

Stakeholder Feedback and IESO Response

Updates to IESO Monitoring Requirements: Phasor Data – June 24 webinar

Following the June 24th public webinar to discuss the synchrophasor technology needs and related Market Rules changes being proposed, the Independent Electricity System Operator (IESO) received feedback from participants on the proposed rules, requirements and implementation schedule.

The IESO received feedback from:

- [Hydro One](#)
- [Ontario Power Generation](#)

This feedback has been posted on the [Updates to IESO Monitoring Requirements: Phasor Data webpage](#).

Notes on Feedback Summary

The IESO appreciates the feedback received from stakeholders on the design proposal. The feedback has been noted and will be considered as the engagement moves forward. The IESO has provided a summary below, which outlines specific feedback or questions for which an IESO response was required at this time.

Proposed Rules:

Feedback

One stakeholder sought clarity on which devices would be required to provide PMU data, stating:

- The last bullet on page 17 of the slide deck refers to dynamic reactive power devices. Hydro One is asking for clarity on which devices currently installed in its transmission system the IESO would like PMU data from.

IESO Response

The dynamic reactive power devices referenced in this requirement are specifically Static Var Compensators (SVC) connected to the transmission system. Currently, such SVCs are located at Nanticoke, Porcupine, Lakehead, Kirkland Lake and Detweiler.

Feedback

The stakeholder also recommended the IESO work to coordinate efforts to avoid double expenses:

- Hydro One also proposes that the IESO coordinate this effort with Hydro One and Generators to avoid potential double expenses through PMUs installed by both Hydro One and Generators.

IESO Response

Both SVCs and generators are considered dynamic devices and both have potential to cause oscillations under certain system conditions. However, if there is a major generation facility (≥ 100 MVA) in the close vicinity of the SVC, the IESO is satisfied with receiving the PMU data either from the SVC or the generation facility. In such cases, the IESO will determine on a case-by-case basis whether obtaining PMU data either from the SVC or the generation facility is more informative based on a variety of factors, such as, facility MVA, system strength, number of controls in the facility and their complexity, potential to cause dynamics, number of mathematical models associated with the facility etc.

Feedback

Another stakeholder noted that more information is required to clarify requirements:

OPG has concerns with the proposed changes to the Market Rules, as it is unclear from the webinar what the exact changes will be in Appendix 4.15 & 4.16. There is also no mention of the expected changes to Market Manual documentation. OPG believes the information on slide 17 requires more clarity on actual generator requirements, as it only states that generation units and aggregated generation units ≥ 100 MVA will require PMUs. The IESO also needs to acknowledge the complexity required to have PMUs on aggregated facilities and define why this would be a requirement. Aggregated facilities would require updated Instrument Transformers (ITs) for each generator unit, data summation devices, as well as many generator outages for installation. OPG encourages the IESO to provide rationale and explanation as to how the criteria was formulated, as it would help justify some of these requirements.

IESO Response

The IESO acknowledges the complexity, cost and time required in implementation of the infrastructure required to provide PMU data to the IESO.

1. The requirement is applicable only to generators or facilities rated equal or higher than 100 MVA. Will impact about 25 stations owned by OPG.
2. The IESO supports the implementation of phasor technology in stages. First proposed stage would include Darlington, Lennox, Beck 1, Beck 2, Saunders.
3. The IESO supports providing PMU data using stand-alone PMU devices as well as via other devices such as DDR or relay IEDs that comply with C37.118-2005 protocol.
4. The IESO will examine a process for exclusion if any generating station is expected to be retired within next 10 years (e.g. Pickering Nuclear Generating Station.)
5. The IESO will endeavour to work with stakeholders on a mutually agreeable time schedule for staged implementation.

Today, SCADA based aggregated generator monitoring requirement is applicable to facilities ≥ 100 MVA even if individual units are rated < 100 MVA. The reason to have such a requirement is if a facility has multiple units with a single connection point to the grid, the dynamics exhibit less damping compared to if same units had separate connection points to the grid. The PMUs provide granular visibility of such dynamics which is not currently possible since SCADA has about 50-100 times slower sampling rate compared to PMU. Thus, applying a PMU based monitoring requirement to facilities to monitor dynamics where similar SCADA based monitoring requirement is already applied is suitable and helps the IESO to identify under-damped facilities or units which is otherwise not possible thru SCADA. Examples of benefits of having a such a requirement are:

1. In real-time to take mitigation measures.
2. In validating system model to comply with NERC MOD-033.

Under certain station configurations where total facility > 100 MVA, (or individual units < 100 MVA, such as Beck 1 for example), providing aggregated values would still require installing instrument transformers to individual generators. While the IESO recognises the cost and complexity in such situations, the IESO would still urge OPG to consider providing PMU data from individual generators where possible as opposed to providing the aggregation.

Any additional details or specifications on PMU data requirement or changes to Operating and Planning Procedures and Policies will be analysed further and documented in appropriate Market Manuals and System Control Orders (SCOs) in the future.

Proposed Requirements:

Summary of proposed specific requirements applicable to Major Generation Facilities and Transmitters:

Specific Requirements Applicable to Major Generation Facilities:

- Generation Unit ≥ 100 MVA (*required quantities are positive sequence current, positive sequence voltage and frequency from generator terminal i.e. low voltage side of generator transformer*)

- Aggregated generation Units ≥ 100 MVA (*required quantities are positive sequence voltage, aggregated positive sequence current and frequency from generation facility side of the connection point to the grid*)

Specific Requirements Applicable to Transmitters:

- 500 kV stations, Bulk Power Stations, Stations required to restore the grid from black-start units (*required quantities are positive sequence voltages and frequency from two station buses*)
- Circuits defining Interconnection Reliability Operating Limits (IROL) and Interties (*required quantities are positive sequence currents, positive sequence voltages and frequency from circuit terminals*)
- Static Var Compensators (SVC) (*required quantities are positive sequence current, positive sequence voltage and frequency from terminal*)

Summary of proposed general requirements:

- Provide phasor data using stand-alone Phasor Measurement Units (PMU) or any other devices such as Digital Disturbance Recorders (DDR) or Intelligent Electronic Device (IED) of protection relays.
- Phasor data are to be complied to latest approved *IEEE standard for Synchrophasor Measurements* at the time of the installation of measuring devices. Lesser standard such as *IEEE C37.118-2005* is acceptable where data is generated by a pre-existing device.
- Provide phasor data at a minimum rate of 30 samples per second.
- Use instrument transformers for phasor data measurements with accuracy equal or better than those used for SCADA measurements.
- Use communication channels with bandwidth adequate for the applicable volume and sample rate of phasor data. Dedicated channels are not essential, but preferred to avoid data interruption and excessive latency.

Feedback

One stakeholder raised potential technical challenges in meeting the data latency requirement, and provided a suggestion around flexibility:

- Bullet 4 on page 18 of the slide deck refers to data latency. Hydro One may face significant technical challenges in meeting this requirement for a selection of our remote stations. The suggestion is to build flexibility in the statement to account for situations where we either cannot or face an unreasonable expense to procure an appropriate telecom circuit. A suggested modifier could be 'subject to telecom circuit availability'. Another potential consideration may be a tiered approach to latency based on the criticality of a location e.g. A higher latency allowance for a less critical site. This may also be a valid concern for Generators.

IESO Response

The original requirement on latency is based on IESO's intent to use phasor data in real-time applications in the future which entails the need for reduced latency.

The tiered approach may not work as the sites to obtain PMU data as proposed are already critical sites such as Bulk Power Stations, 500 kV stations, Interconnection Reliability Operation Limit (IROL) circuits etc. and consequently it won't be possible to define another less or more critical subset within that.

The IESO will modify the requirement to the following: "Provide phasor data with latency adequate to be used in real-time applications".

Feedback

Another stakeholder requested further information on the technical requirements, and suggested that the IESO should endeavor to further understand the implications on market participants:

- The IESO should work with individual market participants to discuss their requirements and fully understand the implications before proceeding towards implementation. The IESO should also provide technical specification documents to participants in order for them to fully understand the expectations – e.g. communication channels, cyber security etc... The IESO webinar highlighted some of the technical requirements at a high level, however significantly more detail is required; for example:
 - Will IESO require the phasor information to be transmitted in a particular protocol format as well as impose the choice of communication media?
 - Will there be communication security implementation requirements?
 - How much visibility (via PMU) does IESO need to achieve its goals regarding secure/reliable operation of the ICG?

IESO Response

The IESO would like to reiterate that the language used to specify the PMU data requirement in proposed Market Rules is intended to provide flexibility to MPs. At this point the IESO believes that the wording is required to reflect broad guidelines and principals rather than strict technical specifications, but is open to entertaining additional clarifications in future versions of Market Rules and Market Manuals to alleviate the concerns raised.

The required PMU data protocol is specified in C37.118-2005 for utilisation of existing devices. (C37.118-2011 is recommended, C37.118-2005 is required). Any future purchased new devices are expected to comply with latest industry accepted protocol at the time of the purchase.

The extent of visibility of the power system that IESO expects to accomplish via PMU data in Ontario is to encompass the 500 kV network, the bulk power stations, the major transmission interfaces associated with Interconnection Reliability Operating Limits (IROL), the tie-lines and major generating stations. The IESO intends to obtain PMU data from external entities in future to extend the visibility into neighbouring jurisdictions.

Feedback

One stakeholder requested clarity on whether communication circuits are required to be dedicated:

- OPG is also unclear if PMUs will need dedicated communication circuits. Some existing facilities have leased lines, and these paths will not be able to provide the speeds or bandwidth required by the PMU.

IESO Response

In order to transmit PMU data, dedicated communication paths are preferred, but not essential. The expectation is the data transmission must have bandwidth and latency sufficient for the IESO to utilise PMU data for real-time applications.

Implementation Schedule:

Feedback

Two stakeholders commented on potential challenges with meeting the implementation timeline, given the constraints and the need to budget resources:

- Bullet 1 on page 19 of the slide deck refers to a December 31, 2020 deadline for new connections. Hydro One anticipates challenges in meeting this timeline for multi-year in flight projects which are nearing completion. A scope change as projects are in the execution stage is disruptive and is a risk factor of error and expense overruns. Hydro One proposes a deadline of December 31, 2022.
- OPG has already addressed concerns with understanding the costs associated with this project prior to implementation. MPs need advance notice to budget resources and develop business plans prior to implementation of the Market Rules, without considering these factors the overall project plan may not be successfully achieved. The IESO has stated MPs with more than one facility will be provided a 'mutually agreed staged implementation plan' - these proposed plans would indicate prioritization, requirements and timelines that would need to be reviewed and agreed upon with MPs ahead of any actual implementation. Therefore, expecting draft redline Market Rules by August and Presentations to TP by Q4 is most likely an unreasonable timeline.

IESO Response

The IESO acknowledges the concerns in relation to the proposed timeline to provide phasor data from projects that are nearing completion and proposes to modify the requirement to the following: "The latter of the time of the connection of the facility to the IESO-controlled grid or December 31, 2023".

The IESO acknowledges the comments by the OPG and agrees the originally planned time schedule requires adjustments. The presentation of the proposed Market Rule amendments is expected to take place during Q4 2020, with presentation to IESO Technical Panel to follow at an appropriate time in Q1 of 2021.

The generators will provide PMU data from low voltage side of generator output transformers whereas transmitters will provide PMU data from transmission levels. Typically, the PMU data from transmitters identify overall power system dynamics at network level whereas the PMU data from generators will strongly reflect the behaviour of that particular generating facility at machine level. Both are required for system analysis of different types.

Feedback

One stakeholder requested further cost/benefit analysis, stating:

- OPG has significant concerns with the planning and costs associated with this project. It is important for the IESO to provide clarity and transparency to Market Participants (MPs) regarding both IESO and MP costs required to complete this project.
- The IESO highlighted they are still working on a Cost/Benefit analysis, and it would be difficult to quantify the benefits. OPG appreciates and understand the difficulty in providing an exact Cost/Benefit analysis, but participants need to know the estimated costs before the IESO proceeds with Market Rule changes, and potential implementation.
- The IESO stated during the webinar they have not yet consulted any vendors and the costs of PMU's are highly varied. The estimated costs stated during the webinar only included the cost of the PMU itself, there are many additional costs that need to be considered, such as labour, engineering, project management, communication channels and processors. Accurate estimated costs for this project need to be clearly defined and made available to MPs before this project can progress.

IESO Response

The cost of the PMU implementation vary with the Market Participant. It depends on many factors such as the infrastructure or selected device Market Participant choose to generate phasor data (using PMU or DDR or relay IED), the vendor selected by the Market Participant to purchase equipment, communication, number of phasor data to be transmitted which is a function of the nature of the facility, overheads, labor cost etc. Therefore, each Market Participant is in best position to estimate the cost for the PMU implementation for their specific facilities.

The substantial financial benefits of phasor data are in its utilisation in real-time. The exact financial benefit by the PMU implementation is not explicitly quantifiable due to many reasons including following.

- (a) The phasor data will be used real-time when severe dynamics (that are not identifiable by SCADA) occur in the power system to foresee and take preventive measures. The frequency, duration and severity of occurrence of such dynamics is not pre-calculatable.
- (b) The phasor data will be used real-time as the input to a special back-up State Estimator called Linear State Estimator (LSE). The LSE will be used real-time when system is unobservable using conventional State Estimator. It is not pre-determinable the observability of the system by the conventional State Estimator.

General Comments

- In terms of the generator MVA, the phasor data requirement proposed is same as the SCADA data requirement already in place for generators. The phasor data provides added advantages of being more granular and universally-timed enabling notable benefits such as real-time identification of oscillations, greater assistance in restorations, robust state-estimation, wide-area view and model validation as per NERC MOD-033 compared to SCADA.
- Staged implementation of supply of phasor data from multiple facilities and mutually agreeable time schedule for that staged implementation will be considered where necessary.

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