

Title: Electromobility and drive technology

Abstract

In Europe there are about 200 Million cars on the road and almost all of them depend on oil and other fossil fuels. Electromobility, an upcoming important field of activity for the industry, is addressing the fossil fuel consumption in order to meet European targets for reduction in CO₂ emissions. A metrological framework for measurement and the characterisation of the major components of the drive system of electric vehicles through development of novel measurement/modelling tools, test protocols and standards is required.

Keywords

Electromobility, electric vehicles, billing, metering, drive technology

Background to the Metrological Challenges

Almost all European automotive manufacturers are now producing electric vehicles, either as prototypes or concept cars. However, there is a clear lack of support for the industry in terms of traceable characterisation, benchmarking of performance/lifetime and standards.

General issues of uncertainty, characterisation of safety with respect to billing, electrical and mechanical power-measurement, have been identified by the stakeholders that cannot be addressed with the current knowledge base and metrological traceability. Development of traceable power measurements ensures the traceability of efficiency measurements on electrical machines. An improved measurement of energy losses in machines becomes possible through appropriate uncertainty evaluation. With these results a benchmark of the machine types for various applications of hybrids, range extender or electric cars is feasible.

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 proposal.

The JRP shall focus on the metrology for determining energy flows in electric vehicles, including safety of the relevant systems and metering.

The specific objectives are

1. To develop traceable measuring techniques for battery charging and discharging, suitable for billing purposes. The effect of the network impedance on the measurement results should be evaluated as well as the advantages and drawbacks of choosing AC or DC measurement for billing.
2. To develop the traceability required for efficiency measurements on frequency converters used in electric vehicles. A calibration set-up to measure accurately (0.1 %) current/voltage signals over an extended magnitude range (from tens of mA to hundreds of A, up to hundreds of V) and frequency range (up to tens of kHz) should be developed. New calibration techniques and systems to measure electrical power generated by distorted currents waveforms (harmonics up to tens of kHz) and rectangular voltage waveforms (harmonics up to 100 kHz or more) should also be provided. The development of algorithms and calibration set-up to synthesize/measure voltage and current waveforms with shapes identified in existing converters carrying known power should be used for verification of newly developed or commercially available power meters/analysers.

3. To design and develop mobile/portable acquisition equipment for on-field evaluation of the electrical energy efficiency of the power converter in a small electric vehicle. The system should be designed for simultaneous measurement of the involved electrical quantities in each driver switching device, together with converter temperature and environment monitoring. Pre-normative work for test systems and methods should be considered. Lead-out or in-cell measurements should stay within the limits in order to overcome the temperature dependence of batteries that limit the capacity or lifetime.
4. To develop thermal models simulating the performance of the electrical vehicle or hybrid cars. A methodology and experimental set-up for traceable dynamic torque, rotational speed and mechanical power in the drive train should also be developed and merged with the electrical input power measurements to achieve the targeted power efficiency measurement.
5. To engage with the automotive industry that manufactures electric cars and other vehicles to facilitate the take up of the technology and measurement infrastructure developed by the project, to support the development of new, innovative products, thereby enhancing the competitiveness of EU industry.”

Proposers shall give priority to work that meets documented industrial needs and include measures to support transfer into industry by cooperation and by standardisation. An active involvement of industrial stakeholders is expected in order to align the project with their needs – both through project steering boards and participation in the research activities.

Proposers should establish the current state of the art, and explain how their proposed project goes beyond this. Particular reference should be made to any relevant projects funded by the European Green Cars Initiative [1] or Electromobility+ [2].

EURAMET expects the average EU Contribution for the selected JRPs to be 1.5 M€, and has defined an upper limit of 1.8 M€ for any 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 deviation from this must be justified.

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,
- Drive innovation in industrial production and facilitate new or significantly improved products through exploiting top-level metrological technology,
- Improve the competitiveness of EU industry,
- Feed into the development of urgent documentary standards through appropriate standards bodies,
- Transfer knowledge to the automotive sector.

You should detail other impact of your proposed JRP as specified in the document “Guide 4: Writing Joint Research Project”

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.

Additional information

The references were provided by PRT submitters; proposers should therefore establish the relevance of any references.

1. European Green Cars Initiative PPP, <http://www.green-cars-initiative.eu>
2. Electromobility+, <http://electromobility-plus.eu/>