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Updates to IESO Monitoring Requirements: Synchrophasor Data

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Purpose

- Introduction and Background
- Proposed Synchrophasor Requirements for Generators
- Proposed Synchrophasor Requirements for Transmitters
- Qualitative Benefit Analysis
- Quantitative Cost Analysis
- Implementation Schedule
- Stakeholder Feedback Request

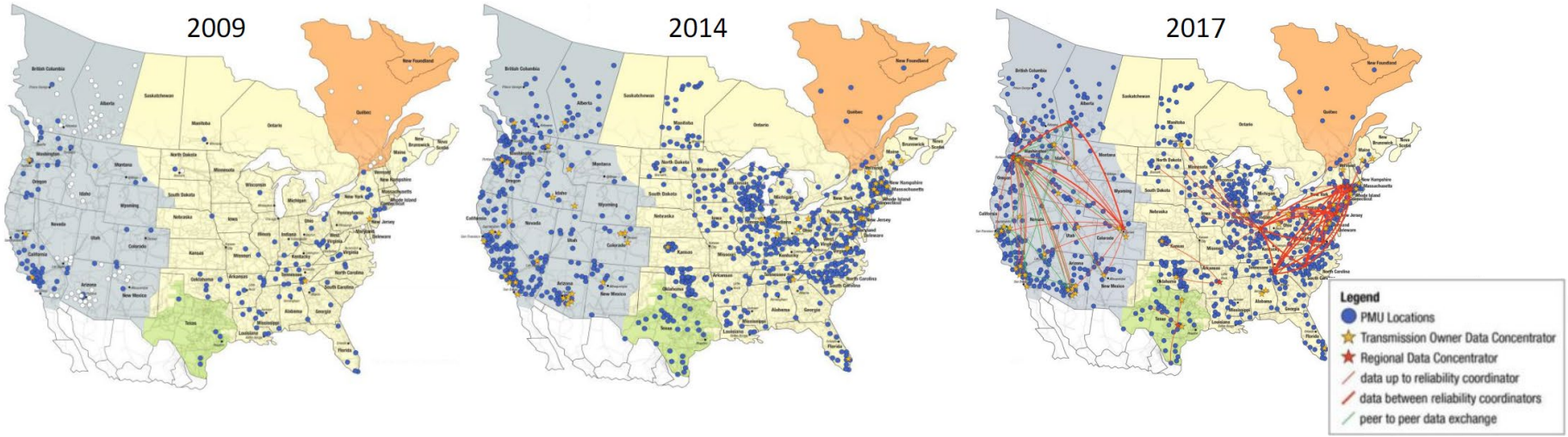
Introduction and Background

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 PMU data in off-line, near-term and real-time systems
- Facilitates sharing and viewing wider portion of the interconnected grid for both Ontario & neighbouring jurisdictions - more accurately and consistently
- 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)

Introduction and Background:

Proposed Market Rule Changes and Requirements

- Proposed Market Rule (MR) changes
  - Appendix 4.15 – IESO Monitoring Requirements: Generators
  - Appendix 4.16 – IESO Monitoring Requirements: Transmitters
- MR will require Transmitters and Generators provide synchrophasor data to the IESO for operational and planning purposes
- IESO responsive to stakeholders via feedback received in SE sessions and individual meetings with highly impacted stakeholders:
  - Updates have been made to proposed MR and draft Market Manual (MM)
  - Reports providing qualitative benefit and quantitative cost analysis have been developed

Proposed Synchrophasor Requirements for Generators

(1) Single Generator Unit ≥ 100 MVA (name-plate rating)

Frequency and positive sequence voltage & current phasors from unit terminal

(2) Aggregated Generator Facility ≥ 100 MVA (aggregate name-plate rating)

Frequency and positive sequence voltage & aggregated current phasors from customer side of connection point to the grid

Generators in (1) and (2) are not required to provide the synchrophasor data if:
The generation facility is not a BPS station or has no connection point voltage > 200 kV.
Generators in (1) and (2) may not be required to provide the synchrophasor data if (*):
(a) The generation facility will be deregistered within a period of 5 years from date of implementation of market rules.
(b) The annual gross capacity factor of the generation facility is significantly low.

(*) *The applicability of items (a) and (b) above are subject to the IESO's periodic review and assessment of the decommissioning plan and evaluation of capacity factors respectively, per mutual agreement on a case-by-case basis.*

Proposed Synchrophasor Requirements for Generators (cont.)

(3) Generation facility output is a part of an Interconnection Reliability Operating Limits (IROL) definition regardless of size

For generation units, regardless of rated size, whose output power flow is a part of an Interconnection Reliability Operating Limit (IROL) definition, provide positive sequence voltage phasor, positive sequence current phasor and frequency at the terminals defining the IROL. This requirement will take precedence even if a facility meets any of the applicability criteria (a) and (b) listed in the previous slide.

Proposed Synchrophasor Requirements for Transmitters

Equipment Type	Monitored Quantities
500 kV Stations, Bulk Power Stations, Stations in Grid Restoration Paths	Frequency and positive sequence voltage phasor from two separate buses
Circuits defining Interconnection Reliability Operating Limits (IROL) and interties	Frequency and positive sequence voltage & current phasors from circuit terminal
SVCs, Static Synchronous Condensers and STATCOMs	Frequency and positive sequence voltage & current phasors from unit terminal

Qualitative Benefit and Quantitative Cost Range Analysis

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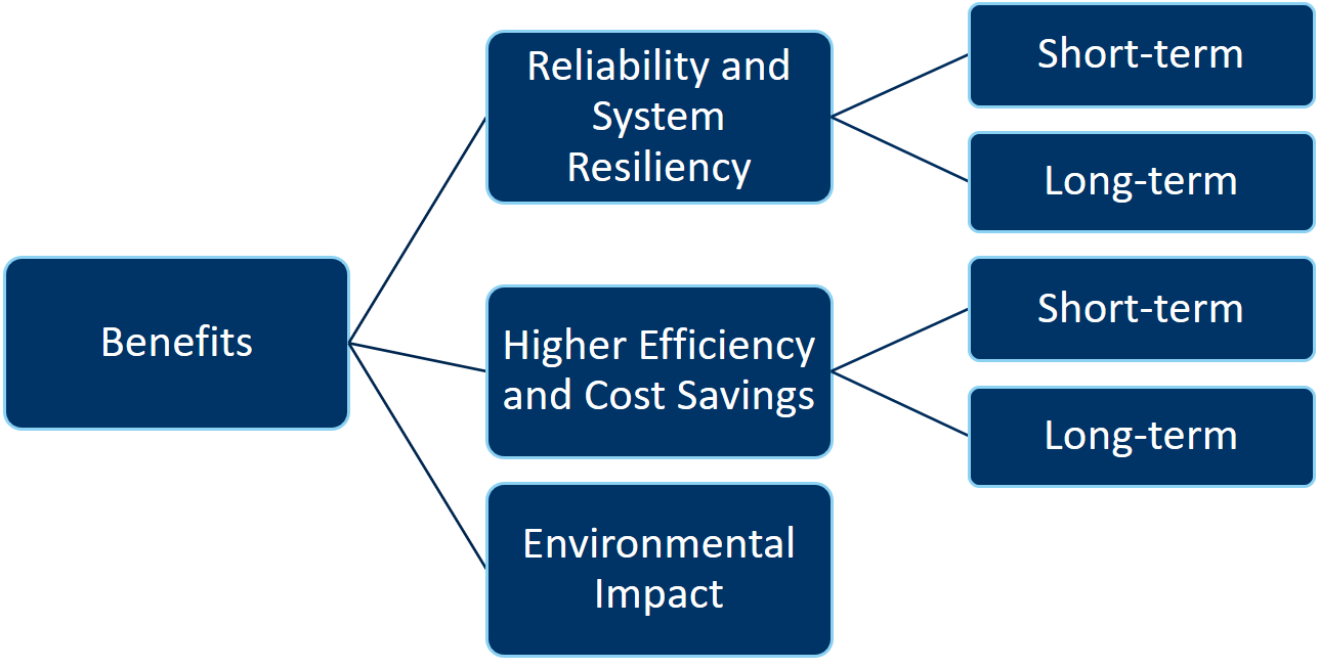
Qualitative Benefit and Quantitative Cost Range Analysis

Qualitative Benefit Analysis



Qualitative Benefit Analysis

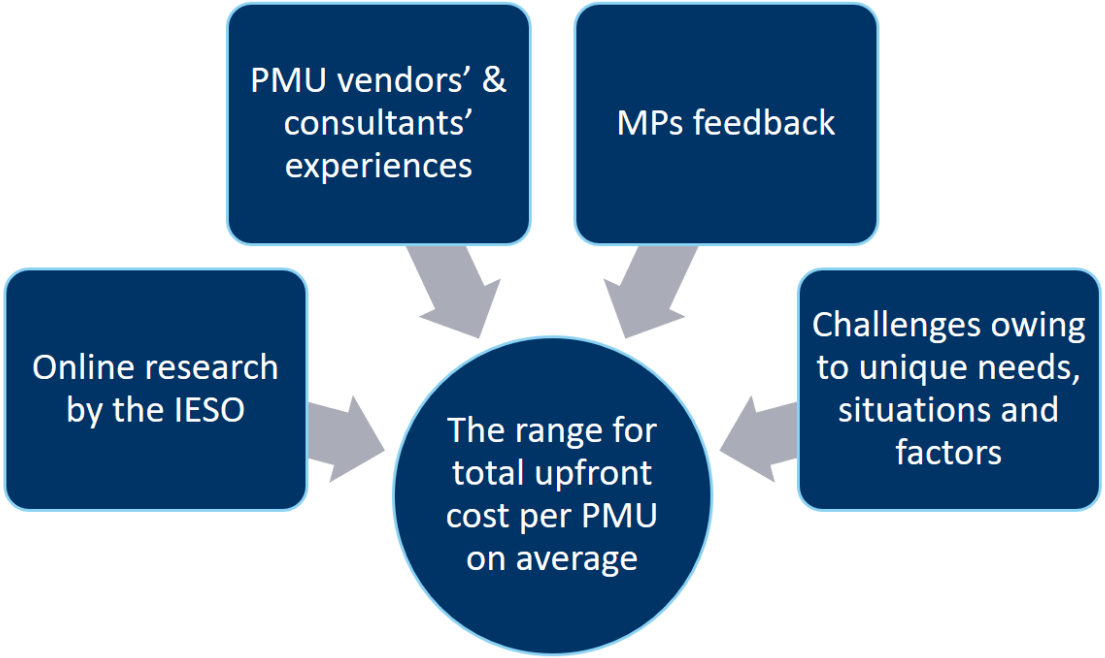
Categories	Short-term Benefits
Reliability and System Resiliency	• Avoiding blackouts and large scale forced outages resulting in significant cost savings • Enhanced situational awareness reducing equipment outages and overall asset downtime with considerable economic benefits • Informed decision tools and accurate operating limits to facilitate new sources of generation with added economic value • Identifying unstable oscillatory modes and faster restoration with reduced damage to grid equipment and system wide cost savings
Higher Efficiency and Cost Savings	• More accurate line limits allowing low-cost energy to flow through the system at a lower system congestion • Reduced plant downtime and shorter troubleshooting aids in keeping assets online safely for longer periods, yielding cost savings • Improved forecasting models and asset utilization with higher economic benefits

Qualitative Benefit Analysis

Categories	Long-term Benefits
Reliability and System Resiliency	• Wide-area visibility and identifying larger issues to take long-term measures and to avoid wide-spread blackouts and their associated economic impacts • Identifying and avoiding system disturbances due to fast switching of renewables and storage technologies to facilitate their increased penetration reliably
Higher Efficiency and Cost Savings	• Enhanced ability to comply with NERC reliability standards and avoiding financial penalties for non-compliance scenarios • More accuracy when modeling and setting the operating limits for transmission infrastructure allows for investments where most beneficial for the system

More details are provided in associated report titled "Qualitative Benefit Analysis of PMU Deployment in Ontario" which is available under the September 2021 entry on the Updates to IESO Monitoring Requirements: Phasor Data webpage

Quantitative Cost Analysis



Quantitative Cost Analysis

Cost Factors	Transmitters Cost Estimates
Communications (C): Telecommunication Network (TN) Electric Devices (ED) C = TN + ED	Install new/upgrade PDC = $135,000 Install new LAN station = $280,000
Security (S) Labor (L) Equipment (E) → (S + L + E) →	Enable PMU on existing IED = $15,000 Upgrade protection IED for PMU = $50,000 Install separate PMU IED = $167,000
Total: (C + S + L + E)	$50,000 - $300,000

All estimates are in Canadian Dollars (CAD).

Quantitative Cost Analysis

Cost Factors	Generators Cost Saving Opportunities
Communications (C): Telecommunication Network (TN) Electric Devices (ED) C = TN + ED	Lower costs when no internal use for PMU data is required or when site-to-site communication is feasible
Security (S) Labor (L) Equipment (E) → (S + L + E) →	Lower telecommunication requirements based on measurands Smaller geographical territory
Total: (C + S + L + E)	$25,000 - $200,000

More details are provided in associated report titled "Quantitative Cost Range Analysis for PMU Installation in Ontario" which is available under the September 2021 entry on the Updates to IESO Monitoring Requirements: Phasor Data webpage

Proposed Implementation Plan

- Draft Market Rules to be presented to IESO Technical Panel in **Q4 2021**
  - MRs expected to be implemented in Q1 2022, with MM updates to follow shortly afterwards
- Facilities connected to the IESO-controlled grid "**pre-Market Rules**":
  - Market Participants having one facility, provide data on or before Dec 31, 2023
  - Market Participants having multiple facilities, provide data via mutually agreed staged implementation plan

- Facilities connecting to the IESO-controlled grid "**post-Market Rules**"(1):
  - Provide data on latter of the time of connection or Dec 31, 2023

(1) Any exceptions will be managed on a case-by-case basis

Stakeholder Feedback

- The IESO is seeking feedback on changes made in proposed Market Rules and Market Manual
- Please use the feedback form found under the September 2021 entry on the Updates to IESO Monitoring Requirements: Phasor Data webpage to provide feedback and send to engagement@ieso.ca by October 12, 2021

Thank You

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