EMPIR Call 2016 – Energy, Environment, Normative and Research Potential

Selected Research Topic number: **SRT-n09**
Version: 1.0

Title: Electromagnetic interference on static electricity meters

Abstract

Smart electricity meters are currently being widely deployed by utilities companies across the EU. Reading accuracy of these static devices is crucial for correct billing, however, recent studies have shown that under certain conditions of grid pollution caused by modern power electronics, some static meters show significant errors in their energy readings. This is despite the meters being certified according to current standards regarding static meter testing. Therefore, in order to ensure future confidence in static meter energy readings, the causes of these errors need to be determined and current standards amended.

Keywords

Static Electricity Meters, Smart meters, Electromagnetic Interference (EMI), electrical energy, metering, billing, Measuring Instruments Directive

Background to the Metrological Challenges

The EU Electricity Directive 2009/72/EC requires that “at least 80 % of consumers shall be equipped with intelligent metering systems by 2020” for the long-term benefit of consumers. In addition to providing more cost-effective energy measurements, the advantages include remote readouts, better reporting of electricity issues and provision of energy consumption patterns, all leading to a better quality of supply and reduced energy consumption.

Metering accuracy is the basis for confidence in correct billing, and static electricity meters should provide at least the same level of performance as the previous generation of electromechanical electricity meters. However, this not automatically is the case, as modern sampling-based static meters may suffer from interference by ‘grid pollution’, for example caused by electromagnetic interferences (EMI). CENELEC TC 205A has collected an extensive overview of actual EMI between electrical equipment, with specific examples of EMI effects on the accuracy of static electricity meters. These and similar cases have led to additional 2 kHz – 150 kHz requirements on static electricity meters in CENELEC TR 50579 and IEC 61000-4-19, which are used in type approval testing of electricity meters, together with the existing EN 50470, in order to prove compliance with the requirements of the Measuring Instruments Directive. However, these additional requirements have not completely solved the issue of conducted EMI effects on static meter readings. In fact, CENELEC TC205A has suggested that many EMI effects remain unrecognised and warns not to underestimate their occurrence.

Given the size of EU smart meter roll-out commitments, this is an unacceptable situation. Hence there is an urgent need to identify the root cause of the errors in smart meter reading and to correct for them. Crucial questions that need to be answered from recent studies also include: what are the characteristics of the applied conducted EMI signals that cause static meters to exhibit errors? Why are some static meters exhibiting major errors, whereas other meters pass the tests? And, importantly: is the conducted EMI applied in recent studies representative of the EMI levels in existing and future electricity grids?

Objectives

Proposers should address the objectives stated below, which are based on the PRT submissions. Proposers may identify amendments to the objectives or choose to address a subset of them in order to maximise the overall impact, or address budgetary or scientific / technical constraints, but the reasons for this should be clearly stated in the protocol.

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The JRP shall focus on metrology research necessary to support improved standardisation in the testing and verification of static electricity meters.

The specific objectives are

1. To develop traceable measurement setups for laboratory and on-site testing of static electricity meters under conditions reflecting grid pollution such as EMI. In addition, to perform testing of static meters, both new and already installed in Europe, under these conditions.
2. To determine the key characteristics of the wideband EMI signals by performing on-site and laboratory measurement of conducted EMI levels in grids and originating from power electronics.
3. To develop a reference signal library with test signals representing specific EMI caused by modern power electronics.
4. To investigate and identify the sources of error for static electricity meters exhibiting major error readings, and to develop remedial actions to correct such errors.
5. To work closely with European and International Standards Developing Organisations (CENELEC TC 205A, IEC 61000-4-19), legal metrology organisations (WELMEC, OIML), and end users to ensure uptake of the project outputs and that they are aligned with their needs. In addition to produce recommendations for incorporation of this information into future standards at the earliest opportunity.

The proposed research shall be justified by clear reference to the measurement needs within strategic documents published by the relevant Standards Developing Organisation or by a letter signed by the convenor of the respective TC/WG. EURAMET encourages proposals that include representatives from industry, regulators and standardisation bodies actively participating in the projects.

Proposers should establish the current state of the art, and explain how their proposed research goes beyond the current state of the art and EMRP JRPs ENG04 SmartGrid and ENG63 GridSens.

EURAMET has defined an upper limit of 1.2 M€ for the EU Contribution to this project.

EURAMET also expects the EU Contribution to the external funded partners to not exceed 30 % of the total EU Contribution to the project.

Any industrial partners that will receive significant benefit from the results of the proposed project are expected to be unfunded partners.

Potential Impact

Proposals must demonstrate adequate and appropriate participation/links to the “end user” community, describing how the project partners will engage with relevant communities during the project to facilitate knowledge transfer and accelerate the uptake of project outputs. Evidence of support from the “end user” community (e.g. letters of support) is also encouraged.

You should detail how your JRP results are going to:

- Address the SRT objectives and deliver solutions to the documented needs,
- Feed into the development of urgent documentary standards through appropriate standards bodies,
- Transfer knowledge to the electrical energy distribution sector and those involved in electrical compliance and regulation.

You should detail other impacts of your proposed JRP as specified in the document “Guide 4: Writing Joint Research Projects (JRPs)”

You should also detail how your approach to realising the objectives will further the aim of EMPIR to develop a coherent approach at the European level in the field of metrology and include the best available contributions from across the metrology community. Specifically the opportunities for:

- improvement of the efficiency of use of available resources to better meet metrological needs and to assure the traceability of national standards
- the metrology capacity of EURAMET Member States whose metrology programmes are at an early stage of development to be increased
- organisations other than NMIs and DIs to be involved in the work

Time-scale

The project should be of up to 3 years duration.