



Comparison of Uncertainty in Different Emission Trading Schemes

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Suvi Monni



Background

- ◆ EU CO₂ emission trading 2005-2007
 - aim: to give one cost effective measure to reduce ghg emissions in the EU in order to achieve the Kyoto target
 - rules set in Directive 2003/87/EC and Guidelines for Monitoring
 - CO₂ from combustion and some raw materials in large installations (plants > 20 MW_{th},)
 - energy, pulp and paper, metal and mineral industry and oil refineries (excluding e.g. chemical industry)
 - 13 000 plants in the EU-25 area (plant-level emission data needed)
 - 2000 Tg CO₂
 - share of CO₂ emissions included in trading varies from <30% to nearly 100% in different member states

Background

- ◆ EU emission trading 2008-2012 (second phase)
 - rules will be decided in 2006
 - may be extended to cover other gases and/or sources
- ◆ Kyoto emission trading 2008-2012
 - rules set in the Marrakesh accords
 - begins, if the Protocol enters into force
 - emissions traded between parties
 - parties can enable companies to trade
- ◆ Uncertainty estimates required under the Kyoto Protocol

Methods

- ◆ Aim: to estimate differences in uncertainty of different ETS
- ◆ Uncertainty in different ETS estimated based on uncertainties in GHG inventories
 - EU-15 and EU-25 concerned
 - method does not give the real uncertainty in emission trading, because of
 - uncertainties in point sources (EU ETS) different from uncertainty in inventories
 - in inventory, random errors cancel each other
 - systematic errors cumulate
 - uncertainty in changes of emissions
 - good for comparison of different schemes

Cases

- ◆ EU CO₂ emission trading scheme for EU-15
- ◆ EU CO₂ emission trading scheme for EU-25
- ◆ Hypothetical EU CO₂ emission trading scheme extended to cover CH₄ & N₂O for EU-15
- ◆ Kyoto Emission trading scheme without LULUCF for EU-15
- ◆ Kyoto Emission trading scheme with LULUCF for EU-15

Comparison of different schemes

	EU CO ₂ ETS	Kyoto ETS	Hypothetical extended ETS
Sectors	Energy, industry (partly)	Energy, industry, agriculture, waste, LULUCF	Energy, industry (partly)
Gases	CO ₂	CO ₂ , CH ₄ , N ₂ O, HFCs, PFCs, SF ₆	CO ₂ , CH ₄ , N ₂ O
Limit for uncertainty	Yes (for activity data)	No	-
Accuracy of emission estimation methods	Calculations accurate for combustion (mass balance), measurements more accurate for some processes	measurement of all emission sources not possible	measurements of CH ₄ & N ₂ O from combustion more accurate than calculation

Material

- ◆ National allocation plans (NAPs)
 - not available for all member states of the EU
 - difficult to separate emissions from combustion and processes (important for uncertainty assessment!)
- ◆ National inventories
 - all emissions from mineral products assumed to be included in EU ETS
 - all process emissions from iron and steel assumed to be included in EU ETS
- ◆ Uncertainty estimates
 - IPCC GPG2000
 - Guidelines for Monitoring (EU ETS)
 - inventory uncertainties estimated by the member states
 - Monte Carlo simulation

Sources of uncertainty in different schemes

- ◆ In general
 - errors in models, measurement instruments, expert judgements
 - unrepresentativeness of emission factors used
 - natural variability
- ◆ EU ETS covers least uncertain sources, even though some sources are rather uncertain
 - waste combustion (share of fossil carbon in waste)
 - oil refineries
 - mineral products

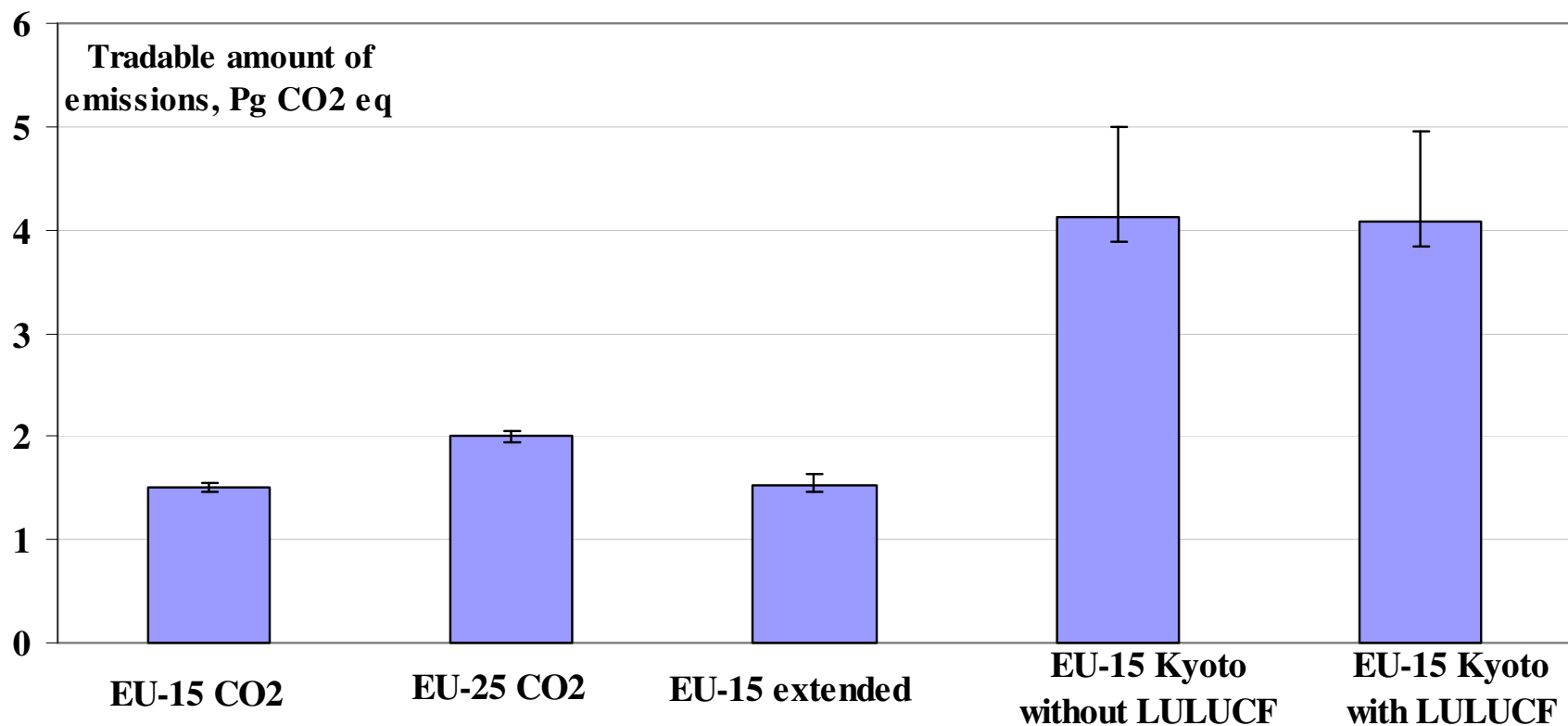
Sources of uncertainty in different schemes (continued)

- ◆ Hypothetical extended EU ETS
 - CH₄ & N₂O from same sources as in EU ETS
 - much larger uncertainties than in CO₂
 - variability of emissions due to combustion technology, temperature, air fraction, fuel type, etc
- ◆ Kyoto ETS
 - many complex and uncertain emission sources, e.g.
 - landfills
 - agricultural soils
 - LULUCF

Examples of input uncertainties

Emission source	Gas	Uncertainty
Stationary combustion under EU ET, EU-15	CO ₂	±3%
Stationary combustion under EU ET, new EU member states	CO ₂	±7%
Cement and lime production EU-15	CO ₂	±7%
Cement and lime production, new EU member states	CO ₂	±10%
Stationary combustion	CH ₄	±50%
Stationary combustion	N ₂ O	-100 to +550%
HFCs and PFCs emissions	HFCs, PFCs	± 40%
Agricultural soils	N ₂ O	-100 to +1000%
Landfills	CH ₄	± 45%
LULUCF	CO ₂	± 90%

Results



EU CO₂ ETS and extended EU ETS

- ◆ Uncertainty in EU ETS rather low ($\pm 3\%$)
 - inclusion of new EU member states did not increase uncertainty notably
- ◆ Inclusion of CH₄ & N₂O in hypothetical emission trading scheme
 - small increase in market volume (2%), large increase in uncertainty (-4 to +7%)
 - uncertainties for measured emissions lower, but measurements costly
 - some emission reductions costs are lower than for CO₂
 - various other possibilities to extend EU ET (e.g. CO₂ from transportation)

Kyoto emission trading

- ◆ Kyoto emission trading without LULUCF
 - uncertainties increased notably (-6 to +21%)
 - agriculture and waste very uncertain
- ◆ Kyoto emission trading with LULUCF
 - inclusion of LULUCF does not increase uncertainty notably (small sector under the KP)
 - consideration of LULUCF did not include all categories (carbon stock changes in dead organic matter, N₂O from forest soils) - inclusion of these may increase uncertainty
 - uncertainties difficult to estimate for activities under Articles 3.3. and 3.4
 - results with LULUCF only indicative

Discussion

- ◆ Uncertainties in (small) installations not included in EU ETS estimated larger than for installations included
 - if included in ET, same rules may apply
- ◆ In the future, ET may cover wider range of countries
 - uncertainties larger in developing countries
 - same rules may be applied for all countries
 - share of non-CO₂ larger in developing countries - larger total uncertainty
 - participation of maximum number of countries may increase cost-efficiency
- ◆ Under the KP, not all emissions are to be traded (only a small share)

Conclusions

- ◆ Significant differences in uncertainties in different ETS
- ◆ Here uncertainty assessment based on inventories
 - in reality based on data from single actors (countries, companies etc)
 - emission allowances exactly defined
- ◆ Inclusion of uncertainty in emission trading schemes in the future may be beneficial, e.g.
 - similar data quality between purchaser and vendor
 - limit for uncertainty in emissions to be traded
- ◆ Uncertainty should be concerned when planning future emission trading schemes