plan will identify new transmission construction and right-of-way acquisition requirements to support load growth.

The Operating Committee endorsed the following additional language to M01 Section 3.6:

For substations with three or more non-radial transmission lines at 100 kV or above, Synchrophasor measurements are required for the following equipment types (see the applicability of requirements below). All measurement points must be in the form of positive sequence values.

- Voltages for busses at 100 kV and above
- Line-terminal voltages and currents (both ends) for transmission lines at 100 kV and above
- High-side/low-side voltage and current values for transformers with a rated low side voltage of 100 kV or greater
- Dynamic reactive device power output (SVCs, STATCOMs, Synchronous condensers, etc.)

Note: These Synchrophasor data 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 Regional Transmission Expansion Plan (RTEP) on or after June 1, 2021. In situations where the installation of a Synchrophasor device causes technical challenges resulting in unusually high installation costs, PJM may, on a case-by-case basis, approve an alternative Synchrophasor device installation plan proposed by the Transmission Owner or Designated Entity. Supporting equipment (PDC, GPS clock, etc.) installed per this requirement shall include necessary design and configuration to make the device 'CIP ready'.

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- Dynamic reactive device power output (SVCs, STATCOMs, Synchronous condensers, etc.)

Note: These Synchrophasor data requirements shall only apply to new **Regional Transmission Expansion Plan (RTEP) baseline and supplemental projects, other than network upgrades for the purpose of interconnecting a new generator,** presented to the Transmission Expansion Advisory Committee (TEAC) and/or the Sub Regional RTEP Committees (SRRTEP) for inclusion **or integration** in the **Regional Transmission Expansion Plan (RTEP)** on or after June 1, 2021. **PMUs will increase the level of observability allowing PJM to better perform its reliability obligations, and facilitate compliance with the applicable NERC reliability standards as the grid continues to evolve.** In situations where the installation of a Synchrophasor device causes technical challenges resulting in unusually high installation costs, PJM may, on a case-by-case basis, approve an alternative Synchrophasor device installation plan proposed by the Transmission Owner or Designated Entity. Supporting equipment (PDC, GPS clock, etc.) installed per this requirement shall include necessary design and configuration to make the device 'CIP ready'.

The Operating Committee endorsed the following additional language to M01 Section 3.6:

For substations with three or more non-radial transmission lines at 200 kV ~~400 kV~~ or above, and four or more non-radial transmission lines between 100 kV and 200 kV. Synchrophasor measurements are required for the following equipment types (see the applicability of requirements below). All measurement points must be in the form of positive sequence values.

- Voltages for busses at 100 kV and above
- Line-terminal voltages and currents (both ends) for transmission lines at 100 kV and above
- High-side/low-side voltage and current values for transformers with a rated low side voltage of 100 kV or greater
- Dynamic reactive device power output (SVCs, STATCOMs, Synchronous condensers, etc.)

Note: These Synchrophasor data requirements shall only apply to new ~~Regional Transmission Expansion Plan (RTEP) baseline and supplemental projects,~~ other than network upgrades for the purpose of interconnecting a new generator, presented to the Transmission Expansion Advisory Committee (TEAC) and/or the Sub Regional RTEP Committees (SRRTEP) for inclusion ~~or integration~~ in the ~~Regional Transmission Expansion Plan (RTEP)~~ on or after June 1, 2021. ~~PMUs will increase the level of observability allowing PJM to better perform its reliability obligations, and facilitate compliance with the applicable NERC reliability standards as the grid continues to evolve.~~ In situations where the installation of a Synchrophasor device causes technical challenges resulting in unusually high installation costs, PJM may, on a case-by-case basis, ~~waive the requirement or~~ approve an alternative Synchrophasor device installation plan proposed by the Transmission Owner or Designated Entity. Supporting equipment (PDC, GPS clock, etc.) installed per this requirement shall include necessary design and configuration to make the device 'CIP ready'. ~~PJM will evaluate the effectiveness of the Synchrophasor measurement requirements on a periodic basis and work with PJM stakeholders to modify such requirements as necessary.~~

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