UNITED
NATIONS

UNFCCC Framework Convention on Climate Change

Distr.
GENERAL

FCCC/ARR/2006/NOR
11 October 2007

ENGLISH ONLY

Report of the individual review of the greenhouse gas inventory of the Kingdom of Norway submitted in 2006*

* In the symbol for this document, 2006 refers to the year in which the inventory was submitted, and not to the year of publication.

CONTENTS

Annex

I. Overview

A. Introduction

1. This report covers the in-country review of the 2006 greenhouse gas (GHG) inventory submission of the Kingdom of Norway, coordinated by the United Nations Framework Convention on Climate Change (UNFCCC) secretariat, in accordance with decision 19/CP.8. The review took place from 23 to 28 April 2007 in Oslo, Norway, and was conducted by the following team of nominated experts from the roster of experts: generalist – Mr. Bernd Gugele (European Community); energy – Mr. Dario Gomez (Argentina); industrial processes – Mr. Jos Olivier (the Netherlands); agriculture – Mr. Ayite-Lo Ajavon (Togo); land use, land-use change and forestry (LULUCF) – Mr. Risto Sievänen (Finland); waste – Mr. Sabin Guendehou (Benin). Mr. Bernd Gugele and Mr. Sabin Guendehou were the lead reviewers. The review was coordinated by Ms. Ruta Bubniene and Ms. Astrid Olsson (UNFCCC secretariat).

2. In accordance with the "Guidelines for the technical review of greenhouse gas inventories from Parties included in Annex I to the Convention", a draft version of this report was communicated to the Government of Norway, for comments prior to its publication.

B. Inventory submission and other sources of information

3. In its 2006 submission, Norway submitted a complete set of common reporting format (CRF) tables for the years 1990–2004 and a national inventory report (NIR). Where needed, the expert review team (ERT) also used previous years' submissions, additional information provided during the review and other information. The full list of materials used during the review is provided in the annex to this report.

C. Emission profiles and trends

4. In 2004, the most important GHG in Norway was carbon dioxide (CO_2), contributing 80.3 per cent to total[1] national GHG emissions expressed in CO_2 equivalent, followed by methane (CH_4), 8.6 per cent, and nitrous oxide (N_2O), 8.3 per cent. Hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6) taken together contributed 2.8 per cent of the overall GHG emissions in the country. The energy sector accounted for 70.1 per cent of total GHG emissions, followed by industrial processes (18.9 per cent), agriculture (7.9 per cent) and waste (2.9 per cent). Total GHG emissions amounted to 54,835.46 Gg CO_2 equivalent and had increased by 10.5 per cent from the base year (1990) to 2004.

5. Tables 1 and 2 show the greenhouse gas emissions by gas and by sector, respectively.

[1] In this report, the term total emissions refers to the aggregated national GHG emissions expressed in terms of CO_2 equivalent excluding LULUCF, unless otherwise specified.

Table 1. Greenhouse gas emissions by gas, 1990–2004

GHG emissions	Gg CO_2 equivalent								Change BY–2004 (%)
	Base year Convention[a]	1990	1995	2000	2001	2002	2003	2004[a]	
CO_2 (with LULUCF)	35 051.02	35 051.02	36 071.17	28 242.42	27 615.36	27 224.21	28 347.03	28 527.96	–18.61
CO_2 (without LULUCF)	49 619.17	49 619.17	49 895.28	53 499.78	54 730.06	53 469.45	54 331.88	54 835.46	10.51
CH_4	4 638.87	4 638.87	5 085.69	4 956.56	4 960.36	4 796.18	4 840.36	4 732.72	2.02
N_2O	4 676.01	4 676.01	4 410.42	4 537.18	4 441.22	4 622.75	4 450.83	4 545.64	–2.79
HFCs	0.03	0.03	25.43	239.20	305.41	355.55	378.36	400.41	1 334 600
PFCs	3 370.40	3 370.40	2 007.72	1 318.56	1 329.29	1 438.26	909.77	880.60	–73.87
SF_6	2 199.78	2 199.78	607.79	934.42	791.20	238.30	234.86	275.68	–87.47

Note: BY = Base year; LULUCF = Land use, land-use change and forestry.

[a] Norway submitted revised estimates for the base year and 2004 in the course of the initial review on 8 June 2007. These estimates differ from Norway's GHG inventory submitted in 2006.

Table 2. Greenhouse gas emissions by sector, 1990–2004

Sectors	Gg CO_2 equivalent								Change BY–2004 (%)
	Base year Convention[a]	1990	1995	2000	2001	2002	2003	2004[a]	
Energy	29 496.27	29 496.27	32 184.97	35 523.07	37 439.26	37 052.67	38 505.24	38 425.06	30.27
Industrial processes	13 661.24	13 661.24	11 044.31	11 525.72	11 069.63	10 332.74	9 674.88	10 355.61	–24.20
Solvent and other product use	180.02	180.02	174.16	166.86	166.86	166.92	167.51	168.00	–6.68
Agriculture	4 444.57	4 444.57	4 534.74	4 489.32	4 364.87	4 292.20	4 358.69	4 311.11	–3.00
LULUCF	–14 568.15	–14 568.15	–13 824.10	–25 257.36	–27 114.70	–26 245.23	–25 984.85	–26 307.50	80.58
Waste	1 837.06	1 837.06	1 957.09	1 794.81	1 689.44	1 624.91	1 625.56	1 575.68	–14.23
Other	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total (with LULUCF)	35 051.02	35 051.02	36 071.17	28 242.42	27 615.36	27 224.21	28 347.03	28 527.96	–18.61
Total (without LULUCF)	49 619.17	49 619.17	49 895.28	53 499.78	54 730.06	53 469.45	54 331.88	54 835.46	10.51

Note: BY= Base year; LULUCF = Land use, land-use change and forestry; NA = Not applicable.

[a] Norway submitted revised estimates for the base year and 2004 in the course of the initial review on 8 June 2007. These estimates differ from Norway's GHG inventory submitted in 2006.

D. Key categories

6. Norway has used a key category tier 2 analysis, both level and trend assessment, and also applied a qualitative approach in determining its key categories as part of its 2006 inventory submission. Norway also reports a tier 1 analysis identifying nine key categories, of which two are considered as key categories under the qualitative approach – cement production (CO_2) and ammonia production (CO_2). Norway has also included the LULUCF sector in its key category analysis. However, no overview table listing all key categories identified in the key category analysis including LULUCF is provided in the NIR; only the LULUCF key categories are reported in a table. The results of the key category analysis are a driving factor for the preparation of the inventory, particularly in the prioritization of resources and the level of methodology (tier) to be applied. Most of the key categories are estimated using a higher-tier method.

7. The key category analyses performed by the Party and the secretariat[2] produced some different results, which are due partly to the use of different levels of aggregation and partly to different approaches (the secretariat used tier 1, while Norway used tier 2). A small inconsistency between the key category analysis and the CRF tables was found for gaseous fuels in manufacturing industries and construction (1.A.2); in the key category analysis coke oven gas and refinery gas were allocated to gaseous fuels whereas in the CRF tables these gases are allocated to solid and liquid fuels, respectively. In addition to the Party, the secretariat identified CO_2 from iron and steel production as a key category (level and trend) in 2004. For transparency, the ERT recommends Norway to provide complete overview tables for both key category analyses (excluding and including LULUCF) and to use consistent fuel definitions in the key category analysis and in the CRF tables.

E. Main findings

8. Norway has the legal, institutional and procedural arrangements in place for the compilation of GHG inventories. Quality assurance/quality control (QA/QC) procedures are in place, although there is scope for improvement, in particular the final quality check of the NIR, the development and implementation of an inventory improvement plan and the setting up of independent peer reviews. The inventory is in general complete in terms of coverage of years, sectors and gases and is largely transparent, although some improvements are needed with regard to the use of the notation keys and explanations of the trends in emissions and implied emission factors (IEFs). Norway uses higher-tier methods to estimate almost all key categories. The main recommendations for improvements relate to QA/QC and transparency.

F. Cross-cutting topics

1. Completeness

9. The inventory is complete in terms of coverage of years, sectors and gases. Some minor categories have been missing in the original 2006 submission, e.g. in the industrial processes sector (CO_2 from the use of lubricants and waxes), in the LULUCF sector (land converted to forest land, carbon stock change in living biomass, carbon stock change in dead organic matter, carbon stock change in soils) and in the waste sector (N_2O emissions from waste-water handling). Estimates of CO_2 from the use of

[2] The secretariat identified, for each Party, those source categories that are key categories in terms of their absolute level of emissions, applying the tier 1 level assessment as described in the Intergovernmental Panel on Climate Change *Good Practice Guidance for Land Use, Land-use Change and Forestry*. Key categories according to the tier 1 trend assessment were also identified for those Parties that provided a full set of CRF tables for the base year or period. Where the Party performed a key category analysis, the key categories presented in this report follow the Party's analysis. However, they are presented at the level of aggregation corresponding to a tier 1 key category assessment conducted by the secretariat.

.

lubricants and waxes and of N_2O from waste-water handling were provided in the course of the review. The ERT recommends that Norway in its future inventory submissions estimate the emissions from those subcategories which are not yet estimated and make further efforts to reduce the number of blank cells in the CRF tables (e.g. in 1990, for the activity data (AD) of lime production, limestone and dolomite use, and plastic and metal production) in order to improve completeness.

2. Transparency

10. The notation keys are used almost throughout the CRF tables. However, they are not always used correctly (e.g. in LULUCF). In industrial processes, "not estimated" ("NE") is used to report SF_6 from manufacture and use of electrical equipment for the three years 1998–2000 although AD and IEFs are provided; and CO_2 from other production (2.D) is reported in the sectoral tables but reported as "NE" in CRF table 9. In the LULUCF sector the use of notation keys is sometimes incorrect, and the information in the CRF is inconsistent with that provided in the NIR. In some CRF tables the documentation boxes are not used (e.g. in LULUCF). The NIR provides much of the information needed to assess the inventory, but the quality of the sectoral chapters varies. Some inconsistencies were found between the NIR and the underlying documentation reports (e.g. in industrial processes). Some additional information could improve the transparency of the NIR, for example: (a) more explanations of inter-annual variations and trends of emissions (e.g. in energy, industrial processes); and (b) more information on important background data, and the use of figures and graphs in the NIR (e.g. in industrial processes). The ERT recommends that Norway: (a) be more consistent in its use of the notation keys and documentation boxes; (b) improve consistency between the NIR, the CRF tables and the underlying documentation; (c) improve the quality checks for the NIR, for example by facilitating review of the draft NIR by Statistics Norway (the SSB) and the Norwegian Forest and Landscape Institute and by improving the timetable for the compilation of the NIR (as part of the inventory development plan); and (d) consider preparing guidance for the compilers of the sectoral chapters in order to make them more consistent (e.g. by including explanations of the trends in emissions and IEFs, and including important background data, figures and graphs).

3. Recalculations and time-series consistency

11. The ERT noted that from the base year to 2003 emissions had been recalculated following the recommendations of the 2005 review and taking into account new information and methods available in Norway. The major changes include: N_2O from agricultural soils (1990, 2003), CH_4 from solid waste disposal sites (1990, 2003) and CO_2 from energy industries (1.A.1, 2003). The rationale for these recalculations is provided in the NIR and they have resulted in improvements to the inventory. The total effect of these recalculations is a 0.82 per cent decrease in estimated total national GHG emissions in 2003 and a 0.68 per cent decrease for 1990. During the review process, following recommendations from the ERT, Norway provided revised estimates in the industrial processes and waste sectors.

4. Uncertainties

12. A tier 2 uncertainty analysis has been performed both excluding and including LULUCF, and the results of this analysis are presented and discussed in the NIR. However, table 6.2 of the Intergovernmental Panel on Climate Change (IPCC) *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (hereinafter referred to as the IPCC good practice guidance) is not included in the NIR, which makes the uncertainty estimates less transparent. The ERT recommends that Norway include this table in the NIR of its future submissions. Norway reports in its NIR that in 2004 the total uncertainty has decreased to 6 per cent compared to the previous uncertainty analysis (excluding LULUCF). This is mainly due to revisions of the uncertainty estimates of N_2O emissions from soils, but also partly due to the use of improved methodologies. The uncertainty estimates for CO_2 have not changed, but the CH_4 uncertainty estimates have been reduced. Although Norway provided further information on the uncertainty estimates (comparison at detailed level), the

reason for this decline is not fully transparent. Moreover, compared with those of other Parties the CH_4 uncertainties seem to be rather low. The ERT recommends that Norway investigate this further and provide an explanation/discussion in its next inventory submission. The ERT also recommends that Norway improve the links between methodological improvements and the uncertainty estimates.

5. Verification and quality assurance/quality control approaches

13. Norway has elaborated a QA/QC plan in accordance with the IPCC good practice guidance. This includes general QC procedures (tier 1) as well as source/sink category-specific procedures (tier 2) for key categories and for those individual categories in which significant revisions to methodologies and/or data have occurred. QA/QC procedures are in place and QC reports are prepared at all three institutions involved in the inventory compilation (the SSB, the State Pollution Control Authority (SFT) and the Norwegian Forest and Landscape Institute). The ERT recommends that Norway further strengthen the QA/QC procedures at the three relevant institutions and elaborate the QC reports, for example, by including summary results of the checks performed and by including references to the underlying checklists.

14. The ERT noted that some review procedures are carried out by staff who have not been involved in the inventory preparation process (e.g. cross-checks between the institutions), which is in line with the IPCC good practice guidance. In 2007, an invitation for public review of the GHG inventory was placed on the Web. However, no further procedures for peer reviews are in place and no improvement plan is available yet, but this is planned for late 2007. The ERT recommends that Norway prepare an inventory improvement plan and encourages it to establish independent peer reviews. It recommends Norway to evaluate after every reporting cycle whether the quality objectives have been met and to use the conclusions from this evaluation to establish the priorities in the improvement plan. The ERT also recommends the Party to involve industrial associations and relevant research institutions in the inventory review process before the inventory is submitted.

6. Follow-up to previous reviews

15. Major improvements have been made to the inventory as a whole as a result of consideration of the recommendations of previous reviews. These include, for example, a thorough review of the point source data, the reporting of CO_2 emissions from ammonia production including CO_2 capture and export to other countries, the use of a higher-tier method for CH_4 from enteric fermentation, the updating of the N_2O emission factor (EF) for road transport, the elimination of double counting of N_2O emissions reported under agriculture and LULUCF, and the transparent reporting of CO_2 capture and storage.

16. The major issue still pending relates to the development of an inventory improvement plan. The large differences between the reference approach and the sectoral approach also need further exploration.

17. The implementation of category-specific QA/QC procedures was very limited in some sectors (e.g. in waste) in the previous (2005) submission. However, in the 2006 submission, QA/QC procedures have been applied not only for the input data but also for the emission estimates for all categories.

18. In the 2005 submission, no information was provided on how the uncertainty estimates for some categories (e.g. in the waste sector) were derived. In the 2006 submission, however, Norway has provided the uncertainties associated with the data used and the emission estimates based on a tier 2 analysis followed by a good explanation.

19. The Party has performed recalculations following recommendations from previous reviews. The recalculations have improved the inventory as a whole.

G. Areas for further improvement

1. Identified by the Party

20. The NIR identifies several areas for improvement. The further formalization of the institutional, legal and procedural arrangements in Norway will improve the reporting and archiving of the inventory information. Several improvements are planned for the LULUCF sector, for example: (a) definition of the area of forest and other wooded land at higher altitudes; (b) improvement of the forest inventory in Finnmark; (c) enhanced use of national aerial photography to supplement field surveys, focusing on regions with high levels of economic activity; and (d) the development of more reliable inventory methods targeted for use in areas for which only limited information is available. In addition, Norway indicates its intention to further improve the estimates of HFC and PFC emissions from products. However, Norway has not yet prepared an inventory improvement plan. In its response to the issues raised during the review, Norway indicated that it will: (a) prepare an inventory improvement plan by late 2007; (b) strengthen the QA/QC procedures; (c) improve the archiving systems; and (d) improve the timetable for inventory preparation.

2. Identified by the ERT

21. The ERT identified the following cross-cutting issues for improvement. The Party should:

(a) Prepare an inventory improvement plan and set up independent peer reviews. Norway may also wish to consider comparing its own data with the data from other Parties;

(b) Improve the working procedures internally in every institution in order to make it possible to meet the timelines for the preparation of the inventory;

(c) Strengthen the QA/QC procedures at the relevant institutions and elaborate the QC reports further;

(d) Improve the transparency and consistency of the CRF tables and the NIR by: (i) reducing the number of blank cells in the CRF tables; (ii) being more consistent in its use of the notation keys and documentation boxes; (iii) improving consistency between the NIR, the CRF tables and the underlying documentation reports; (iv) improving the quality checks of the NIR; (v) providing more explanations of the trends in emissions and IEFs, and more information on important background data; (vi) developing guidance for the drafting of the sectoral chapters of the NIR; and (vii) improving the links between methodological improvements and the uncertainty estimates.

22. Recommended improvements relating to specific source/sink categories are presented in the relevant sector sections of this report.

II. Energy

A. Sector overview

23. The energy sector is the largest contributor to Norway's GHG emissions. In 2004, emissions from the sector (38,425.06 Gg CO_2 equivalent) accounted for 70.1 per cent of total national emissions.

24. The NIR and the CRF tables contain emission estimates for all direct and indirect GHGs from practically all subcategories. Certain subcategories under fugitive emissions are reported as "included elsewhere" ("IE"). However, neither in the NIR nor in the CRF is it explained how the emissions from each of these subcategories are estimated and allocated. The absence of these estimates may not indicate gaps; however, the ERT recommends that Norway re-examine whether these estimates should be reported as "IE" or as "NE".

25. Overall, the methodological approach, the AD, the EFs and the energy contents used to estimate emissions for the energy sector are presented in the NIR in a transparent manner. Tier 2 methods and country-specific EFs are used for a large number of categories. With a few exceptions, AD are compiled by the SSB, which is also in charge of estimating the emissions of the energy sector, based on its own databases and plant-specific data compiled by the SFT. The NIR provides the annual energy balances for the period 1990–2004 and gives an overall description of the energy accounts and the energy sources balance sheets, although it does not give enough specific information about how they are used in inventory preparation. The ERT recommends that Norway enhance the transparency of its reporting by including in the NIR a description of the energy statistics and providing the specific information that is required for preparation of the inventory. In particular, this means replacing the energy balance sheets provided in annex IV to the NIR by the energy source balance sheets that contain disaggregated information for petroleum products; and including further information for those cases where the classifications in the AD that are used to estimate emissions and the energy statistics provided in the NIR differ.

26. The emission estimates have been recalculated for all years, mainly owing to updating of the AD and revision of the energy accounts. There are some inconsistencies between the information reported in CRF table 8(a)s1 of the 2005 submission and that reported in the 2006 submission. This is most probably associated with the automatic generation of table 8(a)s1. Using the data of the 2005 submission, the ERT estimated that for 2003 the recalculations result in a decrease of aggregated emissions of CO_2, CH_4 and N_2O, of 667.42 Gg CO_2 equivalent, mainly due to the change of the N_2O EF in road transportation. Norway has made efforts to ensure time-series consistency, particularly for the early years of the period 1990–2004, for which information is not available at the same level of disaggregation for some subcategories. In these cases, the approaches used for the recalculations are in line with the IPCC good practice guidance.

27. Specific QC checks include comparisons between plant-specific data from the SFT and estimates made by the SSB; comparisons of bottom-up and top-down fuel consumption in road transportation (annually) and navigation (a special assessment undertaken in 2001 for the 1993 and 1998 inventories); and independent methods to estimate the EFs for coal mining. In spite of these checks, small errors and inconsistencies were detected during the in-country visit. Examples include: the discrepancy between CO_2 emissions from gaseous fuels and AD in manufacturing industries and construction for 1992; missing AD under fugitive emissions (oil transport for the periods 1991–1998 and 2003–2004); non-accounting for the amount of CO_2 vented in the Sleipner West field during its first year of operation (1996); and inconsistencies with the information reported in the 2005 submission in CRF table 8(a)s1. The ERT recommends that Norway further strengthen the implementation of QC procedures.

B. Reference and sectoral approaches

1. Comparison of the reference approach with the sectoral approach and international statistics

28. In 2004, CO_2 emissions estimated by the reference approach are 11.3 per cent higher than those estimated by the sectoral approach. By type of fuel, the differences are 21.4 per cent for liquid fuels, –29.6 per cent for solid fuels and –2.6 per cent for gaseous fuels. However, the differences in energy consumption are larger, with 37.7 per cent for liquid fuels, 85.1 per cent for solid fuels and 0.4 per cent for gaseous fuels. Although explanations are not provided in the CRF, the NIR summarizes the inter-annual fluctuations in the differences between the two approaches in the period 1990–2004 and proposes possible causes. During the in-country visit, the Norwegian inventory team confirmed that for some years there have been comparatively large differences between the values of apparent consumption and use for oil and natural gas in the energy balance. These statistical differences may be caused by uncertainty of the data reported for production and exports. Although efforts are made to ensure complete coverage of the production of all oil and gas fields, some inconsistencies remain, which could be explained by difficulties with the split between different oil products and between crude oil,

condensate and natural gas liquids, and non-registered distribution losses for gas. There are plans to review the methods used for data revision and for processing the statistics of production and foreign trade statistics, and to assess possible ways to improve them. The ERT encourages Norway in its efforts to reconcile the methods used in estimating the AD for the two approaches.

29. Energy statistics are compiled at the SSB by the Department of Economic Statistics, which is also responsible for providing statistical information to the International Energy Agency (IEA) and is in charge, together with staff from the SFT, of the preparation of the inventory for the energy sector. During the in-country visit, Norway provided a thorough description of the principles, methodology, data sources and uncertainties associated with the energy balance. In addition, detailed information on the statistics of deliveries of petroleum products and of energy use in manufacturing industries and mining was provided to the ERT. The Norwegian inventory team confirmed to the ERT that the figures sent to the IEA are completely consistent with those used to estimate emissions in the national GHG inventory. The inventory team also explained that different data processing (using for example values for the energy content of fuels) and different aggregation approaches as between the IEA and Norway's inventory team may be the main underlying reasons for the discrepancies between the two data sets. The ERT commends Norway's plan to assess these discrepancies and suggests that Norway carry out a comparative evaluation between the data reported by the IEA and those originally sent by Norway to the IEA.

2. International bunker fuels

30. Jet kerosene consumption in international aviation is estimated as the difference between total sales and domestic consumption. Sales figures are used for the minor use of aviation gasoline. Sales figures for international transport from the SSB are used as the AD for marine gas oil, heavy distillates and heavy fuel oil use in international navigation.

3. Feedstocks and non-energy use of fuels

31. In the reference approach, the non-energy use of bitumen, lubricants, liquefied petroleum gas (LPG), coal, coke oven coke and petroleum coke is taken into account. The IPCC default values are used for the fraction of carbon stored in bitumen and the use of LPG as feedstock, a country-specific value is used for lubricants, and the amounts of carbon present in the coal, coke oven coke and petroleum coke that are used as reducing agents are directly subtracted. In the sectoral approach, this type of use is accounted for in the industrial processes sector in line with the IPCC good practice guidance.

4. Country-specific issues

32. The NIR provides a thorough description of CO_2 capture and storage at the Sleipner West field in section 3.5 and annex V. It includes not only the amount of CO_2 that is vented annually because the injection facilities were inaccessible for the period 1996–2005 but also the annual amounts of CO_2 injected. However, the ERT recommends Norway to improve the transparency of the inventory by providing a description of other potential emissions from the recovery process even if the emissions from these are negligible.

C. Key categories

1. Stationary combustion: liquid, gaseous, biomass, other fuels – CO_2, CH_4, N_2O

33. For energy industries, manufacturing industries and construction, plant-specific data are used to estimate GHG emissions, which can be considered as a methodological refinement according to the IPCC good practice guidance. Key concerns about the inclusion of this type of data are the statistical relationship between the AD of individual plants and the AD for a whole subcategory; the availability of plant-specific data for CO_2 but not for the other GHGs; time-series consistency; and recalculations back to 1990. These concerns are dealt with in an adequate manner in the NIR. The ERT commends Norway

on its effort to implement a system for assessing these estimates. However, there is room for improvement. The ERT recommends that Norway critically assess possible under-/overestimations that may lead to bias; exploit the information compiled and evaluate the possibility of updating EFs; and assess the consistency of the data from the GHG inventories, annual reporting from companies, and the emissions trading system. The Norwegian inventory team may also wish to consider preparing a background document on the use of plant-specific data in Norway's GHG inventories.

2. Stationary combustion: liquid, gaseous, other fuels – CO_2

34. Plant-specific CO_2 emission data for the largest plants have been used for the inventory over the last 10 years. A major revision of plant-specific CO_2 data was undertaken in 2005–2006. During the in-country visit, the Norwegian inventory team informed the ERT that these CO_2 emissions amounted to about 3,000 Gg in 1990, increasing to about 4,500 Gg in 2004. Around 70 per cent of these emissions are associated with the use of coke oven gas while the remaining 30 per cent are mainly associated with the use of coke, residual fuel oil and refinery gas. The SFT has performed checks of emissions against energy consumption; however, the SSB has not yet rechecked whether the same energy data have been used by both institutions. The SSB intends to include checks of reported emissions against energy consumption in its future work. There is also an ongoing process to improve the coordination of the fuel consumption data that the plants report to the SFT and the SSB. The ERT encourages Norway's efforts to reconcile the AD compiled from different information sources.

3. Stationary combustion: liquid fuels – CO_2

35. The IEFs for CO_2 from petroleum refining (35.6–44.7 t/TJ) are the lowest of reporting Parties (the range is 34.3–87.1 t/TJ) and lower than the IPCC default range (63.1–100.8 t/TJ). During the in-country visit, the Norwegian inventory team explained that these low IEFs may be associated with an erroneous allocation of reported emissions from one refinery to carbon monoxide (CO). The ERT recommends Norway to review this issue and, if necessary, reallocate the emissions. In the course of the review, Norway informed the ERT that this has been corrected.

4. Fugitive emissions: oil and natural gas – CO_2, CH_4

36. Emissions from the subcategory oil exploration (1.B.2.a.i) are reported as "IE" and the CRF states that these emissions are included under flaring (1.B.2.c). Emissions from the subcategory oil production (1.B.2.a.ii) are reported as "IE" and the CRF states that these emissions are included under refining/storage (1.B.2.iv). Emissions associated with natural gas from the subcategories exploration (1.B.2.b.i), production/processing (1.B.2.b.ii), transmission (1.B.2.b.iii) and distribution (1.B.2.b.iv) are reported as "IE" and the CRF states that all these emissions are included under other leakage at industrial plants and power stations (1.B.2.v.i). However, the NIR does not explain how the estimates for each of these subcategories are derived and included under the corresponding subcategories. The ERT recommends that Norway clarify whether these emissions are included elsewhere or are actually not estimated. It also recommends Norway to include in its next inventory submission a list of the main activities carried out in the two existing gas terminals of Norway for which the associated GHG emissions have been accounted for in the inventory.

III. Industrial processes and solvent and other product use

A. Sector overview

37. In 2004, the industrial processes sector accounted for 18.9 per cent of total national GHG emissions – one of the highest shares among the Parties. From 1990 to 2004, emissions from the sector fell by 24.2 per cent, mainly due to decreases in PFC emissions from aluminium production (by 73.9 per cent), CO_2 from carbide production (74.6 per cent) and N_2O from nitric acid production (10.5 per cent). CO_2 emissions from aluminium production and HFC emissions from refrigeration have

increased significantly since 1990. Both actual and potential emissions for individual fluorinated gases are reported. The (minor) CO_2 emissions from solvent and other product use decreased by 12.2 per cent between 1990 and 2004.

38. Norway has improved the time-series consistency of this sector as a result of a thorough analysis of the methods and plant-specific data used in the sector, for which the Party is commended. The ERT recommends that Norway provide a full description of the methodologies and the rationale for the data used for all "other" subcategories as well as for new categories.

39. Norway has made significant improvements in the documentation in the NIR of this sector compared to the 2005 submission. However, the transparency and comparability of the emissions reported, which are mostly based on higher tier methods using plant-specific data reported by individual companies, could still be improved, as previous review reports have noted. The transparency of the methods used is in general insufficient, and explanations of significant trend fluctuations (e.g. in emissions of CO_2 from cement and from food and drink and of SF_6 used in aluminium and magnesium foundries, CO_2 from pig iron production and SF_6 from other sources, which Norway explained during the review) are lacking. The explanation of fluctuations of the IEFs (e.g. of CO_2 from cement production, of CO_2 and PFCs from aluminium production and of N_2O from nitric acid production) is also not sufficient for the ERT to be able to assess the consistency of time series. The time series of the subcategory metal production – other shows significant changes over time (e.g. a 21 per cent increase in 1991, and a 66 per cent decrease in 2002) which are not explained in the NIR. As noted in previous review reports, the ERT recommends that in its next inventory submission Norway provide: (a) information on the time series of shares in total production of plants or shares of production technologies with distinctly different EFs (e.g. aluminium, nitric acid); (b) information on the time series of amounts of CO_2 or CO captured/sold and the use of biocarbon; and/or (c) information on the trend in gross IEFs (e.g. ammonia production, ferroalloy production), where applicable and where required to assess the emission trends.

40. The QA/QC system for plant-specific data is focused on trends in emissions and production data. The ERT recommends that Norway add an analysis of the values and trends in the EFs and IEFs used in the CRF tables. In addition, it recommends Norway to document the category-specific QC performed for key categories by plants as described in the IPCC good practice guidance.

41. Norway used higher-tier methods for all key categories and often for non-key categories as well. This is commended by the ERT. The ERT concluded that the methodologies and plant-specific data used for all key categories are in line with the IPCC good practice guidance. The comparability of the IEFs is sometimes hindered by missing AD (e.g. for lime production, limestone and dolomite use, ammonia production (in 1990), metal production other (2.C.5), food and drink production (2.D.2)), some of which are included in the 2007 submission. The notation keys (e.g. for methanol production (2.B.5), consumption of halocarbons and SF_6 in electrical equipment and other consumption of halocarbons and SF_6) are sometimes used incorrectly, and some IEFs (e.g. for HFC-134a in 2000, 2003 and 2004) are missing. The ERT recommends that Norway enhance the completeness of the reporting in its future inventory submissions.

42. In addition, the ERT recommends that Norway report CO_2 emissions from limestone use in magnesium production under limestone use (instead of under the category other – metal production) and report CO_2 emissions from flaring of natural gas under methanol production (2.B.5) instead of under waste incineration (6.C), as recommended in the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the Revised 1996 IPCC Guidelines). This was also noted in the waste section, paragraph 87.

B. Key categories

1. Ammonia production – CO_2

43. The ERT recommends Norway to include in the NIR the time series of gross CO_2 emissions to make it possible to review the actual IEF values and their trends and compare them with those of other Parties. In addition, as in previous reviews, the ERT recommends Norway to clarify in the NIR and the relevant documentation box of the CRF tables what amount of CO_2 emissions per year is captured and sold or reported elsewhere in the inventory and in which subcategory this amount is reported.

2. Nitric acid production – N_2O

44. At some nitric acid production facilities, N_2O emissions are determined by monthly measurements. The ERT recommends Norway to perform additional QC on the accuracy of the annual emission estimates achieved by using monthly measurements and to provide an explanation of the level and trend of the IEF in the NIR of its next submission.

3. Carbide production – CO_2

45. Norway has changed its method for calculating CO_2 emissions from silicon carbide production from the mass balance method described in the Revised IPCC 1996 Guidelines (using input of reducing agents) to a tier 1 method (an EF-based method using crude silicon carbide production as AD), although data on input of reducing agents are available. The two methods provide very similar results, except for 1990. Norway explained that the relatively large difference in 1990 between the results derived using the two methods is caused by a higher uncertainty in the carbon consumption data in the early 1990s due to the use of purchase data as a proxy for carbon consumption instead of the more accurate silicon carbide production data. The ERT therefore concluded that the use of the current method is justified and recommends that in its next inventory submission Norway provide a better explanation of why the EF-based method is used instead of the mass balance method.

4. Aluminium production – PFCs

46. The decreasing trend in the IEF of tetrafluoromethane (CF4) from aluminium production – by 82.8 per cent between 1990 and 2004 – is not explained in the NIR. During the in-country review, data provided by Norway showed that the largest annual IEF changes can be explained by the changing shares of different production technologies, as well as further process optimization that reduces the anode effect minutes. The ERT recommends that Norway include this information in its next inventory submission.

5. Consumption of halocarbons and SF_6 – HFCs

47. The IEFs of HFCs from leakage ("product life factor") from refrigeration and air conditioning equipment (subcategories commercial refrigeration, industrial refrigeration and refrigerated transport) are lower than the IPCC default ranges, and the IEF for mobile air conditioning is also lower than that of several other comparable Parties. The ERT recommends that Norway reassess the present country-specific values and provide in the NIR more justification of the leakage rates used. It also recommends that Norway clarify in the NIR which leakage rates are used per application and identify which of them are country-specific values.

C. Non-key categories

1. Mineral products – CO_2

48. Norway does not report CO_2 emissions from the several glass production companies in the country as these production facilities do not use dolomite or limestone, because they do not produce new glass (only re-melting or production of fibreglass). The ERT recommends that Norway describe this in the NIR of its next inventory submission.

2. Ferroalloys production – CH_4, N_2O

49. Norway reports N_2O emissions from ferroalloys production, a source that is not described in the Revised 1996 IPCC Guidelines. The N_2O emissions for 1990 were 20.8 per cent higher than in 1991, and the determination of the EF and the rationale for its application are not described in the NIR. During the course of the review, Norway provided revised estimates for both N_2O and CH_4 emissions for this category, which resulted in a reduction of about 90 per cent in the estimates. The revision of these estimates led to a reduction of estimated N_2O and CH_4 emissions from metal production in the base year (1990) by 1.5 per cent (96.11 Gg CO_2 equivalent) compared to the 2006 inventory submission. In addition, some documentation on the presence of N_2O and CH_4 emissions, and revised EFs which differ by type of metal produced and process type, were provided. Although Norway could not fully explain how these EFs were determined, the ERT concluded that the EFs used are largely representative. They represent the longer-term average N_2O and CH_4 concentration measurements outside the concentration peaks (which sometimes occur due to avalanches – a sudden fall of a large amount of colder material into the charge of the furnace), and thus the EFs can be regarded as conservative and acceptable. This is acceptable in particular for the early 1990s, when more avalanches occurred. However, the ERT recommends that Norway enhance the transparency of the inventory by explaining in its next inventory submission how the EFs were determined. In addition, transparency could be further improved by reassessing the EFs used, taking into account the impact of the peaks on the EF value. As suggested in the previous reviews, the ERT recommends Norway to clarify where in the energy sector the CO_2 emissions from combustion of CO are reported.

3. Lubricants and paraffin wax use – CO_2

50. In its 2006 inventory submission, Norway has not estimated CO_2 emissions from the use of lubricants and paraffin wax production. However, during the course of the review, following the recommendation of the ERT, Norway provided these estimates for the base year (9.02 Gg CO_2 equivalent) and for 2004 (33.81 Gg CO_2 equivalent). The ERT concluded that the method used to estimate CO_2 from paraffin wax use from the production, import and export of candles ensures that paraffin wax in imported candles (which are not part of the energy statistics) are included in the AD and that the method used by Norway complies with the IPCC good practice guidance. Since this is a rather small source, the ERT also considers the use of a fixed country-specific fraction of all candles made of paraffin wax as a good practice.

51. CO_2 from lubricant use is estimated only for the use of lubricant in two-stroke engines, resulting in 100 per cent CO_2 emissions. The ERT concluded that other uses of lubricants (e.g. as grease) are apparently neglected or are assumed not to result in CO_2 emissions (i.e. oxidation factor = 0). No CO_2 emissions from other uses of lubricants are estimated. The ERT concluded that the assumption that no emissions occur from other lubricant uses ensures that the emissions from lubricant use are not overestimated. The ERT recommends that Norway revise the table (1.A(d)) on feedstocks and non-energy use of fuels accordingly and include the non-energy use of paraffin waxes explicitly in its next inventory submission.

4. Solvent and other product use – CO_2

52. The ERT observed inconsistencies in the time series for CO_2 from degreasing and dry cleaning (3.B) and from chemical production manufacture and processing (3.C) for the two years 1992–1993. During the review Norway explained this as being caused by allocation issues due to a change in economic classifications. The ERT recommends Norway to improve the allocations and to explain in its next inventory submission why these subcategories show such inconsistencies in trend. In addition, the ERT observed that CO_2 from the category other non-methane volatile organic compounds (NMVOCs) (3.D.5) has been kept constant since 2000, which Norway explained as being due to a lack of recent monitoring data. The ERT encourages Norway to update this category, which the Party intends to do in

the 2008 submission, and recommends it to explain in the NIR why this subcategory shows constant emissions since 2000 and how the carbon fraction in NMVOC was determined.

IV. Agriculture

A. Sector overview

53. In its 2006 submission, Norway has submitted a complete set of CRF tables for the agriculture sector for the years 1990–2004. In 2004, total sectoral emissions amounted to 4,311.11 Gg CO_2 equivalent, or 7.9 per cent of national total emissions. They had decreased by 3.0 per cent compared to 1990 and by 1.1 per cent compared to 2003. The largest contributors in the sector are CH_4 from enteric fermentation (44.0 per cent) and N_2O from agricultural soils (45.8 per cent). Emissions from manure management totalled 432.14 Gg CO_2 equivalent, corresponding to 10.0 per cent of sectoral emissions and 0.8 per cent of total national emissions.

54. The ERT noted differences between the AD used for sheep and swine in the Norwegian inventory and the equivalent data of the Food and Agriculture Organization of the United Nations (FAO). These differences are explained and justified in the NIR.

55. The inventory report includes information on key categories, methods, data sources, EFs used, uncertainty estimates and QA/QC procedures, and contains most of the relevant information needed for replication of the inventory. Recalculations have been carried out for the whole time series due to revision of the statistics of animal populations, changes in the ammonia (NH_3) model, and improvements to the AD. The ERT recommends that Norway continue its efforts to provide more details on the methods and models used in the estimates; specifically, it should provide more information on the country-specific methods and models used.

B. Key categories

1. Enteric fermentation – CH_4

56. In 2004, enteric fermentation contributed 1,895.95 Gg CO_2 equivalent or 3.5 per cent of total national GHG emissions. It accounted for 85.7 per cent of the overall CH_4 emissions from agriculture. These missions have been fairly stable, with minor fluctuations. They decreased by 2.6 per cent over the period 1990–2004. Norway has changed the methodology it uses for estimating CH_4 from cattle and sheep to tier 2 in the 2006 submission in response to the recommendations of previous reviews. The CH_4 emission estimates for the other livestock categories are based on tier 1 methods. This is in line with the IPCC good practice guidance.

57. As indicated in previous reviews, Norway should provide more information in the NIR regarding the estimation parameters and the estimation of uncertainties. The ERT noted that the NIR states that new revised figures for the population of different animals have been used for the whole period 1990–2002 and that no recalculations have been carried out since last year, but considers that this cannot be correct as Norway has moved to a tier 2 method for cattle and sheep, and thus recalculations have occurred. The ERT recommends Norway to reflect recalculations correctly in its future NIRs.

2. Agricultural soils – N_2O

58. In 2004, N_2O emissions from agricultural soils amounted to 1,975.88 Gg CO_2 equivalent. They accounted for 3.6 per cent of total national emissions and had decreased by 3.0 per cent over the period 1990–2004.

59. Following the recommendation of the previous review report, Norway has presented clear information on the country-specific value for nitrogen (N) lost due to leaching and surface run-off (FracLEACH) in the NIR. The ERT commends Norway's efforts.

3. Manure management – CH_4, N_2O

60. In 2004, CH_4 emissions due to manure management amounted to 310.13 Gg CO_2 equivalent. N_2O emissions due to manure management amounted to 122.01 Gg CO_2 equivalent. Norway uses a tier 2 methodology for estimating CH_4 emissions and tier 1 with country-specific values for N excretion and for the fraction of total excretion per species for each management system. This is in line with the IPCC good practice guidance.

61. As indicated in previous reviews, more information could be given in order to improve transparency and to explain differences between country-specific parameters and the IPCC default parameters, especially regarding the NH_3 model.

V. Land use, land-use change and forestry

A. Sector overview

62. Norway has followed the IPCC *Good Practice Guidance for Land Use, Land-use Change and Forestry* (hereinafter referred to as the IPCC good practice guidance for LULUCF). The same methodologies are used for all years. In 2004, the LULUCF sector was a net sink (of 26,307.50 Gg CO_2 equivalent) and offset 47.9 per cent of total national emissions. The change in carbon stocks in living biomass in forests is a sink and dominates this sector; other categories are sources of emissions. According to the uncertainty analysis provided in the NIR, the change in carbon stocks in living biomass is considered to have a relatively high accuracy compared to other categories.

63. Net CO_2 removals by the sector increased by 80.6 per cent from 1990 (14,568.15 Gg CO_2 equivalent) to 2004 (26,307.50 Gg CO_2 equivalent). The main factor in this change was an increase in carbon stocks in living biomass in forest land – by 94.1 per cent. This included a 52.1 per cent increase in carbon stocks in living biomass between 1997 and 1998 and a 28.5 per cent increase between 1999 and 2000. Cropland also contributed to this change: its emissions decreased by 71.6 per cent, from 479.33 Gg CO_2 equivalent in 1990 to 136.57 Gg CO_2 equivalent in 2004. These changes, as explained by Norway, are due to the incorporation of new and improved data and information from the updated National Forest Inventory (NFI). To address the data gap, Norway has used interpolation between the years for which forest inventory data sets were available.

64. The ERT noted some inconsistencies between the NIR and the CRF tables. For example, for the category land converted to forest land, only the land area is reported in the CRF tables, while the NIR indicates that the change in carbon stocks has been calculated. The ERT recommends Norway to improve the consistency of the information given in the NIR and that in the CRF tables. Furthermore, the documentation boxes of the CRF tables which should be used to explain the content of the CRF tables are mostly empty, and this affects the transparency of the reporting. For example, Norway reports land areas for cropland converted to settlements, wetlands converted to settlements, and other land converted to settlements, while the associated changes in carbon stocks are reported as "not occurring" ("NO"). The ERT recommends that Norway fill in the documentation boxes correctly and use the notation keys in the CRF tables consistently in its next inventory submission.

65. The implementation of the category-specific QA/QC procedures is still partly under way. The ERT recommends that Norway allocate adequate resources to carrying out category-specific QA/QC and pay careful attention to consistent reporting and completeness in this sector.

B. Key categories

1. Forest land remaining forest land – CO_2

66. Norway has applied an updated country-specific method, which is tier 3, to estimate the changes in carbon stocks in living biomass, dead organic matter and soil organic matter. This is in line with the

IPCC good practice guidance for LULUCF. Living biomass is the most significant subcategory in forest land remaining forest land, and the change in the carbon stock in this pool is responsible for the increase in the trend of net removals in the LULUCF sector. The rapid increase in the carbon stock in living biomass has been explained by the incorporation of the results of the updated NFI, which provided new AD and parameters. According to the Norwegian forest statistics, net increment of tree volume increases steadily and is the main driver behind the change in living biomass. The ERT encourages Norway to find ways of reconciling the difference between the trends in the driver and in the change in biomass stock.

67. In its 2006 submission Norway has applied improved biomass functions to calculate living biomass. The ERT appreciated the effort made by Norway to recalculate the whole time series, taking into account the new information in order to fulfil the requirements of the IPCC good practice guidance for LULUCF. Recalculations are reported not only for living biomass but also for dead organic matter and soil organic carbon. The recalculations have resulted in the increase in net removals compared to the previous inventory submission.

68. Drained organic soil is also a significant subcategory and Norway has estimated the resulting emissions of CO_2 using national AD and the IPCC default EF. The ERT encourages Norway to develop a country-specific EF to be used in future submissions or to demonstrate that the default EF corresponds to its national circumstances.

2. Grassland remaining grassland – CO_2

69. The change in carbon stock in organic soils is identified as a significant subcategory and is the only subcategory that has been estimated. A country-specific EF and constant area for the whole time series have been used. The ERT recommends Norway to further clarify in its next submission why the land area of organic soils has remained constant. The Party should also consider carbon stock change in living biomass. The ERT commends the intention of Norway to consider the uptake of carbon by abandoned organic soils in its future GHG inventory submissions.

3. Cropland remaining cropland – CO_2

70. CO_2 emissions from cropland remaining cropland decreased from 188.6 Gg CO_2 in 1990 to 42.9 Gg CO_2 in 2004. The main cause of this decrease was the changed tillage practice. Carbon stock change in histosols is the most significant subcategory and Norway has used the tier 2 method to estimate these CO_2 emissions, which is in line with the IPCC good practice guidance for LULUCF.

71. The whole time series has been recalculated due to changes in methods and the updating of parameters and data. Norway explained to the ERT during the review that the subcategory horticulture has been reported in the CRF tables by mistake and that there should be no net change. The ERT recommends Norway to correct this in its next inventory submission.

C. Non-key categories

Forest land converted to settlements – CO_2

72. From the NIR, the ERT identified that Norway has reported only emissions from conversion of forest. Emissions from this conversion are calculated using forest inventory data and country-specific parameters. Emissions in 1990 (221.1 Gg CO_2 equivalent) were the lowest in the period 1990–2000 and 26.8 per cent higher than emissions in 2004. The annual emissions fluctuate between 174.4 Gg CO_2 equivalent in 2004 and 650.7 Gg CO_2 equivalent in 1999, without any clear trend. This is caused by annual variations in the areas deforested. Recalculations have been carried out due to changes in AD and parameters, and this has resulted in a decrease in estimated emissions. The ERT encourages Norway to continue reporting this category.

VI. Waste

A. Sector overview

73. In 2004, the waste sector contributed 2.9 per cent to the total national GHG emissions of Norway. Emissions decreased from 1,837.06 Gg CO_2 equivalent in 1990 to 1,575.68 Gg CO_2 equivalent in 2004, a decrease of 14.2 per cent. This trend, as explained by Norway in the NIR and during the in-country review, is the consequence of the implementation of several measures since 1990. The measures include a reduction in the amount of organic waste landfilled, and an increase in the collection and combustion of CH_4 from landfills. In addition, Norway indicated that the recycling of waste has significantly increased since 1990. CH_4 emissions from solid waste disposal on land are the major contributor and responsible for this trend: their contribution to the total emissions of the sector ranges from 88.0 to 94.3 per cent over the inventory period 1990–2004.

74. The inventory in the waste sector is almost complete as it covers all categories and gases for all years from 1990 to 2004 except N_2O emissions from waste-water handling, which are missing.

75. Norway has made considerable improvements in both the methodologies used and its data preparation. The methodologies used are transparent, but some additional information was provided during the visit in order to increase the overall transparency of the methods, data and assumptions used. The ERT recommends that Norway report the additional information in its next inventory submission.

76. Recalculations are reported in the NIR for the whole time series due to methodological changes and the collection of new data. During the review process Norway revised some estimates, in response to questions raised by the ERT, not only to complete the emissions estimates for waste-water handling but also to provide revised estimates for CH_4 emissions from landfills (already reported in the 2007 submission) and CH_4 and N_2O emissions from waste-water handling. The ERT recommends that Norway report revisions in CH_4 and N_2O emissions from waste-water handling in its future inventory submissions in order to improve the completeness and accuracy of the inventory.

77. Category-specific QA/QC procedures have been implemented on the input data as well as on the emission estimates. The Party has provided the uncertainties associated with the data used and the emission estimates based on a tier 2 analysis. This is in line with the IPCC good practice guidance.

78. In general, emissions are reported under the appropriate categories except for emissions from flaring of natural gas from production of methanol, which should be reported in the industrial processes sector in accordance with the IPCC good practice guidance and not under waste incineration. The ERT recommends Norway to reallocate these emissions in its next inventory submission.

B. Key categories

Managed waste disposal on land – CH_4

79. Norway used the first order decay model of the recently published recognized international scientific literature to calculate CH_4 emissions from managed waste disposal on land. The model spreadsheets used and a full explanation were provided during the review. To apply the model, Norway has collected and prepared sufficient historical as well as current data using different sources (surveys and the scientific literature) and techniques (interpolation and extrapolation). The spreadsheets used by Norway to apply the interpolation and extrapolation techniques in order to address some data gaps were provided by the Party and reviewed by the ERT during the in-country visit. The ERT identified that the extrapolation and interpolation are either linear or with driver (population). The ERT encourages Norway to also use the other drivers (e.g. policies, gross domestic product) for the extrapolation and interpolation techniques if this increases the accuracy of estimates in the future submissions.

80. Norway has used a combination of IPCC default parameters (e.g. for fraction of degradable organic carbon (DOC) dissimilated, oxidation factor, methane correction factor (MCF), and fraction of CH_4 in landfill gas) and country-specific data (e.g. DOC, half-life time). Documentation on the country-specific parameters was only provided during the review. Norway is encouraged to indicate references to data used in its future inventory submissions.

81. During the in-country review, Norway presented the recalculations, already reported in the 2007 submission, and justified them by the fact that reliable information on the distribution of waste by material, the DOC and the half-life time has been collected from new studies. The documentation on the new data was provided and the recalculations clearly show an overestimation of emissions for the whole time series. Following the recommendation from the ERT, during the review process Norway provided revised estimates for CH_4 emissions from landfills. The revised estimate –1,417.86 Gg CO_2 equivalent in 2004 – is 2.7 per cent lower than the initial estimate of the 2006 inventory submission. The ERT recommends that Norway report the reasons for the recalculations clearly in its next submission.

82. The ERT identified that Norway has reported emissions from landfill gas collected and used for energy purposes correctly in the energy sector. This is in line with the IPCC requirements.

C. Non-key categories

1. Waste-water handling – CH_4

83. From the NIR, the ERT identified that the IPCC tier 1 method used has not been properly applied. The parameter reported in the NIR as the MCF used does not correspond to the IPCC definition. That parameter is actually the fraction of domestic and commercial waste water treated in "sealed tank" and "separate toilet system" in Norway. That fraction, which is suspected to be high in the 1990s, is reported as constant for the whole time series without any justification being given. In response to the recommendation from the ERT on method to be used, during the review process Norway provided revised estimates of CH_4 emissions from waste-water handling together with supporting material including, for example, the spreadsheets used, the appropriate MCFs for "sealed tank" and "separate toilet system", and the data on population, all of which were reviewed by the ERT. IPCC default factors for biochemical oxygen demand (BOD5) and methane producing capacity (Bo) have been used to estimate emissions from domestic and commercial waste water and sludge. The revised estimate is 78.3 per cent lower than the initial estimate submitted in the 2006 inventory. The ERT recommends Norway to follow the revised methodology in its future submissions.

84. During the review process, the Party also clarified how CH_4 emissions from waste water of breweries, dairies and slaughterhouses have been calculated. For transparency, the ERT recommends that Norway report this clarification in its next submission.

2. Waste-water handling – N_2O

85. Norway has used a country-specific method based on nitrification-denitrification to estimate N_2O emissions from human sewage. The method is not transparently reported. Moreover, it applies only to the population connected to sewage plants, so that the estimate in the category is incomplete. During the in-country visit and following the recommendation of the ERT, the Party provided a calculation of the missing estimate applying the IPCC default method to the population not connected to sewage plants. The missing estimate was 23.3 Gg CO_2 equivalent for 2004. Furthermore, during the review process, Norway provided revised estimates for the N_2O emissions from the nitrification-denitrification process. Taking into account the missing estimate and the revised estimate, the Party provided a new estimate of total N_2O emissions from waste-water handling, which is 133.1 Gg CO_2 equivalent in 2004 and 21.2 per cent higher than the initial estimate reported in the 2006 submission. The ERT recommends that Norway enhance the completeness of the inventory in this category and report these emissions using the revised method in its future inventory submissions.

86. The ERT appreciated that N_2O emissions from sludge spreading on agricultural soils are reported under agriculture. This is in line with the IPCC good practice guidance.

3. Waste incineration – CO_2

87. Norway has estimated emissions from cremation, incineration of solid wastes and flaring of natural gas from production of methanol using country-specific parameters. Emissions from incineration with energy recovery are reported under the energy sector, which is in line with the IPCC good practice guidance, and CO_2 emissions from flaring of landfill gas are excluded following the recommendation of the previous (2005) review. However, the ERT recommends that Norway report CO_2 emissions from flaring of natural gas from production of methanol (2.B.5) in industrial processes and not under waste incineration. Norway is encouraged to report on the associated non-CO_2 emissions as well since country-specific EFs are available.

VII. Conclusions and recommendations

88. The ERT concluded that in general the 2006 submission of Norway provides the information needed to assess the inventory. The inventory is largely complete in terms of years, sectors and gases and is in general accurate, as defined in the "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual inventories", and consistent with the Revised 1996 IPCC Guidelines and the IPCC good practice guidance. The ERT appreciated the efforts made by Norway to use improved data and methodologies. This was reflected in the levels of uncertainties, which have decreased in general compared to the previous (2005) submission.

89. During the in-country review the ERT identified a few categories where the methods or EFs used are not fully in accordance with the IPCC good practice guidance (fugitive emissions of CO_2 from coal mining, CO_2 emissions from combustion of natural gas, CO_2 emissions from glass production, and N_2O emissions from cultivation of histosols). The ERT recommended Norway to revise its estimates for these categories. After the in-country review, Norway provided revised estimates for these categories for the base year and 2004 in accordance with the recommendations of the ERT and in line with the IPCC good practice guidance.

90. In its 2006 submission Norway has made significant improvements since the 2005 submission, most of them in response to recommendations from the 2005 review. The major improvements include:

(a) A thorough review of the point source data, the use of a higher-tier method for CH_4 from enteric fermentation, the updating of the N_2O EF for road transport, the elimination of double counting of N_2O emissions reported under agriculture and LULUCF, and the transparent reporting of CO_2 capture and storage;

(b) The implementation of category-specific QA/QC procedures on input data and emission estimates, which was very limited in some sectors in the 2005 submission;

(c) The provision of information on how the uncertainty estimates are derived for some categories, which was not provided in the 2005 submission.

91. In the course of the review, the ERT formulated a number of recommendations related to the QA/QC and transparency of the information presented in the 2006 submission. Most of these recommendations were implemented during the review process, and those which referred to potential problems that could have led to the underestimation of the emissions in 2004 have been resolved. The key remaining recommendations to Norway are listed below. The Party should:

(a) Prepare an inventory improvement plan; Norway may also wish to consider comparing its own data with the data from other Parties;

(b) Improve the working procedures internally in every institution in order to make it possible to meet the deadlines of the inventory preparation process;

(c) Further strengthen the QA/QC procedures at the three relevant institutions and elaborate the QC reports further;

(d) Improve the consistency between the NIR and the underlying documentation, and also between the NIR and the CRF tables;

(e) Use the notation keys more consistently in the CRF tables;

(f) Improve the transparency of the NIR by providing more explanation of emission trends and more information on important background data, as well as figures and graphs;

(g) Facilitate the review of the draft NIR by the SSB and the Norwegian Forest and Landscape Institute, and involve industrial associations and relevant research institutions in the review process of the inventory before it is submitted in order to improve its quality;

(h) Improve the completeness of the inventory by addressing the few categories that are reported as “NE” in its future inventory submissions.

Annex

Documents and information used during the review

A. Reference documents

IPCC. Good practice guidance and uncertainty management in national greenhouse gas inventories, 2000. Available at <http://www.ipcc-nggip.iges.or.jp/public/gp/english/>.

IPCC. Good practice guidance for land use, land-use change and forestry, 2003. Available at <http://www.ipcc-nggip.iges.or.jp/public/gpglulucf/gpglulucf.htm>.

IPCC/OECD/IEA. Revised 1996 IPCC Guidelines for national greenhouse gas inventories, volumes 1–3, 1997. Available at <http://www.ipcc-nggip.iges.or.jp/public/gl/invs1.htm>.

UNFCCC. Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual inventories. FCCC/SBSTA/2004/8. Available at <http://unfccc.int/resource/docs/2004/sbsta/08.pdf>.

UNFCCC. Guidelines for the technical review of greenhouse gas inventories from Parties included in Annex I to the Convention. FCCC/CP/2002/8. Available at <http://unfccc.int/resource/docs/cop8/08.pdf>.

UNFCCC secretariat. Status report for Norway. 2006. Available at <http://unfccc.int/resource/docs/2006/asr/nor.pdf>.

UNFCCC secretariat. Synthesis and assessment report on the greenhouse gas inventories submitted in 2006. FCCC/WEB/SAI/2006. Available at <http://unfccc.int/resource/docs/webdocs/sai/sa_2006>.

UNFCCC secretariat. Norway: Report of the individual review of the greenhouse gas inventory submitted in the year 2005. FCCC/ARR/2005/NOR. Available at <http://unfccc.int/resource/docs/2006/arr/nor.pdf>.

B. Additional information provided by the Party

Responses to questions during the review were received from Mr. Audun Rosland, Mr. Eilev Gjerard (SFT), Mr. Ketil Flugsrud (SN) and Ms. Gro Hylen (Norwegian Forest and Landscape Institute) including additional material on the methodology, data and assumptions used.

Gjerald E. 2007. Electronic material representing GHG emission factors. *Utslippskoeffesienter SFT - Feb 2007 To ERT 10.6.07.Xls*.

Hoem Br. 2006. *The Norwegian Emission Inventory 2006. Documentation of Methodologies for Estimating Emissions of Greenhouse Gases and Long-Range Transboundary Air Pollutants*. Oslo and Kongsvinger, Statistics Norway: 2006/30.

Norwegian Forest and Landscape Institute. 2007. *QA/QC Report for Norwegian Forest and Landscape Institute*, draft, 2007 April.

Norwegian Forest and Landscape Institute. 2006. A Letter of Norwegian Forest and Landscape Institute regarding national GHG reporting system, 06/403, 13 December 2006.

Norwegian Ministry of Environment. 2006. *Norway's Fourth National Communication Under The Framework Convention On Climate Change*.

Norwegian Pollution Control Authority. 2006. *Key Source Table 1-2 Background Data for the Key Category Analysis*. 23 May.

Norwegian Pollution Control Authority. 2006. *Documentation of Methodology and Results: QA/QC Performed For Greenhouse Gas Emissions for Industrial Plants Included in the National Inventory*. July.

Norwegian Pollution Control Authority et al. 2006. *National Greenhouse Gas Inventory System in Norway*. Oslo, November.

State Pollution Control Authority. 2004. *Bedriftenes Egenrapportering til Forurensningsmyndighetene. Reporting Guidelines to Pollution Authority*, TA -1929/2004 (in Norwegian).

Statistics Norway. 2006. *The Norwegian Emission Inventory* SN Report 2006/30.

Statistics Norway. 2007. *QA/QC Report for Statistics Norway*, Draft, April.

Statistics Norway. 2006. A letter of a Head of the Environmental Statistics Department at Statistics Norway regarding national GHG reporting system, 06/2508-2, 21 December, Oslo.

References used in the energy sector

Arts RJ, Chadwick A, Eiken O, Dortland S, Trani M and van der Meer LGH. 2007. Seismic monitoring of the CO_2 storage at Sleipner sustained by synthetic modelling, unpublished draft article.

Bang J, Figenbaum E, Flugsrud K, Larsen St, Rypdal K and Torp Ch. 1993. *Emissions from Road Traffic in Norway - Method for Estimation, Input Data and Emission Estimates*. State Pollution Control Authority, SFT-Report No. 93-02.

Bang J, Flugsrud K, Holtskog S, Haakonsen G, Larssen St, Maldum KO, Rypdal K and Skedsmo A. 1999. *Utslipp Fra Vegtrafikk i Norge. Dokumentasjon av Beregningsmetode Data og Resultater*. Statistics Norway, State Pollution Control Authority. SFT Report No. 99:04 (in Norwegian).

Flugsrud K and Rypdal K. 1996. *Utslipp til Luft fra Innerrinks Shofart Fiske og Annen Sjotrafikk Mellom Norske Havner*. Statistics Norway 96/17, Oslo and Kongsvinger (in Norwegian).

Rypdal K and Tornsjo B. 1997. *Utslipp til Luft fra Norsk Luftart*. Statistics Norway, Report 97/20 (in Norwegian).

Statoil. 2007. *Arsrapport 2006. Utslipp fra Sleipner Vestfeltet. Annual Report 2006. Emissions from Sleipner West field* (in Norwegian).

Tornsjo B. 2001. *Utslipp til Luft fra Innenriks Sjofart, Fiske og Annen Sjotrafikk Mellom Norske Havner*, Statistic Norway, Report 2001/6. Oslo and Kongsvinger (in Norwegian).

Statistics Norway. 1999. *Utslipp fra Vegtrafikk i Norge, Dokumentasjon av Beregningsmetode Data og Resultater*. 99:04 (in Norwegian).

References used in the industrial processes sector

Elkem Aluminium. 1997. *Utslipp av CF-Gasser*. Letter of Elkem Aluminium to SFT of 15 December 1997 (in Norwegian).

Elkem Aluminium. 1998. *Avtale om Reduksjon av Utslipp av Klimagasser – Årsrapportering.* Letter of Elkem Aluminium to SFT of 25 February 1998 (in Norwegian).

Elkem Aluminium. 2000. *Avtale om Reduksjon av Utslipp av Klimagasser – Årsrapportering.* Letter of Elkem Aluminium to SFT of 28 February 2000 (in Norwegian).

Grådahl S. 2004. *Utslipp av Klimagasser fra Si Prosessen Hos Elkem Thamshavn og Holla Metall med Fokus på NO_X Reduksjon*. SINTEF, Trondheim. Report no STF24 F03555 (in Norwegian).

Hansen KL. 2007. *Emissions from Consumption of HFCs, PFCs and SF_6 in Norway*. Statistics Norway, Documents: 2007/8.

Hydro Aluminium. 1999. *Utslipp av Klimagasser fra Hydro Aluminium 1998*. Letter of Hydro Aluminium to SFT of 1 March 1999 (in Norwegian).

SINTEF. 1998. *Omregeningsfaktorer for CO_2-Utslipp fra Metallurgisk Industri og Sementproduksjon. Delprosjekt 1. CO_2 utslipp fra forskjellige typer reduksjonsmaterialer*. (Revidert Utgave) (in Norwegian).

SINTEF. 1998. *Omregeningsfaktorer for CO_2-Utslipp fra Metallurgisk Industri og Sementproduksjon. Delprosjekt 2. Produksjon av ferrosilisium og silisium metal i Norge*. (Revidert Utgave) (in Norwegian).

SINTEF. 1998. *Omregeningsfaktorer for CO_2-Utslipp fra Metallurgisk Industri og Sementproduksjon. Delprosjekt 4. Utslipp av CO_2 ved Produksjon av Silisiumkarbid og Kalsiumkarbid*. (Revidert Utgave) (in Norwegian).

SINTEF. 1998. *Omregeningsfaktorer for CO_2-Utslipp fra Metallurgisk Industri og Sementproduksjon. Delprosjekt 5. Produksjon av Magnesium*. (Revidert Utgave) (in Norwegian).

SINTEF. 1998. *Emisjonsfaktorer for CO_2-Utslipp fra Sementproduksjon i Norge for 1990 og 1997*. Report no. STF 66 A98511 (in Norwegian).

SINTEF. 1999. *Bruk av Biokarbon i Norsk Ferrolegeringsindustri. Feasibilitystudie 1999* (in Norwegian).

SINTEF et al. 2003. *Klimagassutslipp fra Norsk Treforedlingsindustri, GHG emissions from pulp and paper industry in Norway*. DNV Report No. 2003-1018, Kjelforeningen report No. 25191-RT-0001, SINTEF Report No. TRA 5857 (in Norwegian).

SINTEF and DNV. 2004. *Hvitbok om Klimagassutslipp fra Norsk Landbasert Prosessindustri, Whitebook of GHG emissions from Onshore Industry in Norway*, DNV Report No. 2002-1609, SINTEF Report No. STF24A03501 (in Norwegian).

References used in the waste sector

Berge G, Mellem KB and Undelswedt JK. 2007. *Kommunal Avlopssektor. Gebyrer 2006 - Utslipp, Rensing og Slamdisponering 2005*. Reporter 2007/12 (in Norwegian).

Norwegian State Pollution Control Authority. 1999. *Beregningsmodell for Utslipp av Metangass fra Norske Depoier. Historiske og Framtidige Utslippsmengder, Calculation Model of Methane Emissions from Norwegian Landfill Sites*. SFT Report 99:16 (in Norwegian).

Skullerud H. 2006. *Methane Emissions from Norwegian Landfills. Revised Calculations for Waste Landfilled 1945–2004*. Statistics Norway, 2006/7.

References used in the land use, land-use change and forestry sector

FAO. 2005. *Global Forest Resources Assessment 2005*. Norway Country Report 135. Rome, 2005.

Norwegian Institute of Forest and Landscape. 2006. *2006 Instructions For Field Work. Landsskogtakseringens Feltinstruks*, NIJOS, 40/2006 (in Norwegian).

Center for International Climate and Environmental Research et al. 2005. *Emissions and Removals of Greenhouse Gases from Land Use, Land-Use Change and Forestry in Norway*. NIJOS Report 11/2005, ISBN 82-7464-352-6.

De Wit HA, Palosuo T, Hylen G and Liski J. 2006. *A Carbon Budget of Forest Biomass and Soils in Southeast Norway Calculated Using a Widely Applicable Method*. Forest Ecology and Management 225: 15-26.

Singh BR and Lal R. 2005. *The Potential of Soil Carbon Sequestration through Improved Management Practices in Norway*. Environment, Development and Sustainability, 7:161-184.

- - - - -