

Home > Issue 01/2026 > Connected sensors for the power grid

Safety and certification

Connected sensors for the power grid

By Catherine Bischofberger, 7 January 2026

Sensors are an indispensable tool to inform utility managers of the state of the electricity grid and the occurrence of disruptions of any kind. The IEC provides the standards and conformity assessment that enable them to operate safely and efficiently.



Sensors are the eyes and ears of the electricity grid. As grids become smart, so are sensors ever more relevant to capture data and inform on the electricity network's state of play and performance. But the performance of sensors needs to be assessed and measured as well – and IEC Standards and Conformity Assessment Systems play an important role in helping grid and utility managers do that.

A multiplicity of sensors for different tasks



systems, specifies how to collect accurate and reliable data from various system components, including environmental sensors. This standard only applies to PV systems, and the list of sensors involved is massive. It includes pyranometers, irradiance sensors, module and ambient temperature sensors, wind speed and direction sensors, and relative humidity measuring devices, to name but a few. In fact, sensors can be used to monitor and measure every aspect of a PV solar system's environment, and the same can be said for every electricity device used in the generation, transmission and distribution of electricity – from electricity cables and lines to substations and transformers.

Some experts differentiate between environmental and electricity sensors. The latter, according to these pundits, are used to monitor power levels in the grid, including voltage and current levels as well as power quality. They are becoming ever more crucial as intermittent sources of energy such as wind and solar PV power are integrated into the electricity network.

Smart sensors for smart grids

One of the key developments in smart grids are connected sensors and, more specifically, so-called smart sensors. According to [TechTarget](#), an editorial network which specializes in information about the Internet of Things (IoT), "Smart sensor technology contains integrated communications capabilities that let it connect to a private cloud computing environment or the internet. This lets sensors communicate with external devices."

TechTarget goes on to describe how smart sensors can be components of a wireless sensor and actuator network. These networks can have thousands of nodes, where each is connected to one or more other sensors and sensor hubs as well as to individual actuators.

Sensor networks enable different elements of the grid to communicate with each other and with the utility manager, even with electricity consumers. An example is the use of sensors in digital substations.



TC 57, notably the [IEC 61850](#) series, has been at the forefront of standardizing the requirements for digital substations. He also is an IEC 61850 System Integrator and Grid Modernization Consultant at Tesco Automation. “Digital substation sensors typically refer to merging units (MUs) or process interface units (PIUs) that digitize analogue or discrete signals from instrument transformers, circuit breakers or power transformers and transmit these values in digital substations, enabling safe, flexible and efficient digital communication networks connecting field devices to control and protection devices in the control room,” he explains.

In other words, these sensors not only capture information but also digitize it and transmit it in a digital format to the utility manager. Disruptions in the grid are becoming ever more frequent as, in addition to intermittent energy integration, smart grids have to deal with a rising number of cyber attacks (for more on this read: [Cyber security for the smart grid | IEC e-tech](#)) and the multiplication of extreme weather events. (For more on this read: [Building resilience into the grid | IEC e-tech](#)).

According to the IEC societal and trend report [Smart sensing for future power grids](#), “Sensors can be deployed to detect and measure power flow, voltage level, power quality and equipment conditions throughout the entire generation, transmission and distribution system, up to and including end loads. Sensors can detect, protect and control the grid in a timely and precise manner. By doing so, it becomes possible to assess the operational status of the power grid in real time, predict its behaviour and potential disruptions, and quickly respond to events.”

Standards for grid sensors

Assessing the performance of these sensors is paramount – as the information they capture, digitize and transmit enables monitoring of the grid in real time. Various groups inside the IEC have published standards which enable to specify and monitor the performance of sensors in the grid. One of the IEC TC 57 Standards, [IEC 61850-9-2](#), enables MUs to digitize and transmit primary currents and /or voltages



and time alignment, ensuring reliable grid integration. This supports interoperability in digital substations.”

[ISO/IEC 27019](#), which provides information security controls for the energy utility industry, covers a very wide range of smart grid related technologies, including monitoring and automation technology sensors and actuators. The joint technical committee formed between the IEC and ISO to standardize the IoT ([ISO/IEC JTC 1/ SC 41](#)) has also published [ISO/IEC 30101](#), which specifies the requirements for sensor networks to support smart grid technologies for power generation, distribution, networks, energy storage, load efficiency, control and communications, and associated environmental challenges.

[IEC TC 47](#) has published some documents which pertain to smart sensors: [IEC 60747-19-1](#), which deals with the control scheme of smart sensors. (bidirectional communication/control scheme for smart sensor devices). The second one is [IEC TS 60747-19-2](#), which specifies sensors and power supplies to drive smart sensors for low power operations.

Distributed fibre optic acoustic sensing (DAS) is a promising technology for remote monitoring of critical infrastructure like the grid. It is increasingly used because fibre optic sensors are immune to electromagnetic interference, which makes them ideal for using in high voltage electricity environments – for instance inside transformers. [IEC TC 86](#) has developed several standards in the [IEC 61757](#) series which define the performance of fibre optic sensors. They include [IEC 61757-3-2](#) which specifies the terminology, characteristic performance parameters, related test and calculation methods, as well as specific test equipment for interrogation units used in distributed fibre optic acoustic sensing and vibration measurement systems. (For more on this, read: [Fibre optic sensors and critical infrastructure | IEC e-tech](#)).

Conformity assessment for sensors and the grid

In addition, the IEC Quality Assessment System, [IECQ](#), one of the four IEC Conformity Assessment (CA) Systems, proposes an approved

client specifications accepted within the IECQ System. The IECQ IoT component certification is a specific certification programme to evaluate and certify the evaluation of function useability and performance, voice recognition, and connectivity stress of components used in IoT devices, including sensors.

Another CA System, [IECRE](#), the IEC System for Certification to Standards Relating to Equipment for Use in Renewable Energy Applications, is the internationally accepted conformity assessment system for all power plants producing, storing, or converting energy from renewable sources. The CA system ensures that essential quality and safety standards are met, and as a consequence, reliable performance can be expected.



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