

Important information about these documents

This call is being held ahead of any agreement from the Commission that the relevant funding will be available. At present the relevant legislation is still under discussion in both Council and Parliament, and there is no certainty on the detailed arrangements for funding selected projects. The funding of any selected project, and the terms and conditions of participation in the projects, are dependent on completion of the legislative process and the subsequent contractual processes between the European Commission and EURAMET. Proposers submit to this call at their own risk.

Background

Last year, EURAMET submitted a draft proposal to the EC for a further research programme to be established under article 185 of the Treaty on the Functioning of the European Union (TFEU) to follow on from EMRP and EMPIR. This was published by the EC at https://ec.europa.eu/info/research-and-innovation/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe/european-partnerships-horizon-europe/candidates-digital-industry-and-space_en

The initiative would be called the European Partnership on Metrology and would aim to create, by 2030, a sustainable and effective system for metrology at European level that ensures Europe has a world-class metrology system that:

- Provides metrology solutions, fundamental metrological reference data and methods, offering fit-for-purpose solutions supporting and stimulating European innovation and responding to societal challenges.
- Supports and enables effective design and implementation of regulation and standards that underpin public policies that address societal challenges.

The Commission commissioned an impact assessment into this proposal and 11 others in similar priority areas, and, based on those findings, published their own proposal for the Partnership, their response to the impact assessment and a draft of the Decision on 23rd February 2021. See:

<https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM:2021:89:FIN>

https://ec.europa.eu/commission/presscorner/detail/en/ip_21_702

<https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52021SC0035&qid=1614677899327>

That draft Decision is currently under discussion in the European Council and the European Parliament.

Under the assumption that the Council and Parliament pass the basic act which would form the legal basis for this research programme, and that the participating countries named in the Draft Decision submit the required commitment letters, EURAMET is publishing these potential Selected Research Topics and draft guidance notes. These documents are not approved by the Commission nor will they lead to a binding decision by EURAMET e.V. for any further negotiation or funding. All published guides and templates are subject to amendment by the EC and EURAMET e.V. as further information becomes known.

Title: Metrology infrastructure for system efficiency and loss measurement for electric vehicles

Abstract

The three components of electromobility, electric grid, power conversion systems and electric vehicles (EV) powertrain, are not considered a complete system and lack traceability. Analysis and systemic investigation of the individual components and interaction with each other are needed. This analysis will provide transparent benchmarking and conclusions about the true (system) efficiencies. This, in turn, will support the wider distribution of electromobility and contribute towards more sustainable and careful use of energy.

Keywords

Electromobility, Metering, System Efficiency, Losses, Battery Efficiency, Frequency Converters, Subsystems

Background to the Metrological Challenges

Electromobility has three macro-components: electric grid, power conversion systems (included in charging stations or directly in the EV), and EV powertrain (including batteries and auxiliary systems). Batteries and conversion systems define the efficiency of the charging systems. The same systems, together with the electric motor and control, define the efficiency of the entire electric traction system. Although all components interact with each other, they are not considered a unified system. For example, the disturbances induced and conducted by power conversion systems, even in static conditions, affect the interaction with the network and the measurement accuracy of the electrical quantities like voltage, current, power and efficiency.

In recent years, there has been a rapid development of Power Drive Systems (PDS). These PDS aim to significantly improve energy efficiency, become more environmentally friendly, and be in line with the *EU Climate Action, A European Strategy for low-emission mobility*. Despite the importance of the topic, PDS characterisation remains substantially an industrial subject, not yet fully covered by standards or research. There is a need to investigate not only individual components but the interdependency and interaction with each other. To verify the effectiveness of the adopted solutions, accurate measurement systems for the efficient evaluation of the whole PDS and its components, namely the Complete Drive Module (CDM) and the motor, must be designed and developed.

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.

The JRP shall focus on the traceable measurement and characterisation of electric vehicles and their individual components.

The specific objectives are

1. To develop traceable methods to measure the energy transfer efficiency and related quantities between the grid and the electric vehicles. To include measurement systems for AC and DC, at different transfer power (low, medium and high), real operation conditions, grid (e.g. distortions) and environmental (e.g. temperature). Target uncertainties shall be 0.5 %, in power and efficiency, at least by voltages of 800 V, currents of 300 A and of at least 350 kW charging power.
2. To develop traceable measurements of the actual efficiency of the electric traction systems that include the power electronics and the electric motor, for power up to 100 kW, e.g. with power inverter switching frequency up to 32 kHz. Different supply and load conditions, including power quality issues, shall be accounted for in order to evaluate the powertrain as close as possible to real working conditions including full regenerative braking (recuperation).
3. To determine the energy losses of the various components inside the different sub-systems studied in objectives 1 and 2, covering energy conversion parameters studied as a function of different energy conversion stages. To develop facilities for modelling, and simultaneous measurement of electrical quantities in power converters and energy storage elements (battery and supercapacitors), together with temperature, and related environmental factors with high accuracy.

4. To develop traceable measurements of electric traction systems within electric vehicles with combined electrical and mechanical characteristics. To develop thermal models, based on the distribution of the losses and their thermal consequences, that simulate the performance of the electric vehicle. Different supply and load conditions, including power quality issues, shall be investigated.
5. To facilitate the take up of the technology and measurement infrastructure developed in the project by the measurement supply chain (accredited laboratories, car manufacturers), standards developing organisations (IEC 60349 series, IEC 61287-1), stakeholders (e.g. EMPIR 20NET01) and end users (e.g. automotive industries, European transport system).

These objectives will require large-scale approaches that are beyond the capabilities of single National Metrology Institutes and Designated Institutes. To enhance the impact of the research, the involvement of the appropriate user community such as industry, standardisation and regulatory bodies is strongly recommended, both prior to and during methodology development.

Proposers should establish the current state of the art and explain how their proposed project goes beyond this. In particular, proposers should outline the achievements of the EMPIR 16ENG08 MICEV (Metrology for inductive charging of electric vehicles), and how their proposal will build on those.

EURAMET expects the average EU Contribution for the selected JRPs in this TP to be 2.2 M€ and has defined an upper limit of 2.7 M€ for this project.

EURAMET also expects the EU Contribution to the external funded partners to not exceed 35 % of the total EU Contribution across all selected projects in this TP.

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 environmental and transport sectors.

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 the potential European Partnership on Metrology 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.