Potential European Partnership on Metrology
Call 2021 – Green Deal and Normative

Selected Research Topic number: **SRT-v13**
Version: 1.1

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.

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Title: On farm quantification of ammonia and greenhouse gas emissions from livestock production

Abstract

Ammonia and greenhouse gases have well-known impacts on the environment and the climate. The EU agricultural sector significantly contributes to ammonia (NH_3, 93 %), nitrous oxide (N_2O, 72 %) and methane (CH_4, 48 %) emissions. Estimations of livestock emissions are based on the measurement of several parameters − in particular gas composition and ventilation − combined with mathematical models. Due to the complexity of the measurements and the lack of full SI-traceability, this sector contributes a large amount of uncertainty to the emission inventories. Proposals should aim to provide an SI-traceable field measurement infrastructure for an accurate determination of livestock emissions and for assessing mitigation measures to reduce emissions.

Keywords

Agriculture, emissions, modelling, ammonia, methane, nitrous oxide, greenhouse gases, livestock housing, tracer gas, nitrogen flux, mitigation measures, manure

Background to the Metrological Challenges

Many current food production practices still result in air, water and soil pollution, contributing to biodiversity loss, climate change and poor air quality. [1] Increasing global food demand drives ruminant livestock numbers, rapid land use change and nitrogen (N) fertilizer use, accelerating greenhouse gas (GHG) emissions. The EU agricultural sector significantly contributes to ammonia (NH_3, 93 %), nitrous oxide (N_2O, 72 %) and methane (CH_4, 48 %) emissions. The major contribution of agriculture, in particular to non-CO_2 GHG and NH_3 emissions, has led to many recent initiatives such as the "EU Methane Strategy" and the "Farm-to-Fork Strategy" to increase transparency in agricultural emissions by collecting, reconciling and verifying anthropogenic emissions data. Despite this major contribution agriculture is the source category with the highest emission uncertainty.

One challenge with respect to quantifying livestock emissions is concerned with naturally ventilated housing since the air exchange rate is highly variable due to dynamic wind conditions and uncertainties in emission can be up to 70-80 %. This is in contrary to mechanically ventilated housing where the ventilation rate can be determined more accurately by measuring directly at the ventilation shafts. The current techniques require a detailed analysis of emissions uncertainties. Prerequisites for their use are limited and the representativeness of the sampling and dosing positions must be better specified. CFD modelling must be improved and validated with measurements on a practical scale.

Recently many low-cost sensors for mass deployment have been developed and may have the potential to provide measurements on several farms and thus increase the representativeness of measurement data. With measurements on many farms, key-indicators for emission-relevant influencing variables (e.g. milk urea content and manure storage) must be identified on a broad data basis and improving modelling of emissions and mitigation strategies is required. Previous modelling is largely based on measurements in the lab or on an individual (experimental) farm and mostly focused on a specific influencing variable. For NH_3 sensors, current modelling methods do not have the required accuracy for concentrations <1 µmol/mol. Thus, they cannot be used in naturally ventilated cattle housings with very low concentrations. For CO_2 and CH_4 sufficiently sensitive sensors are under development however, correction algorithms for interferences (e.g. humidity, hydrocarbons), data correction and filtering algorithms must be developed.

Livestock also affect GHG emission through NH_3 emission from housings deposited to surrounding soils and manure used as fertilizer on agricultural fields. The recent global growth in anthropogenic N_2O emissions from fertilized soils exceeds some of the highest projected scenarios, underscoring the urgency to improve our understanding of N_2O emission processes. N_2O flux measurements using chamber-based methods and micrometeorological techniques have been applied across a wide variety of terrestrial ecosystems providing an extensive set of measured emission fluxes over a range of spatial and temporal scales. However, due to the very dynamic and variable character of N_2O emissions, up-scaling N_2O budgets to regional or even national scales remains an unresolved challenge. Recent progress in laser spectroscopy and reference gases provides the opportunity to analyse N_2O fluxes and their isotopic signature at field sites to differentiate N_2O production pathways.

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 livestock emissions.

The specific objectives are

1. To develop, building upon existing techniques, traceable techniques for quantifying NH_3 and CH_4 emissions from selected livestock housings with a target uncertainty of 10 % (CH_4) to 20 % (NH_3) for mechanically ventilated and 30 % (CH_4) to 40 % (NH_3) for naturally ventilated housing. In addition, to define target applications (e.g. animal category, housing systems) according to stakeholder needs.
2. To develop and characterise CO_2, NH_3 and CH_4 emission monitoring techniques, considering atmospheric conditions, for enhanced spatial and temporal coverage.
3. To identify, using emissions data from objective 2, key-indicators (e.g. milk urea content and manure storage) and to improve emission models (e.g. based on feeding, climate conditions) for increasing the representativeness of the emission estimations and determine their uncertainty. In addition, to develop farm-monitoring systems for evaluating the efficiency of reduction measures and provide management tools to farmers for ensuring reduction performance.
4. To reduce the uncertainty associated with up-scaling GHG emissions and nitrogen loss from soils by improving model parameterisation (e.g. relative contributions of nitrification and denitrification to N_2O emission) using field-deployable spectroscopic techniques to determine N_2O isotopic species for different production pathways. In addition, to improve methods for quantifying NH_3 deposition from livestock housing and tracing nitrogen isotopes (e.g.^{15}N) in managed soils.
5. To facilitate the dissemination and uptake of the technology and measurement infrastructure developed in the project by (i) contributing to missions inventory reports under the UNFCCC, (ii) providing guidelines to the measurement supply chain (researchers, commercial measuring institutes), expert groups (VERA, COST Action LivAGE) and standardisation developing organisations (CEN TC264) on techniques/modelling approaches to facilitate the establishment of decision matrices and the promotion of mitigation measures by policy makers, and (iii) providing farmers access to reliable methods for identifying efficient mitigation strategies and provide quantitative GHG emissions at farm level.

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 EMRP projects ENV52 HIGHGAS, ENV55 MetNH3 and IND63 MetAMC and EMPIR projects 16ENV06 SIRS, 15NRM01 Sulf-Norm and 18NRM04 Heroes 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 farming sector.

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.

Additional information

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

[1] IPCC (2019) Climate Change and Land: an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems.