EMRP Call 2013 – Energy, Environment

Selected Research Topic number: **SRT-v04**
Version: 0.1

Title: Metrology for high-impact greenhouse gases

Abstract

Global climate change poses one of the greatest risks to society worldwide. Consequently there is an urgent need to provide a validated and traceable measurement infrastructure to support our understanding of the increasing influence of human activity on the global atmosphere. The measurement of greenhouse gases is pivotal to understanding the changes in the Earth's climate. Research is required to develop traceable standards with long-term stability for the high impact greenhouse gases identified by the World Meteorological Organisation (WMO) as critical for global monitoring. Standards for these compounds are required with low uncertainties to improve the quality assurance and control processes used to assess global climate trends.

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 page 24.

Keywords

Global monitoring networks; greenhouse gases; atmospheric composition; Global Atmospheric Watch (GAW); dynamic measurements; isotope ratio standards; optical methods; OIRS; delta value

Background to the Metrological Challenges

The development of national and international legislation aimed at reducing emissions of greenhouse gases is a significant driver in this area. These include the Kyoto protocol, rules for emission inventories developed under the UNFCCC, EC directives, ICOS and the WMO GAW programme. Although significant progress has been made, the interpretation of data used to improve our understanding of the contribution of key compounds to stratospheric and tropospheric chemistry is limited by a lack of traceable calibration resulting in poor comparability of measurement results.

The Gas Analysis Working Group of the CCQM coordinates the provision of standards for global monitoring of greenhouse gases by the WMO's GAW programme. Reference standards of greenhouse gases are currently disseminated in high-pressure gas cylinders and have been the subject of intensive research to determine their accuracy and lifetime.

In order to maintain short and long term stable values of greenhouse gases for analysis of trends in the atmosphere with confidence, reference standards are required with typical uncertainties below 0.02 % (a factor of at least 5 better than has currently been demonstrated at CCQM). However, this can only be achieved when full traceability is in place. Systematic biases are often introduced from instrumentation at monitoring stations when reference gases vary in isotopic composition from the measured environment.

Current methods for isotopic composition measurements enable the determination of the origin of a certain greenhouse gas species, and its sinks and sources. However, there is also a strong need to address metrological aspects for traceability of optical isotope ratio spectrometry (OIRS) for stable isotope measurements on gaseous molecular species containing C, N, O, H, or S atoms, which is emerging as an alternative method.

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 performing research and developing metrological methodology which will facilitate and improve SI- traceability for high impact greenhouse gases.

The specific objectives are

1. Enabling and improving SI- traceability for the highest impact greenhouse gases (CO_2, CH_4, N_2O, F-gases) and gases that have indirect effects on global warming such as CO.
2. Development of novel primary standards for monitoring high-pressure gas mixtures.
3. Development of dynamic generation methods for on-site preparation of standards at trace concentrations with accurate quantification to the level of parts-per-billion and below.
4. Development of complementary and alternative optical methods (such FTIR, TDLAS, CRDS or OIRS) for isotopic composition measurements to determine the origin of a greenhouse gas species (such as CO_2 and N_2O).

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.

EURAMET expects the average size of JRPs in this call to be between 3.0 to 3.5 M€, and has 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 environmental, energy and health sectors.

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.