ISON

System Operator Priorities

December 2025

Important notice

Purpose

This document has been prepared by ISON, a network of system operators, based on information available as at the date of publication.

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Version control

Version	Release date	Changes
1	20/12/2024	First release
2	5/12/2025	Updated for 2026

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Overview

The International System Operator Network (ISON) brings together six system operators to align on shared priorities to help transition to high renewable power systems. The founding members of ISON are:

- Australian Energy Market Operator (AEMO - Australia)
- California Independent System Operator (CAISO - California)
- EirGrid (Ireland)
- Electric Reliability Council of Texas (ERCOT - Texas),
- Energinet (Denmark)
- National Energy System Operator (NESO- Great Britain).

The energy transition continues at pace, and there is an increasing need for, and benefit from, collaborating with a broad range of stakeholders. While each System Operator (SO) manages a its own unique system, with different regulatory regimes and markets, the integration and operation of renewable generation – particularly variable, inverter-connected, decentralised generation – common challenges and opportunities across transmission and distribution systems.

SOs must maintain the reliability and security of power systems while navigating major changes in how the power system operates and performs. This System Operator Priorities Report highlights a set of key priorities that ISON SOs are working together to address as they navigate the energy transition, with the aim of encouraging engagement on these topics from a broad range of industry stakeholders including academics, research institutes, manufacturers, vendors and other stakeholders.

The key priorities addressed in this report relate to six topics – inverter performance, modelling tools, control room of the future, planning, system restoration and system services.

ISON would like to acknowledge contributors to the precursor of this document, the G-PST Research Agenda[1].

A separately published appendix[2] includes a detailed list of SO priority questions across short-, medium- and longer-term time horizons.

ISON welcomes engagement on this report and associated appendix, and encourages those working on related areas to share their expertise.

[1] See https://globalpst.org/wp-content/uploads/042921G-PST-Research-Agenda-Master-Document-FINAL_updated.pdf.

[2] At LINK.

Summary of priorities

Table 1 summarises the ISON SO priorities for the 2026 calendar year.

Table 1 Summary of System Operator priorities

No.	Topic	Priority	Details
2026_01	Inverter performance	Large load (data centre) performance	What performance standards are appropriate for loads, in particular power electronic-based load types such as electric vehicle (EV) chargers, hydrogen electrolysers and data centres, to ensure they can be successfully and reliably integrated into the system without adverse impact to power system operations, considering their susceptibility to voltage and frequency fluctuations and the impact on system security? What power system model requirements are appropriate?
2026_02	Modelling tools	Oscillation detection and tracing	What methods and tools are needed for off-line and on-line analysis and detection of instabilities including oscillations? What thresholds are appropriate for planning and operational studies?
2026_03	Control room of the future	Visualisation capabilities for decision-making	What visualisation capabilities are needed to enable operators to effectively and efficiently interpret relevant information and make operational decisions (in the context of the vast increase in number of connections and data, alarms, new phenomena such as oscillations)?
2026_04	Control room of the future	AI use-cases	How can automation and new artificial intelligence (AI)/machine learning (ML) capabilities be leveraged to assist operators, reduce operational risk and/or improve security/resilience? How can AI/ML help operators identify complex system states and operational patterns including operational security margins and suggested actions/constraints where decisions need to be made promptly following a major event?
N/A	Planning	While ISON has not identified a priority question for 2026 under these topics, members will continue to collaborate on key areas.	
	System restoration		
	System services		

Abbreviations

Abbreviation	Term	Abbreviation	Term
AI	artificial intelligence	IBR	inverter- (and converter) based resources
BESS	battery energy storage system	IS	information system
CROF	control room of the future	ISON	International System Operator Network
DC	direct current	IT	information technology
DER	distributed energy resources	ML	machine learning
DPV	distributed photovoltaic	MW	megawatt(s)
DSO	Distribution System Operator	OEM	original equipment manufacturer
EMT	electromagnetic transient	PEID	power electronic interfaced device
EV	electric vehicle	PMU	phasor measurement unit
GET	grid-enhancing technology	PV	photovoltaic
GFL	grid-following	RE	renewable energy
GFM	grid-forming	RMS	Root mean square
HVDC	high-voltage direct current	RT	real time
HIL	hardware-in-the-loop	SO	System Operator
HILP	high impact low probability	TSO	Transmission System Operator
HVDC	high voltage direct current	VPP	virtual power plant
IP	intellectual property	VRE	variable renewable energy

1. Inverter performance

This section sets out priorities relating to the effective integration and operation of inverter-based resources (IBR) and power electronic-based loads.

The objective of this priority area is to help identify the optimal design characteristics needed to maximise the potential of inverter (and converter) based resources to support secure and reliable power system operation in power systems with up to 100% instantaneous operation of IBR, for a range of generation and load technology portfolios. The priority area encompasses:

- technical standards and settings,
- mandated technical capabilities (including advanced inverter capabilities and grid forming),
- operation and service provision, and
- economic factors (design, cost of service provision).

Table 2 Inverter performance

No.	Priority	Details
2026_01	Large load (data centre) performance	What performance standards are appropriate for loads, in particular power electronic-based load types such as EV chargers, hydrogen electrolysers and data centres, to ensure they can be successfully and reliably integrated into the system without adverse impact to power system operations, considering their susceptibility to voltage and frequency fluctuations and the impact on system security? What power system model requirements are appropriate?

In addition to the above, other areas of SO interest relate to:

- inverter tuning – design of inverter control systems to reduce undesired performance,
- frequency performance – establishment of standard IBR frequency response behaviour to respond to system incidents and maintain a reliable power system, and
- protection schemes in IBR-dominated grids – adapt protection schemes to unique characteristics of IBR-dominated systems.

2. Modelling tools

This section sets out priorities relating to power system data, models, modelling tools and simulation methods.

The objective of this priority area is to define offline and online power system modelling capabilities needed by system operators to evaluate stability and meet relevant technical standards for power systems with areas of the power system dominated by IBR and characterised by low system strength.

Table 3 Modelling tools

No.	Priority	Details
2026_02	Oscillation detection and tracing	What methods and tools are needed for off-line and on-line analysis and detection of instabilities including oscillations? What thresholds are appropriate for planning and operational studies?

In addition to the above, other areas of SO interest relate to:

- methodologies and processes for studies – development of techniques to maximise simulation performance, improving speed and accuracy for system studies,
- control room tools for power system phenomenon and developments – creation of tools to analyse system performance, technical limits, high impedance areas, grid-forming (GFM) and grid-following (GFL) device performance, system inertia, frequency control, voltage collapse and reactive power control,
- inverter-based technology models – establishment of requirements to validate models of inverter-based technology, such as variable renewable energy (VRE), distributed energy resources (DER) and inverter-based loads, and
- data centre models – development of electromagnetic transient (EMT) and root mean squared (RMS) models to represent relevant data centre electrical characteristics and behaviour.

3. Control room of the future

This section sets out priorities relating to operational and control room capabilities, with a view to leveraging new technologies.

The objectives of this priority area are two-fold:

- define the suite of control room tools needed to operate a power system with very high levels of VRE and IBR across transmission and distribution networks, and
- identify new capabilities, technologies and visualisation methods that can be integrated into the SO control room environment to improve operational decision-making and reduce operational risks.

Table 4 Control room of the future

No.	Priority	Details
2026_03	Visualisation capabilities for decision-making	What visualisation capabilities are needed to enable operators to effectively and efficiently interpret relevant information and make operational decisions (in the context of the vast increase in number of connections and data, alarms, and new phenomena such as oscillations)?
2026_04	AI use-cases	How can automation and new AI/ML capabilities be leveraged to assist operators, reduce operational risk and / or improve security/resilience? How can AI/ML help operators identify complex system states and operational patterns including operational security margins and suggested actions / constraints where decisions need to be made promptly following a major event?

In addition to the above priority areas, other areas of SO interest relate to:

- capabilities needed to ensure real-time situational awareness of the state of the power system,
- how system operators can best employ grid-enhancing technology (GET), virtual power plants (VPPs) and grid topology to optimise the operation of a power system,
- digital architecture required to support control room operations,
- effective monitoring and control of DER for a given system architecture,
- leveraging big data, artificial intelligence (AI) and machine learning (ML) for operational insights, and
- cybersecurity and cyber protection of the control room, and in-bound and out-bound communications.

4. Planning

The objective of this priority area is to define the metrics, methods and tools needed for long-term planning, resource adequacy and assessment of resilience for a power system with a VRE instantaneous penetration of up to 100%.

While ISON has not identified a priority planning question for 2026, members continue to collaborate on the following key areas:

- resource adequacy/capacity planning – long-term studies into resource adequacy of future power systems, including probabilistic forecasting of inverter-based and battery technologies, and
- system risks – planning for a resilient system taking into account environmental conditions and system/market costs.

5. System restoration

The objectives of this priority area are to enable SOs to develop required restart processes and capabilities into the future.

While ISON has not identified a priority system restoration question for 2026, members continue to collaborate on the following key areas:

- exploring how system restart standards and procedures should evolve as power systems move from large, centralised synchronous generators to dispersed VRE and, ultimately 100% IBR penetrations,
- determining what technical capabilities are needed to restart a power system with 100% transmission- and distribution-connected IBR generation, and
- developing procedures to restart specific infrastructure, such as feeders with DER, and identifying equipment that may assist with restoration of future energy systems.

6. System services

The objectives of this priority area are to enable SOs to objectively evaluate and determine system needs into the future.

While ISON has not identified a priority system services question for 2026, members continue to collaborate on the following key areas:

- defining and quantifying services required by a system with 0% synchronous, constant fuel generators, considering how they can be procured and dispatched over a range of timeframes to effectively operate gigawatt-scale power systems with very high levels of VRE and IBR,
- defining the structural arrangements and market design to enhance the capability of legacy power systems to enable secure and efficient operation with up to 100% instantaneous supply from centralised and distributed renewables (including up to 100% penetration of DER),
- defining operational and modelling requirements for 100% instantaneous penetration of DER,
- identifying system services that can be provided in a cost effective manner by IBR plants, offshore wind, high voltage direct current (HVDC) and DER, and
- considering wholesale market design – development of market structures and incentives to enable the energy transition.