

Draft Market Rules Updates – February 2022

(Synchrophasor Data Requirements)

Refer to following sections/titles and requirements outlined in red text below:

Chapter 11 Definitions

Appendix 4.15 and subsequent titled “Synchrophasor Information Requirements”, and

Appendix 4.16 and subsequent titled “Monitored Synchrophasor Quantities”

Chapter 11 Definitions

phasor measurement unit (PMU) is a device used to measure *synchrophasor* data. It can be a dedicated device, a protective relay or other device that is capable of providing *synchrophasor* data.

synchrophasor is phasor representing the fundamental of an AC signal whose magnitude is the root mean square (RMS) value of the fundamental amplitude and angle is the difference between the signal fundamental angle and the phase angle of a cosine at the nominal signal frequency that is synchronized to the Coordinated Universal Time (UTC) time.

supervisory control and data acquisition (SCADA) is a computer system for gathering and analyzing real time data.

Appendix 4.15 – IESO Monitoring Requirements: Generators

The following information, as a minimum, shall be available on a continual basis to the *IESO* from:

- (a) any *generator* (i) whose *generation facility* is *connected* to the *IESO-controlled grid*, or (ii) that is participating in the *IESO-administered markets*; and
- (b) any *embedded generator* (i) that is not a *market participant* or whose *embedded generation facility* is not a *registered facility*; (ii) whose *embedded generation facility* includes a *generation unit* rated at greater than 20 MVA or that comprises *generation units* the ratings of which in the aggregate exceeds 20 MVA; and (iii) that is designated by the *IESO* for the purposes of section 7.3.1 of this Chapter as being required to provide such data in order to enable the *IESO* to maintain the *reliability* of the *IESO-controlled grid*.

TYPE	SCADA INFORMATION REQUIREMENTS
Major generation facility	<p>Monitored Quantities</p> <p>1. Active Power (MW) and Reactive Power (MX)</p> <ul style="list-style-type: none"> a) The standard requirement for active and reactive power is the provision of <i>net MW and net or gross MX</i>. <i>Gross MW and gross or net MX</i> are also to be provided, if designated by the <i>IESO</i> as required for: <ul style="list-style-type: none"> (i) determination of operating <i>security limits</i>; (ii) to maintain <i>reliable</i> operation of the <i>IESO-controlled grid</i>; (iii) for compliance monitoring purposes; or (iv) if provision of only the standard requirement values as defined above would have a negative impact on other <i>market participants</i> through reduced operating <i>security limits</i>. b) For <i>generation units</i> rated greater than or equal to 100 MVA, the standard requirement as defined in part a) for each <i>generation unit</i> shall be provided, and <i>gross MW and gross or net MX</i> for each <i>generation unit</i> shall be provided if designated by the <i>IESO</i> as required using the criteria listed above in part a). c) For <i>generation units</i> rated at less than 100 MVA: <ul style="list-style-type: none"> (i) for a group of <i>generation units</i> if those <i>generation units</i> are similar in size and operating characteristics, the standard requirement as defined in part a) shall be provided as a total for these <i>generation units</i>, and total <i>gross MW and gross or net MX</i> shall be provided if designated by the <i>IESO</i> as required using the criteria listed above in part a); or (ii) if designated by the <i>IESO</i> as required for determination of operating <i>security limits</i> or to maintain <i>reliable</i> operation of the <i>IESO-controlled grid</i> or for compliance monitoring purposes, the standard requirement as defined in part a) for each <i>generating unit</i> shall be provided, and <i>gross MW and gross or net MX</i> for each <i>generation unit</i> shall be provided if designated by the <i>IESO</i> as required using the criteria listed above in part a). d) For <i>generation facilities</i> that have been aggregated pursuant to Chapter 7 section 2.3: <ul style="list-style-type: none"> (i) the standard requirement as defined in part a) shall be provided as an aggregated total, and an aggregated total <i>gross MW and gross or net MX</i> shall be provided if designated by the <i>IESO</i> as required using the criteria listed above in part a); or (ii) if so designated by the <i>IESO</i> as required for determination of operating <i>security limits</i> or to maintain <i>reliable</i> operation of the <i>IESO-controlled grid</i> or for dispatch compliance monitoring purposes, the standard requirement as defined in part a) for each <i>generating unit</i> shall be provided, and <i>gross MW and gross or net MX</i> for each <i>generation unit</i> shall be provided if designated by the <i>IESO</i> as required using the criteria listed above in part a). e) For frequency changers: <ul style="list-style-type: none"> (i) total MW and MX at either frequency; or (ii) if so designated by the <i>IESO</i> as required for determination of operating <i>security limits</i>, total MW and MX at both frequencies. f) For synchronous condensers: <ul style="list-style-type: none"> (i) total MX. <p>2. Voltage:</p>

TYPE	SCADA INFORMATION REQUIREMENTS
	<p>a) For each <i>generation unit</i>, unit terminal voltage, except if <i>generation units</i> are connected to a common low voltage bus section, then the bus section voltage is adequate for those <i>generation units</i>.</p> <p>3. Frequency:</p> <p>a) For each <i>generation unit</i> or <i>generation facility</i> providing <i>black start capability</i>, frequency of the applicable <i>generation unit</i> or <i>generation facility</i>.</p> <p>4. Equipment Status</p> <p>a) Unit mode (i.e. generator, condenser, pump) for each <i>generation unit</i> capable of different modes of operation.</p> <p>b) AGC status for each <i>generation unit</i> providing <i>regulation</i>.</p> <p>c) AVR and Stabilizer Status for each <i>generating unit</i> with a rated capacity ≥ 100 MVA. Stabilizer status reporting is only required if it can be switched off by <i>generation facility</i> personnel remotely or at the <i>facility</i>.</p> <p>d) AVR and Stabilizer status for each <i>generation unit</i> with a rated capacity ≤ 100 MVA if the status of this equipment is designated by the <i>IESO</i> as required for determination of operating <i>security limits</i> or to maintain <i>reliable</i> operation of the <i>IESO-controlled grid</i>. Stabilizer status reporting is only required if it can be switched on or off by <i>market participant</i> operating personnel remotely or at the <i>facility</i>.</p> <p>e) Synchronizing Breaker status for each <i>generation unit</i>. Where a <i>generation facility</i> is designed such that no low voltage synchronizing breaker is installed for each <i>generation unit</i>, the status of the appropriate HV breaker(s) and disconnect switch(es) normally used to isolate the <i>generation unit</i> must be provided. Where this results in access to the majority of breakers on a bus, the status of the remainder of the breakers shall be provided to complete the bus configuration.</p> <p>Where a <i>generation facility</i> is designed such that there are disconnect switches in parallel, or directly in series, with the synchronizing breaker, the status of those switches is also required.</p> <p>f) <i>Special Protection System</i> status for each applicable <i>generation unit</i>.</p>
<p>Significant <i>generation facility</i> and <i>minor generation facility</i> connected to <i>IESO-controlled grid</i></p>	<p>Monitored Quantities</p> <p>1. Active Power (MW) and Reactive Power (MX):</p> <p>a) The standard requirement for active and reactive power is the provision of <i>net MW and net or gross MX</i>. <i>Gross MW and gross or net MX</i> are also to be provided, if designated by the <i>IESO</i> as required for:</p> <ul style="list-style-type: none"> (i) determination of operating <i>security limits</i>; (ii) to maintain <i>reliable</i> operation of the <i>IESO-controlled grid</i>; (iii) for compliance monitoring purposes; or (iv) if provision of only the standard requirement values as defined above would have a negative impact on other <i>market participants</i> through reduced operating <i>security limits</i>. <p>b) For <i>generation facilities</i> that have not been aggregated pursuant to Chapter 7 section 2.3:</p> <ul style="list-style-type: none"> (i) for a group of <i>generation units</i> if those <i>generation units</i> are similar in size and operating characteristics, the standard requirement as defined in part a) shall be provided as a total for these <i>generation units</i>, and total <i>gross MW and gross or net MX</i> shall be provided if designated by the <i>IESO</i> as required using the criteria listed above in part a); (ii) if designated by the <i>IESO</i> as required for determination of operating <i>security limits</i> or to maintain <i>reliable</i> operation of the <i>IESO-controlled grid</i> or for compliance monitoring purposes, the standard requirement as defined in part a) for each <i>generating unit</i> shall be provided, and <i>gross MW and gross or net MX</i> for each <i>generation unit</i> shall be provided if designated by the <i>IESO</i> as required using the criteria listed above in part a). <p>c) For <i>generation facilities</i> that have been aggregated pursuant to Chapter 7 section 2.3:</p> <ul style="list-style-type: none"> (i) the standard requirement as defined in part a) shall be provided as an aggregated total, and an aggregated total <i>gross MW and gross or net MX</i> shall be provided if designated by the <i>IESO</i> as required using the criteria listed above in part a); or (ii) if so designated by the <i>IESO</i> as required for determination of operating <i>security limits</i> or to maintain <i>reliable</i> operation of the <i>IESO-controlled grid</i> or for dispatch compliance monitoring purposes, the standard requirement as defined in part a) for each <i>generating unit</i> shall be provided, and <i>gross MW and gross or net MX</i> for each <i>generation unit</i> shall be provided if designated by the <i>IESO</i> as required using the criteria listed above in part a). <p>d) For frequency changers:</p> <ul style="list-style-type: none"> (i) total MW and MX at either frequency; or (ii) if so designated by the <i>IESO</i> as required for determination of operating <i>security limits</i>, total MW and MX at both frequencies. <p>e) For Synchronous Condensers:</p> <ul style="list-style-type: none"> (i) Total MX.

TYPE	SCADA INFORMATION REQUIREMENTS
	<p>2. Voltage:</p> <p>a) For <i>generation units</i> that are VAR <i>dispatchable</i>, unit terminal voltage, except if the <i>generation units</i> are connected to a common low voltage bus section, then the bus section voltage is adequate for those <i>generation units</i>.</p> <p>3. Frequency:</p> <p>a) For each <i>generation unit</i> or <i>generation facility</i> providing <i>black start capability</i>, frequency of the applicable <i>generation unit</i> or <i>facility</i>.</p> <p>4. Equipment Status</p> <p>a) Unit mode (i.e. generator, condenser, pump) for each <i>generation unit</i> capable of different modes of operation.</p> <p>b) AVR and Stabilizer Status for each <i>generation unit</i> if the status of this equipment is designated by the IESO as required for determination of operating <i>security limits</i> or to maintain <i>reliable</i> operation of the IESO-controlled grid. Stabilizer status reporting is only required if it can be switched on or off by <i>market participant</i> operating personnel remotely or at the <i>facility</i>.</p> <p>c) Synchronizing Breaker Status for each <i>generation unit</i>. Where a <i>generation facility</i> is designed such that no low voltage synchronizing breaker is installed for each <i>generation unit</i>, the status of the appropriate HV breaker(s) and disconnect switch(es) normally used to isolate the <i>generation unit</i> must be provided. Where this results in access to the majority of breakers on a bus, the status of the remainder of the breakers shall be provided to complete the bus configuration.</p> <p>Where a <i>generation facility</i> is designed such that there are disconnect switches in parallel, or directly in series, with the synchronizing breaker, the status of those switches is also required.</p> <p>d) <i>Special Protection System</i> status for each applicable <i>generation unit</i>.</p>
Self-scheduling generation facility with a name-plate rating of less than 10 MW	None
Intermittent and transitional scheduling generator	<ul style="list-style-type: none"> • if a <i>major generation facility</i>, as described above for a <i>major generation facility</i> • if a <i>significant generation facility</i>, as described above for a <i>significant generation facility</i> • if a <i>minor generation facility</i>, as described above for a <i>minor generation facility</i> if designated by the IESO at the time of registration as affecting the <i>reliability</i> of the IESO-controlled grid • if a <i>small generation facility</i>, none
Small generation facility	None
Minor generation facility that is embedded in a distribution system and registered as a dispatchable generator	<ul style="list-style-type: none"> • Total active power (MW) output of the individual <i>generation unit</i> or of the aggregated resource. • Unit status if the <i>facility</i> is comprised of a single <i>generation unit</i>. • Aggregated resource status if the <i>facility</i> is comprised of aggregated resources, i.e. if at least one unit of the aggregated resource is synchronized, the aggregated resource is synchronized or if no unit in the aggregated resource is synchronized, the aggregated resource is not synchronized. • Reactive Power (MX) output, if requested by the IESO for reliable operation of the IESO-controlled grid, of individual <i>generation units</i> or of the aggregated resource.

TYPE	SYNCHROPHASOR DATA REQUIREMENTS
Generation facility	<p>Unless exempted The following are required unless otherwise specified by the IESO:</p> <p>(1) For <i>generation units</i> rated greater than or equal to 100 MVA (name-plate rating), each <i>generation unit</i> shall provide positive sequence voltage phasor, positive sequence current phasor and frequency from generator terminal.</p> <p>(2) For <i>generation units</i> connected to the IESO-controlled grid through a common connection point, whose aggregated rated size is greater than or equal to 100 MVA (aggregate name-plate rating), positive sequence voltage phasor, aggregated positive sequence current phasor and frequency shall be provided from generation facility side of the connection point to the grid.</p> <p>(3) For <i>generation units</i>, regardless of rated size, whose output power flow is a part of an Interconnection Reliability Operating Limit (IROL) definition, positive sequence voltage phasor,</p>

	positive sequence current phasor and frequency shall be provided at the terminals defining the IROL.
<p>Unless exempted otherwise specified by the IESO, synchrophasor data requirements shall comply with the corresponding Market Manual.</p> <ul style="list-style-type: none">(a) Comply to latest approved IEEE standard for Synchrophasor Measurements at the time of the installation of the phasor data measuring device.(b) Include voltage, current and frequency quantities at a minimum rate of 30 samples per second.(c) Have latency adequate to be used in real-time applications.(d) Be measured using Instrument Transformers whose accuracy is equal or better than those used for SCADA measurements adequate to be used in real-time applications.(e) Have telecommunication bandwidth adequate for the data rate.(f) Be synchronised via a high-accuracy satellite clock and reported in Coordinated Universal Time with zero offset.	

Appendix 4.16 – IESO Monitoring Requirements: Transmitters

The following information regarding the *IESO-controlled grid*, as a minimum, shall be available on a continual basis to the *IESO* from *transmitters*. Needs of the state estimation process or other reasons may result in additional requirements. The direction of all real and reactive power flows shall be indicated measurements.

Equipment Type	Voltage Level	Monitored Status	Monitored SCADA Quantities
Station Buses	50 kV and higher		<p><u>Voltage:</u> Specified phase-phase and phase to ground voltages measured at different buses. Note: a line voltage may be used if bus PT is not available.</p> <p><u>Frequency:</u> As directed by the <i>IESO</i> for points on the <i>IESO-controlled grid</i> that are significant for reliability purposes. High accuracy PTs & measurements of frequency are required at a number of stations at the discretion of the <i>IESO</i>.</p>
Transformation			
Autotransformers	50 kV and above	<p>Isolating switches</p> <p>As described in the “Reactive Devices” section below for ancillary equipment associated with the transformer</p>	<p>Megawatts (MW) and Megavars (MVAR) for the high voltage winding for each transformer</p> <p>MW and MVAR for the low voltage winding for each transformer, if other than station service is connected to the tertiary winding.</p> <p>ULTC tap positions for the transformer</p> <p>The <i>IESO</i> may require the monitoring of any Off-Load Tap Changer positions.</p>
Phase Shifting Transformers	50 kV and higher	Bypass and isolating switches	<p>Voltage, MW and MVAR may be required as directed by the <i>IESO</i></p> <p>All transformer tap positions</p>
Step Down Transformers	50 kV and higher	Bypass and isolating switches	<p>MW and MVAR</p> <p>Phase to ground Voltage, for each winding measured on the high voltage side. Where only LV PTs are available: MW and phase to phase voltages for each LV winding</p> <p>ULTC tap positions.</p>
Voltage Regulating Transformers	50 kV and higher	Bypass and isolating switches	<p>MW and MVAR may be required as directed by the <i>IESO</i></p> <p>ULTC tap positions for the transformer</p>

Equipment Type	Voltage Level	Monitored Status	Monitored SCADA Quantities
			The IESO may require the monitoring of any Off-Load Tap Changers.
Isolating Devices			
Breakers and Switches	50 kV and higher including connected tertiary	<p>All Circuit breakers, including bus tie breakers</p> <p>All breakers connecting loads for each tertiary winding of autotransformer other than that for Station Service</p> <p>Each capacitor breaker</p> <p>All line disconnect switches</p> <p>All transformer disconnect and by-pass switches</p> <p>All bus sectionalizing switches</p> <p>All isolating switches for reactors and capacitors where circuit breakers are not provided</p> <p>All in line switches as specified</p> <p>Note: The status of breaker isolating switches is not required</p>	
	Below 50 kV	<p>Breakers of Low Voltage Capacitors, Reactors, Transformers that are part of or have an impact on the IESO-controlled grid or that are subject to a contracted ancillary services contract including by means or within the scope of an operating agreement</p> <p>Each reactor or condensor breaker.</p>	
Isolating and by-pass switches	50 kV and higher	<p>Isolating and bypass switches for each transformer</p> <p>Bus sectionalizing switches</p> <p>Reactor and capacitor isolation</p>	
Circuits			
Circuit forming part of the IESO-controlled grid	50 kV and higher		MW and MVAR line flow at each terminal
Circuit that is an interconnection with another control area	50 kV and higher		<p>MW and MVAR line flow</p> <p>(MW from the billing meter point) where practical</p>
Special Protection Schemes			

Equipment Type	Voltage Level	Monitored Status	Monitored SCADA Quantities
<i>Special Protection Systems (SPS)</i>	50 kV and higher	As directed by the IESO on a case-by-case basis. Where so directed, must include all associated capacitors and reactors breaker status.	As directed by the IESO on a case-by-case basis.
Reactive Power Devices			
Capacitors, Synchronous Condensers, Reactors, Static Var Compensators, FACTS	All levels designated by the IESO as affecting the reliability of the IESO-controlled grid	Breaker Status	MVARs

Equipment Type	Voltage Level	Monitored Synchrophasor Quantities
<i>Station Buses</i> (a) 500 kV station (b) <i>Bulk Power System (BPS)</i> (c) Required to restore IESO-controlled grid from generating facilities providing <i>black-start capability</i> .	50 kV and higher	Positive sequence voltage phasor magnitude Positive sequence voltage phasor angle
		Frequency
Circuits defining Interconnection Reliability Operating Limits (IROL) and interties	50 kV and higher	Positive sequence current phasor magnitude measured at terminals Positive sequence current angle magnitude measured at terminals
		Positive sequence voltage phasor magnitude measured at terminals Positive sequence voltage phasor angle measured at terminals
		Frequency
Static Var Compensators (SVCs), Synchronous condensers, and Static synchronous compensators (STATCOMs)	Below 50 kV	Positive sequence current phasor magnitude measured at terminals Positive sequence current angle magnitude measured at terminals
		Positive sequence voltage phasor magnitude measured at terminals Positive sequence voltage phasor angle measured at terminals
		Frequency
Unless approved otherwise specified by the IESO, <i>synchrophasor</i> data requirements shall comply with the corresponding Market Manual. (a) Comply to latest approved IEEE standard for Synchrophasor Measurements at the time of the installation of the phasor data measuring device. (b) Include voltage, current and frequency quantities at a minimum rate of 30 samples per second. (c) Have latency adequate to be used in real-time applications. (d) Be measured using Instrument Transformers whose accuracy is equal or better than those used for SCADA measurements adequate to be used in real-time applications. (e) Have telecommunication bandwidth adequate for the data rate. (f) Be synchronised via a high-accuracy satellite clock and reported in Coordinated Universal Time with zero offset. (g) Be from two separate buses in the station for Station Bus quantities.		