EMRP Call 2013 – Energy and Environment

Selected Research Topic number: **SRT-g01**
Version: 1.0

Title: Metrology infrastructure for alternative liquid fuels

Abstract

Limited natural resources, sustainability, and the goal to reduce greenhouse gas emissions require a compositional change in liquid fuels. Biofuels are the mid-term alternative for the transport sector due to their high energy density and established infrastructure. The production, trade, transport sectors and use of liquid biofuels requires robust and traceable measurements which are not fully available or not in line with the rapid developments of biofuels industry. The need is to develop robust traceable measurement of 1) origin, identification and biogenic mass fraction, 2) relevant chemical parameters and 3) relevant physical properties for liquid biofuels for light vehicles, heavy vehicles and aviation. These measurements are required to realise and implement a measurement infrastructure assisting the rapidly increased use of biofuels as envisaged by the European Commission.

Conformity with the Work Programme

This Call for JRPs conforms to the EMRP Outline 2008, section on “Grand Challenges” related to Energy and Environment on pages 8/9 and 23/24/25.

Keywords

biodiesel, thermodynamical properties, equation of state, on-line sensor; reference material, advanced biofuels, aviation fuel, biofuels, chemical properties, hydrogenated vegetable oil, metrology, reference methods, reference material, origin, well to wheel.

Background to the Metrological Challenges

In order to meet the aims and objectives of Directive 2009/28/EC [1], prescribing an increased use of renewable energy sources targeting an overall fraction of 20 % in 2020, it is necessary to have relevant requirements for biofuels in order to promote production, trade, transport and use. The requirements should be based on achieving the highest possible reduction of fossil CO_2 in a well to wheel analysis. An area where a future demand of liquid biofuels can be expected is aviation transport, since alternatives like electric engines are unlikely to work in this application within the foreseeable future. The varying feedstock used for production of biofuels has been shown to have very different impact with regard to fossil CO_2 reduction. Thus, there is both a need and a requirement to be able to assess the origin of the fuel, both regarding type of feedstock and where it was grown.

The use of future biofuels can lead to vehicle malfunction such as engine misfiring due to clogged fuel injectors, filter clogging and corrosion at fill stations or corrosion within the vehicle. The standard laboratory methods as well as on-line measurements need to be adapted to all fuel types in order to become useful and reliable. The fuel manufacturers need relevant standards to show that a new fuel will work in an actual engine. The new properties to be tested need traceable and robust methods in order to meet the demand on comparability of measurement. The origin of the fuel will also become increasingly important as HVO is difficult to distinguish from petroleum diesel which invites to misuse to avoid fuel taxation.

Nowadays, many of the methods used by industry and field laboratories to evaluate the quality of biofuels to be put on the market are strongly linked with regional standard methods and parameters are often method-dependent. EMRP JRP ENG09 “Metrology for Biofuels” developed a measurement infrastructure able to provide reliable data and able to be rapidly adapted to the changes in type and bio-origin of biofuels.

Certified Reference Materials (CRMs) are essential tools for the quality assurance of analytical measurements. At present, no CRMs are available on the market for blends of biofuels with conventional

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fuel, i.e. for fuel as distributed to petrol stations (and sold to the final customer). Those developed in ENG09 need to be combined with other techniques to improve reliability.

Scientific and Technological 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 JRP-Protocol.

The JRP shall focus on the traceable measurement and characterisation of biofuels.

The specific objectives are

1. To develop robust methods for assessing the origin of biofuel (raw material, production location, biogenic mass fraction in fuel)

2. To support challenging analyses in current (e.g. EN14214) and up-coming biofuel chemical specifications by development of robust traceable methods (e.g. oxidation stability, water content, glycerides, free water, short chain fatty acids, hydroperoxides and major components not yet specified like steryl glycosides)

3. To develop and validate methods (or improve their accuracy) for traceable measurements related to physical and chemical properties of liquid biofuels (e.g. calorific value, vapour pressure, heat capacity, heat of vaporization, speed of sound, surface tension, water separation properties, filtration properties, and deposition properties of biofuel on hot surfaces)

4. To reduce the uncertainty in the determination of the density-temperature relationship and to develop equations of state with improved accuracy

5. To develop methods for monitoring the quality of biofuels, by means of new sensor technology for on-line traceable measurements, of e.g. water content, conductivity, oxidation stability, and hydroperoxide content.

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 R&D work, the involvement of the user community such as industry, and standardisation and regulatory bodies, as appropriate, is strongly recommended.

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 EMRP project ENG09 and how their proposal will build on those.

EURAMET expects the average size of JRPs in this call to be between 3.0 to 3.5 M€, and defined an upper limit of 5 M€ for any project. The available budget for integral Research Excellence Grants is 30 months of effort.

Potential Impact

Proposals must demonstrate adequate and appropriate participation/links to the “end user” community. This may be through the inclusion of unfunded JRP partners or collaborators, or by including links to industrial/policy advisory committees, standards committees or other bodies. Evidence of support from the “end user” community (eg letters of support) is encouraged.

You should detail how your JRP results are going to:

- feed into the development of urgent documentary standards through appropriate standards bodies
- transfer knowledge to the biofuels sector.

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

You should also detail how your approach to realising the objectives will further the aim of the EMRP to develop a coherent approach at the European level in the field of metrology and includes 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 Member States and countries associated with the Seventh Framework Programme whose metrology programmes are at an early stage of development to be increased
- outside researchers & research 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] Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing directives 2001/77/EC and 2003/30/EC.