
Title: Metrology to support emissions trading schemes

Abstract

The European Emissions Trading Scheme (ETS) is a mechanism adopted by the EU to mitigate climate change caused by the emission of greenhouse gases (GHGs). The proposed joint research project (JRP) should seek to establish an internationally acceptable and recognised measurement infrastructure to support the current European Emissions Trading Scheme (ETS), but also future global trading and the use of Clean Development Mechanisms (CDMs). Improved methods and techniques are needed for the estimation of power plant and country-level fossil emissions, and for accounting for emissions from biomass (considered as carbon neutral for greenhouse gas trading and monitoring). It is essential that methods and techniques are well proven, accurate, traceable and standardised, and that uncertainties in the emissions factors are correctly calculated.

The EC also encourages the development of carbon capture and storage (CCS) technologies within the ETS, but this is addressed in a separate Call for JRPs

Conformity with the Work Programme

This Call for JRPs conforms with the EMRP 2008, section on “Grand Challenges” related to Environment on page 8, and page 24.

Page 8 addresses the specific challenge of measuring flow and concentration of species under regulation such as the Kyoto protocol. It also targets the most urgent research aims of “validated and traceable measurement techniques, sensors and measurement standards”.

Page 24 states:

“Research into innovative new systems and technologies that mitigate environmental impacts. These require:

- Internationally-recognised standards to underpin measurements of the flow and concentration of species regulated under the Kyoto protocol and EU’s emission trading schemes.”

“Minimising future negative environmental impacts depends on the implementation of policies that encourage the sustainable use of energy and resources. The EMRP will develop new measurement capabilities for:

- The validation of the long-term efficiency of carbon sequestration technologies.”

Keywords

Emission monitoring, emission trading, emission allowance, greenhouse gas, Carbon dioxide, CO₂ monitoring, biogenic CO₂, fossil CO₂, on-line measurements, on-site measurements, traceability, international comparability. Kyoto Clean Development Mechanisms (CDM)

Background to the Metrological Challenges

Climate change caused by greenhouse gas (GHG) emissions is one of the most severe challenges for mankind today. The EC is fighting this change by reducing its GHG emissions substantially, supported by an emission trading scheme (ETS) based on monitoring, reporting and verification and of annual activity specific GHG emissions. GHGs are carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride (SF₆) and other gases that absorb and re-emit infrared radiation. The ETS will include even the aviation industry from 2012.

The emission trading allowance (ETA) comprises:

- (I) the determination of the emissions on the basis of the feedstock used or products produced (activity data),
- (II) the determination of the emissions based on measurement of the flow and GHG-concentration of flue gases and
- (III) the determination of avoided emissions due to carbon capture and storage (CCS).

Many projects related to the Clean Development Mechanism (CDM) arranged under the Kyoto Protocol require means to monitor and verify the reduction of fossil CO₂ emissions. Moreover, climate change mitigation policies outside EU include national legislation on taxation or subsidies to power plants and other operators. Both CDM projects and other countries' policies could benefit from new accurate and reliable monitoring methodology as well as create business opportunities for EU countries.

The extension of trading to include more complex sources and industries (such as aviation from 2012, the inclusion of CDMs in trading quotas and the adoption of trading of additional GHGs, for example N₂O will require the ability to quantify and compare 'carbon' from disparate sources. The Directive 2004/101/EC allows for the use of certified emission reductions (CERs) and emission reduction units (ERUs) to link Kyoto Protocol project mechanisms (Joint Initiatives and Clean Development Mechanisms) to the ETS. There is a need for tools that support the verification of these 'carbon credits' and their quantification in terms of equivalent tonnes of CO₂.

Improved measurements are required to provide traceability and comparability between the different estimation and calculation approaches currently used. If the EU does not develop a harmonised and rigorous measurement infrastructure to support the ETS, then EU industries and Governments will be at a disadvantage when negotiating international agreements and in the developing global carbon market.

Currently emission factors can be measured with an uncertainty of approaching 0.6 %, while the target is better than 0.5 %

Target uncertainties for reporting emissions range from 2.5 % to 10 % depending on the size of the facility. These represent significant measurement challenges. For example, combustion process activity data requires the determination of fuel use with an uncertainty of better than 1.5 %. Emissions factors for large combustion sources are required to be determined directly for the fuel used, with an uncertainty of 0.5 % over the reporting period. Current online capability to determine the carbon content of fuel is reported as having an uncertainty of ~ 1 %, however the online weighing of coal feed can have uncertainties of 20 %, and all areas of the traceability chain must be addressed.

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 objectives are based around the PRT submissions. As experts in the field, JRP proposers should establish the current state of the art, which may lead to amendments to the objectives - these should be justified in the JRP proposal.

The proposed JRP should aim to provide an internationally acceptable and recognised measurement infrastructure in support of the current European Emissions Trading Scheme (ETS), but also of the future global trading and the use of Clean Development Mechanisms (CDMs).

The aim of your JRP should be to provide validated and reliable measurements/methods with traceability wherever it is practicable to do so for

1. Development of metrological tools and methods to quantify GHG emissions covered by ETS, for classical localised measuring instruments, distributed measuring systems based on sensor networks as well as on-line and on-site measurements.
2. Application of direct measurement capabilities to validate current emissions calculation approaches.
3. Development of harmonised approaches to uncertainty calculation, including the validation of these calculations and development of documentary standards.

4. Development of metrologically-based decision-making procedures in support of the assessment and quantification of ETS and Kyoto Clean Development mechanisms.
5. Measurements to support future expansion of the scheme – e.g. measurements of GHG emissions from waste, agriculture and road transport.

Proposers shall give priority to work that meets documented stakeholder needs and may include measures to facilitate the development of European standards and Directives.

Proposers should establish the current state of the art, and explain how their proposed project goes beyond this.

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 (e.g. letters of support) is encouraged.

Where a European Directive is referenced in the proposal, the relevant paragraphs of the Directive identifying the need for the project should be quoted and referenced. It is not sufficient to quote the entire Directive per se as the rationale for the metrology need. Proposals must also clearly link the identified need in the Directive with the expected outputs from the project.

In your JRP submission please detail the impact that your proposed JRP will have on the following Directives (see references for full details):

- Directive 2009/31/EC “geological storage of carbon dioxide”
- Directive 2009/29/EC “to improve and extend the greenhouse gas emission allowance trading scheme of the Community”
- Directive 2004/101/EC “establishing a scheme for greenhouse gas emission allowance trading within the Community”
- Directive 2004/22/EC “measuring instruments”
- Directive 2003/87/EC “Establishing a scheme for greenhouse gas emission allowance trading within the Community”

You should also detail other Impacts of your proposed JRP as detailed in the document “Guidance for writing a JRP”

You should detail how your JRP results are going to:

- feed into the development of urgent standards through appropriate standards bodies
- transfer knowledge to the climate change and environmental sectors.

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. 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 3 years duration.

Additional information

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

Directives:

- [1] Directive 2009/31/EC of the European Parliament and of the Council of 23 April 2009 on the geological storage of carbon dioxide and amending Council Directive 85/337/EEC, European Parliament and Council Directives 2000/60/EC, 2001/80/EC, 2004/35/EC, 2006/12/EC, 2008/1/EC and Regulation (EC) No 1013/2006 <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:140:0114:0135:EN:PDF>
- [2] Directive 2009/29/EC of the European Parliament and of the Council of 23 April 2009 amending Directive 2003/87/EC so as to improve and extend the greenhouse gas emission allowance trading scheme of the Community <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:140:0063:0087:en:PDF>
- [3] Directive 2004/101/EC of the European Parliament and of the Council of 27 October 2004 amending Directive 2003/87/EC establishing a scheme for greenhouse gas emission allowance trading within the Community, in respect of the Kyoto Protocol's project mechanisms. <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2004:338:0018:0023:EN:PDF>
- [4] Directive 2004/22/EC of the European Parliament and of the Council of 31 March 2004 on measuring instruments, Annex MI002 <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2004:135:0001:0080:EN:PDF>
- [5] Directive 2003/87/EC EC of the European Parliament and of the Council of 13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2003:275:0032:0032:EN:PDF>

EC decisions

- [6] DRAFT: Commission Decision of xx/xx/2009 amending Decision 2007/589/EC as regards the inclusion of monitoring and reporting guidelines for greenhouse gas emissions from the capture, transport and geological storage of carbon dioxide
- [7] Commission Decision 2009/339/EC of 16 April 2009 amending Decision 2007/589/EC as regards the inclusion of monitoring and reporting guidelines for emissions and tonne-kilometre data from aviation activities <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:103:0010:0029:EN:PDF>
- [8] Commission Decision 2009/73/EC of 17 December 2008 amending Decision 2007/589/EC as regards the inclusion of monitoring and reporting guidelines for emissions of nitrous oxide <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:024:0018:0029:EN:PDF>
- [9] Commission Decision 2007/589/EC of 18 July 2007 establishing guidelines for the monitoring and reporting of greenhouse gas emissions pursuant to Directive 2003/87/EC of the European Parliament and of the Council <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2007:229:0001:0085:en:PDF>
- [10] Brussels European Council 8/9 March 2007 Presidency Conclusions. P10-14, p19-23 <http://register.consilium.europa.eu/pdf/en/07/st07/st07224-re01.en07.pdf>

Other References

- [11] Kyoto protocol <http://europa.eu/rapid/pressReleasesAction.do?reference=MEMO/03/154&format=HTML&aged=0&language=EN&guiLanguage=en>
- [12] European Commission International Press Release. IP/08/1998, 17/12/2008. "Climate change: Commission welcomes final adoption of Europe's climate and energy package" <http://europa.eu/rapid/pressReleasesAction.do?reference=IP/08/1998>
- [13] "EU action against climate change. Leading global action to 2020 and beyond" 2009 Edition. Luxembourg: Office for Official Publications of the European Communities,

http://bookshop.europa.eu/is-bin/INTERSHOP.enfinity/WFS/EU-Bookshop-Site/en_GB/-/EUR/ViewPublication-Start?PublicationKey=KH7809725

- [14] EU Questions and answers on the ETS
<http://europa.eu/rapid/pressReleasesAction.do?reference=MEMO/08/796&format=HTML&aged=0&language=EN&guiLanguage=en>
- [15] EU website - Frequently asked Questions on Carbon leakage:
<http://ec.europa.eu/environment/climat/emission/pdf/faq.pdf>
- [16] CEN TC 264, WG23 Measurement of Flow in Ducts
- [17] CEN TC 264 WG 33 and CEN BT 210 – GHG emissions in energy intensive industries
- [18] Intergovernmental Panel On Climate Change <http://www.ipcc-nggip.iges.or.jp>
- [19] Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories. Reference Manual (Volume 3) <http://www.ipcc-nggip.iges.or.jp/public/gl/invs6.html>
- [20] Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories. Reporting Instructions (Volume 1). Annex 1 “Managing Uncertainties”, p. A1.4 <http://www.ipcc-nggip.iges.or.jp/public/gl/invs4.html>
- [21] IPCC Special Report on Carbon Dioxide Capture and Storage. Metz, B., O. Davidson, H. C. de Coninck, M. Loos, and L.A. Meyer (eds.). Cambridge: Cambridge University Press, 2005
http://www.ipcc.ch/publications_and_data/publications_and_data_reports_carbon_dioxide.htm
- [22] OIML Recommendation R 140 (2007), “Measuring systems for gaseous fuel”, p. 20
- [23] How Reliable are GHG Combustion Calculations and Emission Factors? Extended Abstract #57
Scott Evans, Clean Air Engineering, Presented at CEM 2009, Stresa
- [24] L. S. Rothman et al., *The HITRAN 2008 molecular spectroscopic database*, Journal of Quantitative Spectroscopy & Radiative Transfer 110 (2009) 533–572
- [25] Carbon Dioxide Emission Factors for U.S. Coal by Origin and Destination, Quick J, Environ. Sci. Technol, 2010
- [26] “Comparison of Two U.S. Power-Plant Carbon Dioxide Emissions Data Sets” Katherine V. Ackerman and Eric T. Sundquist. Environ. Sci. Technol., 2008, 42 (15), pp 5688–5693
- [27] Speech by Jos Delbeke - Environmental policy in times of economic crisis – the example of the EU ETS. Adam Smith Prize 2009, Berlin, 29 May 2009.
- [28] Recommendation for a new CO2 emission factor for natural gas (from 1990 onwards) Drs. H.H.J. Vreuls, 21 March 2006
[http://www.broeikasgassen.nl/docs/Vreuls%202006%20\(EN\)%20Advies%20EF%20Aardgas.pdf](http://www.broeikasgassen.nl/docs/Vreuls%202006%20(EN)%20Advies%20EF%20Aardgas.pdf)