Report ECCP review meetings on Non-CO2 gases 30 January, 1 March and 2 May 2006

The present report tries to distil the important messages coming from the two meetings on non CO2 green house gases. Most presentations are on the Circa-website: http://forum.europa.eu.int/Public/irc/env/eccp_2/library?l=/eccp_fluorinated&vm=detailed&sb=Title

Like the meetings the report is divided in 8 parts: N2O in industry, N2O from combustion and other, small N2O sources, methane from waste, methane from coal mines, methane from oil and gas production and distribution, other methane emissions and emissions of fluorinated gases.

N2Oemissions from industry:

1. Emission trends:

The ECCPI process identified large and very cost effective N2O reduction potentials in EU industry – 89 mill t CO2e (EU 15) – notably in the nitric acid and adipic acid industries. The conclusion was to establish a BREF (Best Available Technique Reference Document) under the IPPC Directive to limit these emissions. There are around 80-100 nitric acid plants in EU 25 today, but less than 10 adipic acid producers, a similar number of caprolactam and only a few producers of glyoxylic acid. Emissions have been decreasing significantly coming down around 60 Mill. t (EU 15) from notably the adipic acid production since 1990 due to national programmes. Still, the two major industries emit around 45 Mill. t CO2e (EU 15) annually as of 2003. The largest reduction potentials are in the nitric acid industry – 20-30 Mill. t CO2e, while only one adipic acid (6 Mill. t) plant had not yet reduced emissions. A reduction of 85 % of N2O emissions from the production of glyoxylic acid was reported. No economic feasible reduction measures have been confirmed for N2O emissions from caprolactam manufacturing so far, but research is ongoing.

Some new EU members clearly have not reported fully on emissions of N2O from nitric acid production, and only 2 member states have reported on N2O emissions from caprolactam, even if it is known to be produced in a larger number of EU countries. As a consequence there is some uncertainty as to both emissions and remaining reduction potentials. Reduction potentials will also depend on the reduction efficiency of mitigation technologies to which there is also continued uncertainty.

2. Regulatory approach

A BREF is under preparation covering N2O emissions from nitric acid**.** The conclusions in the BREF on Best Available Techniques (BAT) on this issue have not yet been finalised (final discussions expected before the summer 2006). The BREF is not binding on Member States but is a reference document adopted by the Commission, which has to be taken into account by competent authorities in the Member States to set permit conditions based on BAT.

Recently, the French and Dutch governments have announced plans to opt-in N2O emissions from the nitric- and adipic-acid industries in the European emissions trading scheme (ETS). UK, Lithuania and Finland consider their positions. France has developed draft monitoring and reporting guidelines. This raises questions on how the two regulatory approaches interact in practice. No derogation from BAT-based permit conditions is granted for N20 in the IPPC and ET Directives. All installations concerned have to fully comply with the IPPC Directive at the latest by October 2007.

Two positions to this question emerged during the meeting:

- Regulation of N_2O emissions from industry shall solely be based on the IPPC directive. Inclusion in the ETS runs the risk of double-counting of emission reductions that have already been realised due to national measures. Furthermore, there are risks related to inclusion – such as over-allocation of free allowances.
- Emissions trading could replace the implementation of the IPPC Directive from as regards emissions of green house gases.

All present at the meeting agreed that – in case these emissions are included in the ETS - reduction efforts could not be left to emissions trading without setting a benchmark, as this could create uneven playing fields for industries across Europe, and create huge windfalls for some industries in countries allocating large amounts of free allowances.

The discussion furthermore concentrated on:

- The potential benchmark level to be set – with industry arguing for a value around the future German TA-luft standard of 2.5 kg N_2O/t nitric acid. The starting point in French opt-in discussions is 1.2 kg N_2O/t nitric acid. NGOs argued for a low benchmark, if these industries are allowed into the ETS, as a high benchmark would leave industry with high windfall profits.
- Differentiation of benchmarks: Abatement costs vary across different kinds and sizes of nitric acid installations. Industry argued that the application of BAT-based permit conditions as required by the IPPC Directive would be too expensive and would lead to the closure of smaller nitric acid plants. Industry claimed for financial incentives to be provided to ensure that emissions of N_2O would be further reduced.
- Effectiveness of the different regulation processes: Industry argued that combining the IPPC permitting with emissions trading would create an incentive for industry to reduce more than required under the IPPC Directive – potentially up to10 Mill. t CO_2e - and that reductions would come earlier than solely under the IPPC Directive. At the same time this could help EU industry to stay competitive – avoiding de-location of industry to countries without restraining climate obligations, where competing industries can enjoy the full economic benefits of JI- and CDM-projects.
- Monitoring and reporting: An opt-in requires the development of monitoring and reporting guidelines, which must be accepted by the EU Commission. France has developed draft guidelines.
- The risk of double-counting: There could be some risk of double-counting of national climate policy measures by inclusion of these industries in the ETS, but EU governments have clear obligations to separate the effects of different instruments applied in national inventories.

N_2O in combustion:

1. Emission trends:

During the ECCPI process fluidised bed combustion (FBC) – and in particular circulating fluidised bed boilers (CFBB) – were identified as major emitters of N2O, especially when burning coal. Furthermore, selective non-catalytic reduction (SNCR) can also contribute to formation of N2O – especially when urea or cyanuric acids are used as reduction agents.

The amount of N2O emissions from combustion were discussed during ECCPI, as statistics were (and are) fairly limited in detail. Total N2O emissions from combustion reported to the UNFCC from EU 15 were around 40 Mill. t CO2e – and FBC emissions were roughly estimated to be around 38 % of that – approximately 15 Mill. t CO2e. Reductions of 2 Mill. t at a cost lower than 20 €/t CO2e were estimated as possible. Expectations were further that the FBC share of solid fuel combustion could be rising due to potentially favourable economics and other environmental benefits.

Previous expectations on growth of FBC have barely been fulfilled due both to increased focus on Natural Gas Combined Cycle in electricity production in recent years, and that CFBC only recently has been scaled up to normal power station size (>300 MW). But a revival may be possible due to higher oil and gas prices and the successful scale-up of FBC-plants. China reportedly has plans for very large CFBC investments in order to cope with SO2 and NOx emissions.

Presentations confirmed ECCPI findings as regards the prime sources of N2O from combustion.

However, recent Finnish measurements indicated that the average FBC emissions from hard coal may only be 1/3 of IPCC and IIASA recommended default values 30 mg/MJ_{fuel} as compared to 96 mg/MJ_{fuel} (IPPC and 80 mg/MJ_{fuel} (IIASA). One of the reasons for this seems to be that coal-burning takes places at higher temperatures than expected – implying thermal destruction of a major part of the N2O formed. Reports from some member states on higher N2O emissions from burning of biomass than from coal could not be verified. Operation on part load increases specific emissions by a factor of 2-3.

Still, N2O emissions from coal burning CFBC may be 8-10 % of CO2-emissions from the same process, even when applying the lower average emission estimate of 30 mg/MJ_{fuel}. Emissions from different CFBC boilers using same fuels seem to vary considerably – indicating potential reduction possibilities. Afterburning and advanced air-staging are other reduction possibilities, but with increased NOx and SO2-emissions as a result.

2. Regulation

No action on N2O emissions from combustion was suggested in ECCPI. National regulation has been discussed, but not materialised. Some member states have undertaken measurement programmes, though, in order to get a better picture of actual emissions.

Potential regulation of the problem was briefly discussed from the perspective that all green house gas emissions ideally should be covered by a form of regulation.

N2O emissions should be regulated in IPPC permits, whereas the Combustion Plants Directive does not cover green house gases.

An alternative approach could be to include emissions of N2O from significant sources under the EU Emissions Trading Scheme. This requires the availability of precise, reliable and affordable measurement equipment and procedures – an issue that has to be analysed further.

Other, small N2O sources:

ECCPI identified a number of small sources of N2O:

Wastewater:

N2O emissions from wastewater treatment are around 2 % of EU totals, but statistics remain highly uncertain (factor 2-3) due to measurement problems. Trends are expected to be downwards, as wastewater treatment is being upgraded across the EU. One study claim emissions can be reduced by 40 % at no cost by changes to WWTP operation, but this has not been verified.

N2O-use:

N2O is used in a number of very different end-uses:

Anastaetichs: N2O has traditionally been used as an anastaetich for many years. Still, statistics on this application are weak. Based on a few national communications to the UNFCC emissions could be anywhere between 5 g/capita to 50 g/capita in the EU – or between 0.7 and 7 Mill. t CO2e a year for the EU. The trend is downwards, due to health concerns in hospitals and dental clinics. A possible replacement with xenon is extremely costly.

Aerosol: N2O is used as a propellant for whipped cream in boxes, and EU consumption is around 0.8 Mill. t CO2e a year according to industry. Still, national information on this in National Communications to the UNFCC varies considerably from 7 g/cap to 50 g/cap. No economically feasible replacements have been identified.

Other:

N2O is also sold in cartridges, and the only known use here is as an – illegal – drug. Total sales are unknown.

N2O is also used for motor-tuning in racing cars. In this application most of the N2O is presumably destroyed due to high temperatures. Sales unknown.

Another N2O-use found in literature is N2O as inactive air-fill in potato chip bags. This has not been confirmed by a leading Scandinavian producer of potato chips, which claim N2 is the commonly used bag-filler in Europe.

A Swiss company report sales of N2O production equipment, which match EU's reported production several times. No information is available on the destiny of most of this N2O.

Conclusion: The chair concluded that statistics for both wastewater and N2O uses are weak and that more substantive information is needed, before any interventions can be considered.

The emissions are too small on a national scale to warrant much attention. The Non CO2 Green House Gas Forum organised by Netherlands may be a good vehicle to survey these issues.

Methane from waste

1. Emission trends:

Methane from waste is 27 % of EU total methane emissions in 2003 – second largest source after agriculture at 52%. But emissions have decreased by 35 % since 1990 – from around 115 Mt CO2e to 74 Mt CO2e a year (Poland, Malta and Cyprus not included). The main driver for this emission reduction is waste policies – more recycling of paper and less land-filling of biodegradable waste. The Landfill Directive has set out to reduce land-filling of biodegradable waste to 65 % of such waste produced in 1995 by 2016 and demand capture and flaring of methane emissions, as far as possible with energy recovery. As a result 80% of previous emissions will eventually disappear as methane capture from landfills can never become 100% effective. The avoided emissions may be higher than 80%, if some Member States go beyond the EU diversion target, as is the case for example in Denmark, Germany and Austria. As of 2003 waste policies and methane emissions still differed widely across the EU with some countries having stopped land-filling of bio-waste altogether and using waste for composting and/or energy recovery through incineration/electricity production/district heating, whereas other countries still depend almost totally on land-filling and some member states lag behind deadlines set in EU legislation.

Recycling of waste in the EU avoids over 200 Mill. t CO2 emissions annually – about the double of the total emissions from the waste sector. Paper recycling is a significant contributor to this success as landfilling of paper produces methane: Recycled paper has increased from 25 Mt or 32 % of paper used in 1990 to 48 Mt and 56% of paper used in 2005. According to the paper industry each ton paper recycled equals around 1.4 t of saved CO2e emissions – a total of around 67 Mt CO2e avoided by paper recycling a year. Metals also make significant contributions mainly through the energy savings related to using waste materials rather than virgin materials in the production processes.

2. Regulation

EU and national waste policies are the main drivers behind the emissions reductions achieved so far, and are expected to remain so. The thematic strategy on waste released in 2005 set out a framework for further steps towards a recycling society. A new waste framework directive has been proposed by the Commission that takes a life cycle approach to waste policy which would increase policy maker's focus on environmental impacts of which global warming is a significant category particularly important for waste recycling and recovery policies.

Some attendants pointed at high residual potentials for methane emission reductions – even if present EU legislation is fully complied with. Composting could be considered as a temporary sink and could be considered for inclusion in future revisions of the EU emission trading scheme.

Methane from coal mining and handling

1. Emission trends:

EU 25 methane emissions from coalmining and handling of 32 Mt CO_2e were around 8 % of total EU methane emissions 2003. They have decreased around 59 % since 1990 along with reduction in coalmining and establishment of methane capture programs. Reporting from some new member states still seems somewhat lacking.

Germany reported ambitious coal mine methane capture programs from both closed and operating mines with total avoided emissions of 6,5 Mt CO_2e of an estimated total potential emission of 13,5 Mt CO_2e. But economic incentives are reported as too low to make full use of the economic potential for methane recovery and use.

Poland, which is by far the largest coal producer in the EU, has less capture and utililisation, but a number of pilot projects have proven the potential.

2. Regulation

There are no EU regulations on methane emissions from coal mining, and few national regulations are reported in national greenhouse gas inventories. Most countries have mining safety regulations requiring methane to be withdrawn from mines in order to avoid explosions, but few countries report regulations on how the methane released is to be used. A significant share of coal mine methane is extracted in very low concentrations to avoid explosion risks – too low to be used for energy purposes or even flared. But another significant share is extracted before mining of coal faces and in concentrations that can be utilised for energy purposes. In Poland large shares of this methane is still vented into the atmosphere, whereas Germany through economic incentives for electricity production based on coal mine methane has reduced emissions to the atmosphere by about 50%.

But even in Germany economic incentives pr. t CO_2e of avoided emissions are less than 20% of the present market price of CO_2 in the European emissions trading scheme, and the full economic capture potential is not being exploited. German authorities demand proof that methane capture projects are not viable with existing subsidies, if JI-projects are to be allowed. In Poland there are no special economic incentives for methane recovery and use, and high capture levels does not seem viable on a purely commercial basis. JI-projects are being considered as a possible financing source, but JI-procedures are complex and cumbersome.

Command and control regulation could be one way to bring down emissions. But often the abandoned mines do not have owners, and for operating mines a loss making mining industry would try to avoid yet more costs. Furthermore, compliance control would be quite costly, as it is very costly to measure total emissions from coal-mines.

Inclusion in the EU emissions trading scheme (ETS) could be a less complex way to incentivise cost-effective methane capture and use from coal-mines. This could be done in various ways: (i) individual Member States could opt-in individual coal mines as of 2008, (ii) the coverage of the ETS could be extended to coalmines across the EU (would be possible as of 2013 and require and amendment of the ETS Directive) or (iii) methane capture and use could be included in the ETS via an offset facility (again as of 2013 based on an amendment o the ETS Directive). In the present ETS free allowances are distributed to installations according to an allocation plan – normally as a share of historic emissions. But such an approach would require very costly monitoring of total emissions from coalmines ,In the offset mechanism reduction credits (similar to JI and CDM) could be issued in relation to methane/CO_{2e} captured. In essence, coal mines will get free allowances for methane captured and burned – giving clear incentives to optimise capture and use.

If inclusion in the ETS is not feasible, national governments could be encouraged to ensure subsidy levels for coalmine methane capture at levels ensuring exploitation of the full economic potential.

Methane from oil and gas production, distribution and use

1. Emissions trends

Total methane emissions from oil and gas production and distribution in the EU 25 have decreased from 38.5 to 32 Mt CO2e per year from 1990 till 2003, or by 17 %. About 90% of the emissions are from transmission and distribution of natural gas. Methane emissions from transmission and distribution of natural gas have gone down about 16 % in EU-15 since 1990 in spite of increased amounts of gas being sold. Specific emission factors pr. m^3 of gas transported have gone down by 29-50 % in large EU15 countries since 1990, but this has partly been neutralised by increased use of gas. Emissions estimates are, however, uncertain – not least for natural gas distribution. Comprehensive monitoring of the very large networks would be very expensive, and estimates are based on a combination of measurement methods.

Leakages of methane from natural gas transport mainly take places in the distribution system. In France losses in high-pressure transmission lines is estimated at 0.03 % of amounts transported, whereas it is 0.4 % of natural gas transported in low-pressure distribution lines. Grey cast iron networks built originally for town-gas is a major source of emissions, but these networks are gradually being phased out – in France the last few meters are being replaced in 2006 though mainly due to security concerns.

Oil and gas production emits around 2.35 Mt CO2e in 2003 – having decreased by about half since 1990. They are dispersed over a number of operations, and marginal costs of remaining reduction potentials are high according to industry sources.

Methane emissions from natural gas use in energy industries have risen from 1.7 Mt CO2e in 1990 to 2.4 Mt CO2e 2003. A significant share of this comes from un-burnt methane in lean-burn gas-motors – often used in small-scale CHP-installations due to their favourable energy efficiency and low NOx-emissions. Methane emissions measured from Danish gas-motors average 3,6 % of total gas-consumption in these motors. The global warming impact of these methane emissions almost neutralises the benefit of producing electricity and heat together as compared to separate production. Catalysts are available but fairly expensive, but some motor types have emissions much lower than the average. With the new CHP directive entering into force the number of such gas-motors and related methane emissions could increase significantly over the next few years.

2. Regulation: There is no EU regulation on methane emissions from oil and gas production, transmission, distribution or use.

As for oil and gas-production Norway has put in place a major VOC-reduction program in off-shore oil production in order to fulfil obligations under the Gothenburg Protocol. Methane is captured as a by-benefit of the VOC-programme in about half of the systems applied. Netherland has a covenant with the oil and gas-producers to reduce methane emissions. Similar programs could be considered on an EU basis, but only after careful analysis of abatement costs have been made.

As for natural gas transmission and distribution few national measures are reported in member state inventory reports. One member state reports a voluntary agreement with gas-distributors, and others reportedly have the same without having reported on it in national inventories. Distributors of natural gas in some countries have undertaken reduction programmes targeting the remaining grey-cast-iron network and other major emissions sources. The natural gas industry has also developed a new method for estimation of methane leakages. As emissions are widely spread and hard to measure, command and control regimes would be costly to monitor. A voluntary agreement with the natural gas industry with set deadlines for phasing out of the largest and most cost-effective emissions sources may be considered.

As for methane emissions from gas-motors reportedly only one country - Denmark - has a regulation limiting methane emissions from gas-motors to 3,6 % of total gas-consumption. A similar EU- regulation but with a lower limit could be considered, as new motors with lower emissions are available.

Other methane emissions

1. Emission trends

Other methane emissions comprise emissions from wastewater, biomass combustion, fossil fuel combustion and open burning of agricultural waste. Total annual emissions are estimated at 27 Mt CO2e in 2003, down from 35 Mt in 1990, but numbers are uncertain, as quite primitive models have been used to calculate emissions. Around half of the emissions are from wastewater (declining with increasing wastewater treatment). Around 1/3 of emissions are from burning of biomass (slightly increasing with increased biomass use for energy), while fossil fuel combustion is around 1/5 (decreased substantially as DDR was reunited with Germany). Technical abatement potential is around 35% in 2010, but costs vary widely.

2. Regulation

Emissions from wastewater are covered indirectly by the EU Water Framework Directive driving further reductions, especially in new member states. In some countries national regulations cover methane emissions from burning of agricultural waste and biomass.

Fluorinated gases

1. Emission trends

Fluorinated gases comprise HFCs, PFCs and SF_6. Total annual emissions were 55 Mt CO2e in 1990 and 68 Mt in 2003. Emissions of HFCs are going up, whereas those of PFCs have declined by almost 2/3 and of SF_6 have declined slightly. Under BAU emissions are estimated to be 98 MT CO2e in 2010.

2. Regulation

The legislative package on F-gases has just been finally adopted by the European Parliament (6 April 2006) and the Council (7 April). The package has two elements: A regulation for containment, recovery, use bans and prohibitions and a directive on the phase-out of HFCs in air conditioning systems in motor vehicles with a Global Warming Potential of more than 150. Member states have the possibility to maintain existing national measures in force before 31 December 2005. A review will be undertaken four years after application. The expected emission reductions by 2012 are 21 Mt CO2eq compared to a business-as-usual scenario and 40-50 Mt CO2eq by 2020.