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Updates to IESO Monitoring Requirements: Synchrophasor Data

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Territory Acknowledgement

The IESO acknowledges the land we are delivering today's webinar from is the traditional territory of many nations including the Mississaugas of the Credit, the Anishnawbe, the Chippewa, the Haudenosaunee and the Wendat peoples and is now home to many diverse First Nations, Inuit and Métis peoples. We also acknowledge that Toronto is covered by Treaty 13 with the Mississaugas of the Credit First Nation.

As we have attendees from across Ontario, the IESO would also like to acknowledge all of the traditional territories across the province, which includes those of the Algonquin, Anishnawbe, Cree, Oji-Cree, Huron-Wendat, Haudenosaunee and in addition to the Métis and Inuit peoples.

Purpose

- Introduction and Background
- Overview of MR amendment
- Proposed changes to MM
- PMU Registration and Connection Process
- Expected Timeline / Future Changes

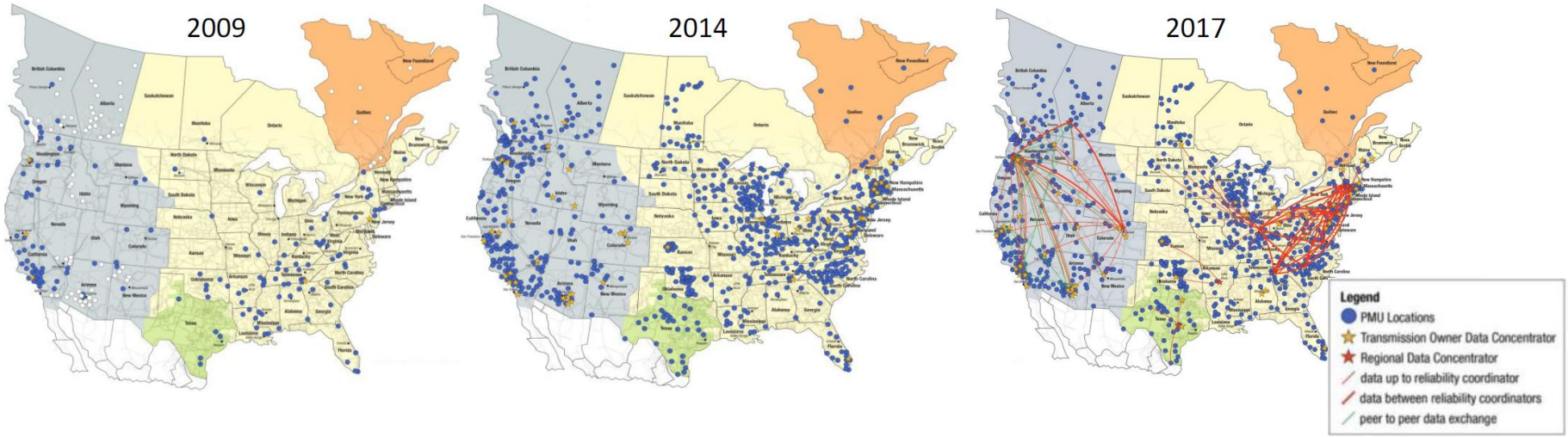
Introduction and Background

PMUs in the Broader Context

- Enhances the IESO's situational awareness – critical to maintaining reliability and resiliency with an increasingly dynamic power system
    - Increasing applications of phasor measurement unit (PMU) data in off-line, near-term and real-time systems
- Promotes improvement in interconnection-wide monitoring by sharing PMU data between Ontario and neighbouring jurisdictions
- Improves IESO's ability to demonstrate reliability standards compliance
    - NERC reliability guideline for PMU placement published, future PMU related reliability standard anticipated

Introduction and Background

Growth of PMU Deployments in North America



Source: North American Synchrophasor Initiative (NASPI)

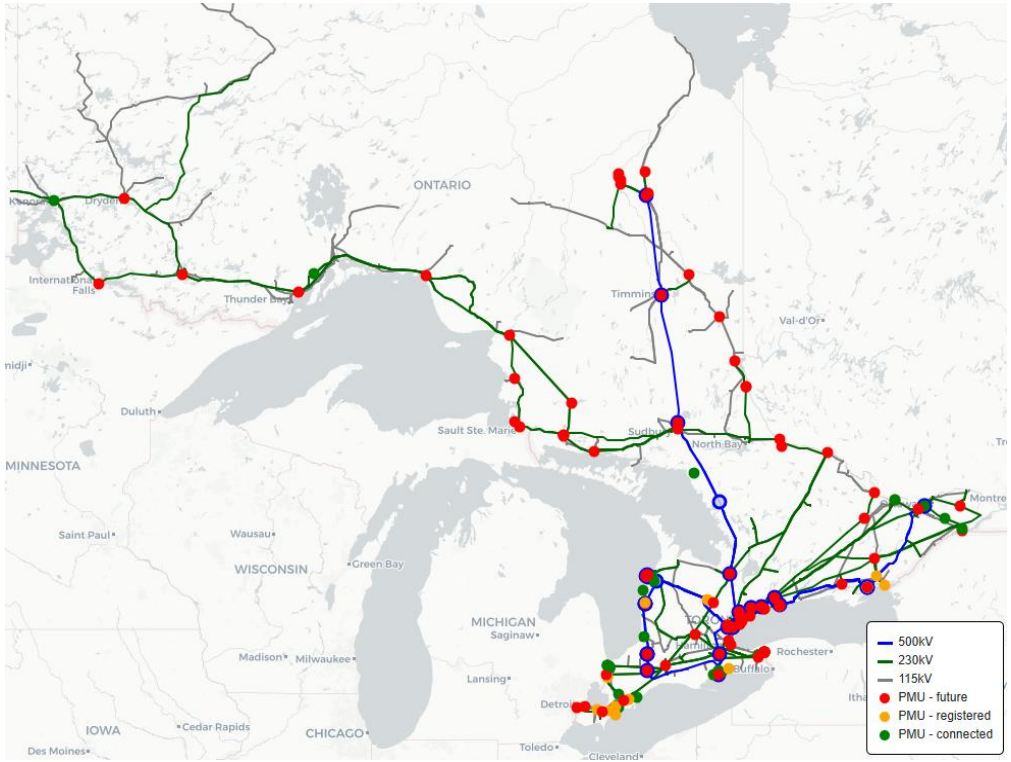
PMUs in Ontario

240 PMUs

111 Facilities

30 IBR based

- To date we have **54** PMUs connected from **24** facilities
  - 4 Gas
  - 14 Wind
  - 1 Solar
  - 5 Substations



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Overview of changes

Market Rule amendment **MR-00487-R00:**

- Addition of Section 7.2.1 to Chapter 4
- Modification to Ch.4 App. 4.15
- Addition of Synchrophasor Data Requirements table to Ch.4 App. 4.24- IESO Monitoring Requirements: Electricity Storage Participants

Changes made accordingly to MM 1.7: Synchrophasor Data Requirements

Addition of Section 7.2.1 to Chapter 4

A general provision is inserted into Chapter 4 outlining the obligations market participants have relating to the infrastructure required to support synchrophasor data.

These obligations previously existed in the market manual but are being moved to the market rules, as this is a more appropriate place for such obligations.

Apart from relocation, the substantive change is to extend these obligations to storage resources.

Appendix 4.15- IESO Monitoring Requirements: Generators

Several changes are proposed to;

- The respective measurements that should be provided.
- Recognize exemptions to strict adherence to these requirements as outlined in the market manual.

These changes were instigated upon further review of the market rules while developing similar rules for electricity storage resources.

Appendix 4.24- IESO Monitoring Requirements: Electricity Storage Participants

New section outlining requirements for synchrophasor data from electricity storage resources.

These new requirements are largely consistent with the requirements for generators with the exception being size;

- All storage units greater than 20 MVA must provide data (vs. 100 MVA for generators).

Proposed Market Rule Changes

Synchrophasor data requirements for Electricity Storage Participants

Type	**Synchrophasor Data Requirements**
Electricity storage facility	For all three phases the voltage and current phasor measurements and frequency measurements, as further described in the applicable *market manual*, shall be required for each *electricity storage unit* as outlined below; 1. For all *electricity storage units* with a name-plate rating at greater than 20 MVA, measured from the *electricity storage facility* side of the *connection point* to the *IESO-controlled grid* 2. For all *electricity storage units* connected to the *IESO-controlled grid* through a common *connection point* whose aggregate name-plate rating size is greater than 20 MVA, measured from the *electricity storage facility* side of the *connection point* to the *IESO-controlled grid*

Proposed Market Rule Changes

Synchrophasor data requirements for Electricity Storage Participants (2)

Type	**Synchrophasor Data Requirements**
Electricity storage facility	3. For all *electricity storage units*, regardless of rated size, that are associated with, or have the potential to, impact an Interconnection Reliability Operating Limit, measured from the terminals defining the Interconnection Reliability Operating Limit. 4. Notwithstanding the foregoing, a *market participant* is not required to measure and provide such data when exempted from such requirement as determined in accordance with the applicable *market manual*.

Overview of Market Manual changes

Summary of the changes made to Market Manual 1.7

- Changes to data requirements for all market participants;
  - Voltage and Current phasors required for each phase
  - Minimum reporting rate increased from **30** to **60** samples/sec
- Requirements now include Electricity Storage Participants (Section 4)
- Added section on PMU Connection process (Section 6)
- Reformat Market Manual to post-MRP template and conventions
  - This includes the re-location of some requirements to the market rules such as the need for MPs to maintain synchrophasor infrastructure.
- Removed section: Background Information for Synchrophasors and Associated Infrastructure (Previously Section 5)

Proposed Market Manual Changes

Requirements(1): Generators

Attribute	Status	Requirement
Measurement Point	Required	*Generation facility* that has one or multiple *generating units* that aggregate to **100** MVA or more must provide phasor measurements for all **3** phases as well as frequency measurements *Generation units*, regardless of rated size, that are associated with or have the potential to impact a NERC IROL must provide phasor measurements for all **3** phases as well as frequency measurements
Measured Quantities and Units	Required	Provide voltage magnitude and phasor angle (3-phase), current magnitude and phasor angle (3-phase), frequency (Hz), ROCOF
Reporting Rate	Required	Provide synchrophasor data at minimum **60** samples per second (1/60th of a second intervals)

(1) The content presented here is for informational purposes only and does not reflect or replace the official requirements outlined in the Market Manual.

Proposed Market Manual Changes

Requirements(1): Electricity Storage Participants

Attribute	Status	Requirement
Measurement Point	Required	*Electricity storage facility* that has one or multiple electricity storage units that aggregate to 20 MVA or more must provide phasor measurements for all 3 phases as well as frequency measurements *Electricity storage units*, regardless of rated size, that are associated with or have the potential to impact a NERC IROL must provide phasor measurements for all 3 phases as well as frequency measurements
Measured Quantities and Units	Required	Provide voltage magnitude and phasor angle (3-phase), current magnitude and phasor angle (3-phase), frequency (Hz), ROCOF
Coordinates	Required	Provide phasor data in polar coordinates, magnitudes in SI units

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Proposed Market Manual Changes

Requirements[1]: Electricity Storage Participants (2)

Attribute	Status	Requirement
System Frequency	Required	Provide data continuously between 57 Hz and 62 Hz
Reporting Rate	Required	Provide synchrophasor data at minimum 60 samples per second (1/60th of a second intervals)
Time-Tag Format and Accuracy	Required	Report time in UTC with zero offset. Include time tag traceable to UTC clock with accuracy of at least 1µs within 100 years
Data Format and Accuracy Standard	Required	Data provided to the *IESO* shall comply with the IEEE Std 60255-118-1-2018.
Instrumentation Channel	Required	Provide instrument transformers and corresponding channel components accurate enough for IESO real-time applications

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Proposed Market Manual Changes

Requirements[1]: Electricity Storage Participants (3)

Attribute	Status	Requirement
Network Protocol	Required	Provide phasor data via site-to-site VPN with the IESO. A public static IP address is required
Latency	Required	Total latency from PMU to IESO ≤ 500 ms. Market participants shall be required to provide a total latency ≤ 100 ms if informed by the IESO that its synchrophasor data is to be used in a Linear State Estimator as part of a Transient Stability Program
Bandwidth	Required	Provide adequate bandwidth to transmit PMU data at selected reporting rate (typically 1 Mbps per transmitting PMU device)
Bandwidth	Preferred	Provide dedicated communication channels to avoid data transmission interruptions and fluctuations in latency

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Proposed Market Manual Changes

Requirements(1): Electricity Storage Participants (4)

Attribute	Status	Requirement
Redundancy	Required	Provide primary communication path for synchrophasor data to the IESO
Redundancy	Preferred	Provide primary and secondary communication paths
CVT/PT Selection	Preferred	Use Metering Class Bus CVT/PT or Metering Class Transmission line/feeder CVT/PT measurements where possible
CT Selection	Preferred	Use Protection Class CTs for dynamic and fault conditions
Reliability, Maintenance and Repair	Required	Adhere to MR Ch 0.4 s.7.7 for all installed synchrophasor data devices and infrastructure (transformers, communication channels, PDCs)

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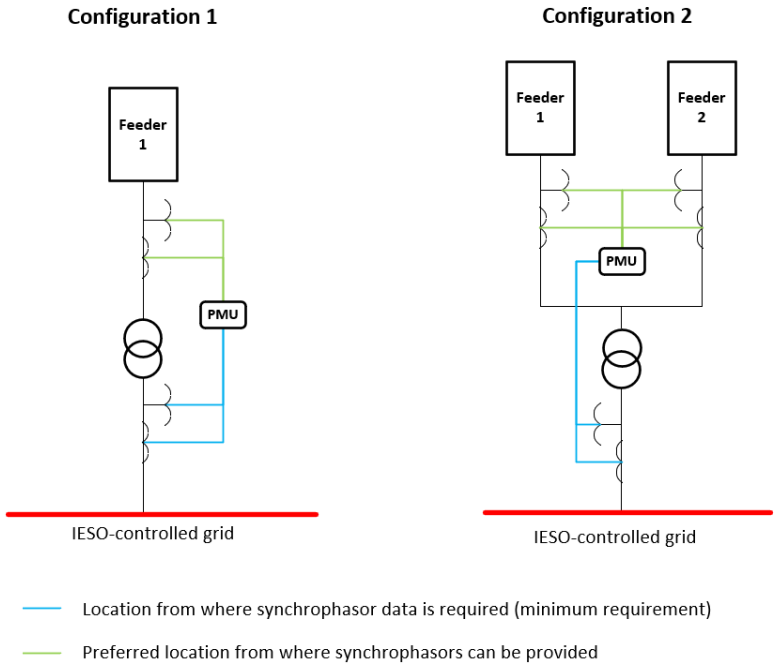
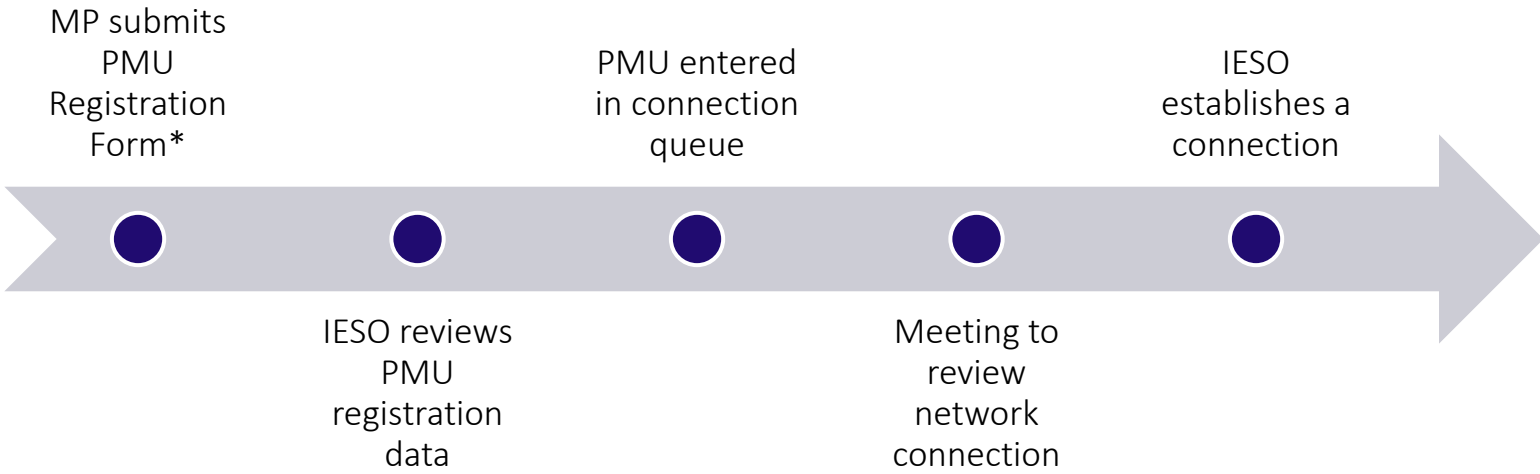
Measurement Locations

Requirements: Electricity Storage Participants



PMU Registration and Connection

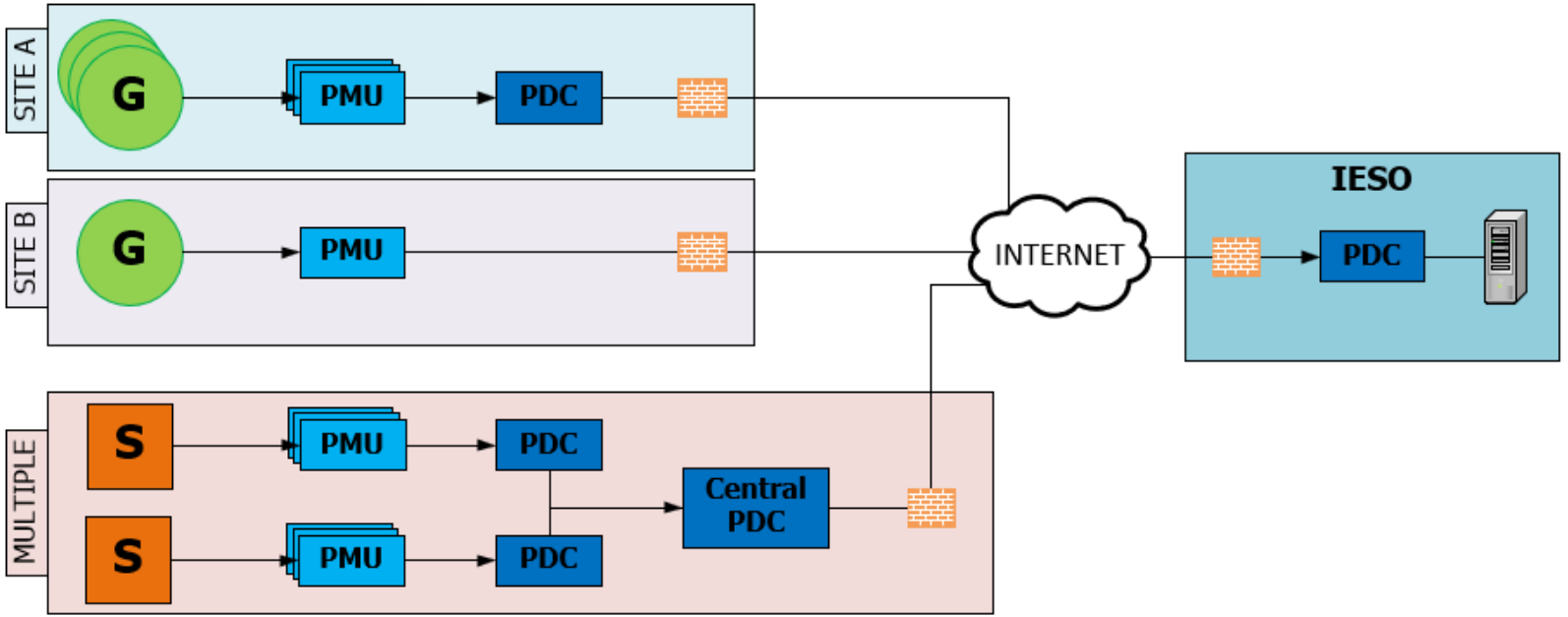


* PMU Registration Form is expected to move to Online IESO in 2026

Section 6 – PMU Connection Process

Step	Description
6.1 Initial Design Discussion	*Market participant* and the *IESO* shall review the networking technical requirements via meeting
6.2 Exchange of VPN Form	*Market participant* shall complete and submit the VPN configuration form provided by the *IESO*
6.3 Network and/or Application Validation Meeting	*IESO* will implement VPN tunnel based on 6.2 above, and once ready initiate a meeting to validate the connection at the network and application levels
6.4 Final Confirmation	Following the application validation meeting, *market participant* commences transmission of the *synchophasor* data and the *IESO* confirms successful receipt of the data and the PMU connection process is complete.

Common Connection Configurations



Expected Timeline

Activity	Time
Stakeholder MR amendment (MR-00487-R00) and redline changes to Market Manual 1.7	December 18, 2025
Receive and review stakeholder feedback	January 22, 2026
Technical Panel vote to post	April 14, 2026
Technical Panel vote to recommend	May 12, 2026
IESO Board reviews and approves proposed MR changes	June 12, 2026
Market rules and market manual changes come in effect	December 2, 2026

Future Work / Lookout

- Synchrophasor requirements for Large Loads that are classified as Inverter Based resources
  - The IESO advises applicants to include PMU-capable devices and associated infrastructure in their project design during the System Impact Assessment (SIA) process.
- The Novel Applications for Synchronized Power Instrumentation (NASPI) working group is drafting a white paper to propose future NERC requirements for real-time stability monitoring using synchrophasor data

Additional Support

- Market Participants are encouraged to reach out to the IESO if they require support.

Thank You

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