

The significance of monitoring capabilities to decide about the scope of a carbon market

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Approach

- **European perspective: brief analysis of monitoring issues of source categories not covered in EU ETS**
- **Perspective from GHG inventories: analysis of the uncertainties in national GHG inventories for other gases than CO₂**
- **Focus on emission factors**
- **Brief analysis for a number of individual gases and source categories, general conclusions at the end**

CH₄ and N₂O from stationary combustion

- **High uncertainties of the emission factors for Non-CO₂ emissions from stationary sources in GHG inventories**

CH₄: 20-100% uncertainty of EFs reported

N₂O: 20-1000% uncertainty of EFs reported

- **High uncertainties in measurements**
- **Continuous measurements are no standard practice**

➔ **Non-CO₂ emissions from stationary combustion less suitable for regulation under a carbon trading scheme**

Fugitive CH₄ from coal mining

Underground coal mines

- Measurements of ventilation airflows or drainage systems of coal mines are common practice.
- Continuous measurements already applied in modern mines
- Continuous measurements bring uncertainties of annual emissions to **± 5% (IPCC 2006 GL)**
- ➔ CH₄ emissions from underground mines suitable for regulation under a carbon trading scheme

Surface coal mines

- Emission factors vary as a result of local geological features
- Emissions are directly released to the atmosphere and measurement is difficult
- High uncertainties of the emission factors
Factor 2 to Factor 3 (IPCC)
- ➔ CH₄ emissions from surface mining less suitable for regulation under a carbon trading scheme

- Emission factors difficult to estimate due to the lack of knowledge on leakage rates for old (in particular iron cast) gas distribution systems
 - Uncertainties of default emission factors
 - IPCC: **-20% to +500%**
 - Emissions will be largely reduced with the replacement of old infrastructure, which is an ongoing effort by gas distributors in many industrialized countries.
- ➔ CH₄ emissions from gas distribution less suitable for regulation under a carbon trading scheme

CH₄ from enteric fermentation

- **Uncertainties of emission factors:**
 - **± 5-40%** (inventories)
 - **± 20%** (IPCC for higher tier methods)
 - **Direct measurements of CH₄ emissions from livestock are often lacking or have been conducted using a limited number of diet types**
 - **Considerable amount of ongoing research, but few results validated to the point that they can be extrapolated to non-research conditions**
- ➔ **Less suitable for regulation under trading scheme**

CH₄ and N₂O from manure management

- High uncertainties of the emission factors:
CH₄: ± 5-40%, N₂O: ± 50-400% (inventories)
 - Many influencing parameters (N and C content of manure, duration of storage, type of manure management system, temperature, aeration and moisture conditions) and variations in process conditions
 - Measurements require significant resources, expertise and equipment as part of national research programmes
 - Measurements of emissions for different animal types in all relevant actual management systems under wide range of conditions necessary
 - Significant upfront costs for governments to develop national parameters for methodology
- ⇒ Less suitable for regulation under trading scheme

Emissions from **agricultural soils**

N₂O emissions

- Source with highest uncertainties: **± 150-400%** (GHG inventories)
- Very difficult to develop national emission factors
- Frequent measurement campaigns over several years (> 500 datasets) produce considerably different average EF, large standard deviations and high uncertainties of **± 100%**
- Most countries use default EFs for the amount of N₂O emitted from the various N additions to soils.

CO₂ emissions

- Large gaps in existing monitoring of CO₂ emissions and removals from soils (14 EU Member States not estimated)
- High uncertainties due to large number of influencing parameters and lack of information how these interact on a specific land unit
- Lack of long-term replicated field experiments for all climatic regions, soil types and management systems
- Sophisticated soil carbon models often validated by small/ limited number of long-term field data

↔ Emissions from soils not suitable for regulation under trading scheme

CH₄ emissions from solid waste disposed to landfills

- Uncertainties of emission factors: **± 25-70%** (GHG inventories)
 - Significant different results from measurement campaigns compared to model results at landfill level. Current models for national level not suitable for application for individual landfills.
 - On-site measurement on landfills very costly:
 - Mass balance method: 10,000 € per 8 weeks measurement period, equipment cost € 70,000
 - Static plume method: € 15,000 per measurement campaign, equipment cost € 55,000
 - Emissions can be easily reduced by regulatory requirements for mandatory collection and use of landfill gas
- ➔ landfills less suitable for regulation under carbon trading scheme

Conclusions

What minimum requirements in terms of monitoring are needed?

- **Clear quantified relationship between an anthropogenic activity and release of emissions**
- **Emission factors with acceptable uncertainty can be derived from measurements.**
- **‘Acceptable’ uncertainty level for inclusion in trading schemes has to be defined.**
- **Standard measurement procedures and equipment are developed for market application**
- **Emission factors can be determined with reasonable costs by participants of the scheme or**
- **Governments are able to develop sufficiently accurate default EFs with reasonable costs that are able to address the specific circumstances of participants**
- **Other types of regulations or policies do not offer a much cheaper and more effective solution for reducing emissions.**

Thank you for your attention!

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