European Metrology Research Programme

Delivering Impact

A new calibration for current sensors

Lowering carbon dioxide emissions from fossil fuels requires an increased use of renewable sources for electricity generation. Integrating these non-conventional energy sources into the grid can cause problems with supply security and power quality. New current and voltage sensors are needed to monitor network performance, and these will require different calibration methods to ensure their accuracy and traceability to the SI.

Europe's National Measurement Institutes working together

The European Metrology Research Programme (EMRP) brings together National Measurement Institutes in 23 countries to address key measurement challenges at a European level. It supports collaborative research to ensure that measurement science meets the future needs of industry and wider society.

Challenge

Europe aims to generate at least 32 % of energy from renewables by 2030 but traditional power networks find it difficult to incorporate these sources of energy which can be variable and bi-directional. This can produce harmonics that distort the AC current already flowing through the grid which compromises the power quality and lead to blackouts or outages in supply. To address this new smart grids are being rolled out that can monitor and respond to changes in the network in real-time. However, these grids require a new generation of current and voltage sensors to monitor their stability and performance. In turn these novel sensors require new ways to calibrate them to ensure their accuracy and traceability to the SI.

A Rogowski Coil (RC) is a type of current sensor that can withstand a wide range of voltages, react to fast changing currents and is not damaged by large over-loads. These have the potential to be used both as a sensor for electrical networks or as a calibration device for other sensors. However, the accuracy of a RC can be affected by external currents or magnetic fields near the coil which has limited their use.

Solution

The EMRP project *Non-conventional voltage and current sensor for future power grids* tested a number of emerging technologies designed to monitor electrical networks.

During the project a magnetic shield for a RC was developed which reduced the interference from external currents down to 10 μA/A, or 10 parts per million, which is a 100-fold improvement on existing coils.

The calibration performance of the improved coil was then validated in test setups at both high and medium voltage levels. TÜBİTAK UME, the National Measurement Institute of Turkey, now has an accredited Calibration and Measurement Capability (CMC) for using the coil and now offers a calibration service using this device.

Impact

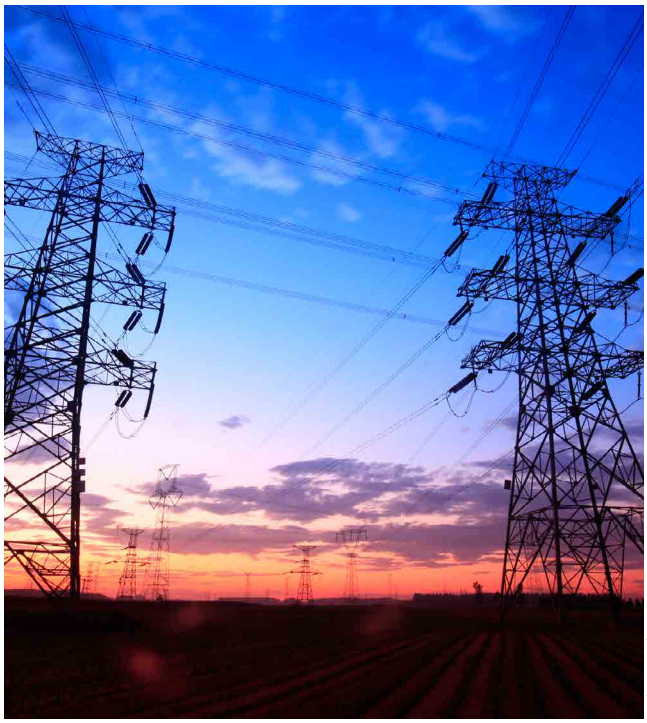
One of the first users to take up TÜBİTAK UME's new calibration service was ALCE Elektrik, a global supplier of services and instrumentation to the energy sector, which counts major industrial companies such as Siemens, ABB, Alfanar and GE amongst its clients.

The company approached TÜBİTAK UME, as an impartial National Metrology Institute, to assess a novel current sensor it had developed for medium level voltages. A successful test series against the RC validated the new sensor's performance and the data obtained led to further improvements in the device. *ALCE* Elektrik anticipates that the prototype sensor will be released in 2020 and gain an eventual 20 % market share in Europe. Based on this the company predicts that these sales will generate 1,000,000 € per year - comprising 2.5 % of the company's annual sales.

The successful use of RCs as a calibration standard for non-conventional current sensors represents a significant step forward for validating the new types of measurement instruments required for the power grids of the future.

Novel sensors for smarter power grids

The EMRP project *Non-conventional voltage and current sensor for future power grids* examined emerging measurement technologies required for monitoring the smart electrical grids that are being introduced to better integrate sources of renewable energy. Novel optical current and voltage sensors were developed with the potential to monitor networks over larger distances than conventional instruments. As well as these, a 100-fold improvement in shielding against environmental interference for a non-conventional current device, used for calibrating high and medium voltage transformers, was also demonstrated. As a result, the national measurement institutes PTB, METAS, TÜBİTAK UME, VSL and MIKES now provide calibration services for new types of sensors. These advances in instrument technology and calibration capabilities will enable the real time monitoring of the power grids of the future and enable delivery of a stable, sustainable and secure electricity supply.



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