UNITED
NATIONS

UNFCCC Framework Convention on Climate Change

Distr.
GENERAL

FCCC/ARR/2009/NOR
27 January 2010

ENGLISH ONLY

Report of the individual review of the annual submission of Norway submitted in 2009*

* In the symbol for this document, 2009 refers to the year in which the inventory was submitted, and not to the year of publication.

CONTENTS

I. Overview

A. Introduction

1. This report covers the centralized review of the 2009 annual submission of Norway, coordinated by the United Nations Framework Convention on Climate Change (UNFCCC) secretariat, in accordance with decision 22/CMP.1. The review took place from 7 to 12 September 2009 in Bonn, Germany, and was conducted by the following team of nominated experts from the UNFCCC roster of experts: generalists – Mr. Bernd Gugele (European Community) and Ms. Barbara Muik (Austria); energy – Mr. Darío Gómez (Argentina), Mr. Daniel Tutu Benefoh (Ghana) and Mr. Hristo Vassilev (Bulgaria); industrial processes – Ms. Lisa Hanle (United States of America) and Ms. Sonia Petrie (New Zealand); agriculture – Mr. Etienne Mathias (France) and Mr. Rob Sturgiss (Australia); land use, land-use change and forestry (LULUCF) – Mr. Leandro Buendia (Philippines) and Ms. Kimberly Klunich (United States of America); and waste – Mr. Eduardo Calvo (Peru) and Ms. Medea Inashvili (Georgia). Mr. Gómez and Mr. Gugele were the lead reviewers. The review was coordinated by Mr. Harald Diaz-Bone (UNFCCC secretariat).

2. In accordance with the "Guidelines for review under Article 8 of the Kyoto Protocol" (decision 22/CMP.1), a draft version of this report was communicated to the Government of Norway, which provided comments that were considered and incorporated, as appropriate, into this final version of the report.

B. Emission profiles and trends

3. In 2007, the main greenhouse gas (GHG) in Norway was carbon dioxide (CO_2), accounting for 81.7 per cent of total GHG emissions[1] expressed in CO_2 eq, followed by methane (CH_4) (8.0 per cent) and nitrous oxide (N_2O) (7.7 per cent). Hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6) collectively accounted for 2.6 per cent of the overall GHG emissions in the country. The energy sector accounted for 72.7 per cent of the total GHG emissions, followed by industrial processes (16.7 per cent), agriculture (7.8 per cent), waste (2.4 per cent) and solvent and other product use (0.3 per cent). Total GHG emissions amounted to 55,050.12 Gg CO_2 eq and increased by 10.8 per cent between the base year[2] and 2007. The trends for the different gases and sectors are reasonable and similar to those of other Parties with similar national circumstances.

4. Tables 1 and 2 show total GHG emissions by gas and by sector, respectively. Table 1 includes emissions from Annex A sources only and excludes emissions and removals from the LULUCF sector.

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

[2] "Base year" refers to the base year under the Kyoto Protocol, which is 1990 for all gases. The base year emissions includes emissions from Annex A sources only.

Table 1. Total greenhouse gas emissions by gas, 1990–2007[a]

Greenhouse gas emissions	Gg CO_2 eq							Change base year–2007 (%)
	Base year[b]	1990	1995	2000	2005	2006	2007	
CO_2	34 791.58	34 791.58	37 812.68	41 590.90	42 906.96	43 336.64	44 962.19	29.2
CH_4	4 614.62	4 614.62	4 847.74	4 759.05	4 433.53	4 259.35	4 411.47	–4.4
N_2O	4 718.48	4 718.48	4 404.06	4 517.69	4 737.55	4 398.20	4 233.30	–10.3
HFCs	0.02	0.02	25.82	238.36	482.17	521.32	565.51	3 085 447.5
PFCs	3 370.40	3 370.40	2 007.74	1 317.90	828.65	742.50	801.41	–76.2
SF_6	2 199.78	2 199.78	607.79	934.42	312.03	212.09	76.24	–96.5

Abbreviation: NA = not applicable.

[a] Total GHG emissions includes emissions from Annex A sources only (and excludes emissions/removals from the LULUCF sector).

[b] Base year refers to the base year under the Kyoto Protocol, which is 1990 for all gases. The base year emissions include emissions from Annex A sources only.

Table 2. Greenhouse gas emissions by sector, 1990–2007

Sector	Gg CO_2 eq							Change base year–2007 (%)
	Base year[a]	1990	1995	2000	2005	2006	2007	
Energy	29 536.48	29 536.48	32 264.47	35 579.56	37 667.32	38 488.81	40 030.51	35.5
Industrial processes	13 698.18	13 698.18	10 967.22	11 565.37	10 123.55	9 236.78	9 197.61	–32.9
Solvent and other product use	191.18	191.18	186.74	182.05	197.07	182.48	187.86	–1.7
Agriculture	4 444.57	4 444.57	4 534.23	4 489.09	4 343.67	4 209.96	4 297.29	–3.3
LULUCF	NA	–12 288.82	–11 670.62	–17 078.27	–27 920.01	–22 538.02	–25 882.57	NA
Waste	1 824.46	1 824.46	1 753.17	1 542.25	1 369.27	1 352.07	1 336.84	–26.7
Other	NA	NA	NA	NA	NA	NA	NA	NA
Total (with LULUCF)	37 406.06	37 406.06	38 035.21	36 280.04	25 780.87	30 932.07	29 167.55	–22.0
Total (without LULUCF)	49 694.88	49 694.88	49 705.83	53 358.31	53 700.88	53 470.09	55 050.12	10.8

Abbreviation: NA = not applicable.

[a] Base year refers to the base year under the Kyoto Protocol, which is 1990 for all gases. The base year emissions include emissions from Annex A sources only.

C. Annual submission and other sources of information

5. The 2009 annual submission was submitted on 15 April 2009; it contains a complete set of common reporting format (CRF) tables for the period 1990–2007, and a national inventory report (NIR). Norway also submitted information required under Article 7, paragraph 1, of the Kyoto Protocol, including information on activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, and information on its accounting of Kyoto Protocol units. The standard electronic format (SEF) tables were also submitted on 15 April 2009. The annual submission was submitted in accordance with decision 15/CMP.1. The Party indicated that the 2009 submission is also its voluntary submission under the Kyoto Protocol.

6. Norway submitted emission estimates for CH_4 and N_2O from flaring of oil in well testing on 26 October in response to questions raised by the expert review team (ERT) during the course of the review.

7. In addition, the ERT used the standard independent assessment report (SIAR) , Parts I and II, to review information on the accounting of Kyoto Protocol units (including the SEF and its comparison report) and on the national registry.[3]

8. During the review, Norway provided the ERT with additional information. The documents concerned are not part of the annual submission but are in many cases referenced in the NIR. The full list of materials used during the review is provided in the annex to this report.

Completeness of inventory

9. The 2009 inventory submission is complete in terms of years, sectors and gases, in line with 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) and 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" (hereinafter referred to as the UNFCCC reporting guidelines). As already indicated by the previous ERT, some minor categories are missing from the 2009 inventory submission: CH_4 and N_2O from oil flaring; potential emissions of SF_6; a number of carbon stock changes in different pools and subcategories in the LULUCF sector (e.g. carbon stock change in dead organic matter and carbon stock change in soils for land converted to forest land) and N_2O from industrial wastewater. The number of subcategories that were reported as not estimated ("NE") under the LULUCF sector has decreased in the 2009 inventory submission in relation to the number in the 2008 inventory submission. In response to questions raised by the ERT during the course of the review Norway submitted emission estimates for CH_4 and N_2O from flaring of oil in well testing. The Party indicated that these emissions would be included in next year's inventory. The ERT recommends that, for its next annual submission, Norway continue to make efforts to estimate emissions from such subcategories and reduce the number of blank cells in the CRF tables (e.g. activity data (AD) for lime production, and limestone and dolomite use), and also recommends that Norway provide additional information on waste generation rates and population. The ERT commends

[3] The SIAR, Parts I and II, is prepared by an independent assessor in line with decision 16/CP.10 (paragraphs 5(a), 6(c) and 6(k)), under the auspices of the international transaction log administrator using procedures agreed in the Registry System Administrators Forum. Part I is a completeness check of the submitted information relating to the accounting of Kyoto Protocol units (including the SEF and its comparison report) and to national registries. Part II contains a substantive assessment of the submitted information and identifies any potential problem regarding information on the accounting of Kyoto Protocol units and the national registry. The SIAR is not publicly available.

Norway for providing estimates of emissions from bunker fuels for the first time in its 2009 inventory submission.

D. Main findings

10. The 2009 inventory submission is in line with the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the Revised 1996 IPCC Guidelines), the IPCC good practice guidance and the *Good Practice Guidance for Land Use, Land-Use Change and Forestry* (hereinafter referred to as the IPCC good practice guidance for LULUCF). It is of a high quality and shows improvement in relation to the previous inventory submissions. It is complete in terms of coverage of years, sectors and gases, although some minor categories are missing (see para. 9 above). In response to questions raised by the ERT during the course of the review Norway submitted emission estimates for CH_4 and N_2O from flaring of oil in well testing. The Party indicated that these emissions would be included in next year's inventory.

11. The Party has submitted, in part, on a voluntary basis supplementary information required under Article 7, paragraph 1, of the Kyoto Protocol in accordance with Part I of the annex to decision 15/CMP.1. The expert review team (ERT) noted that information on changes in the national system and in the national registry; the commitment period reserve; and adverse impacts under Article 3, paragraph 14, of the Kyoto Protocol was not provided in the NIR. However, some of this information was provided in the SIAR. During the review, Norway informed the ERT that no changes had been made to the national system.

12. Norway has also reported on a voluntary basis information on activities under Article 3, paragraph 3, and elected activities under Article 3, paragraph 4, of the Kyoto Protocol in accordance with section I.D of the annex to decision 15/CMP.1. Furthermore, the Party has reported information on its accounting of Kyoto Protocol units in accordance with section I.E of the annex to decision 15/CMP.1, and used the SEF tables as required by decision 14/CMP.1. The national system continues to perform its required functions as set out in the annex to decision 19/CMP.1. The national registry continues to perform the functions set out in the annex to decision 13/CMP.1 and the annex to decision 5/CMP.1, and continues to adhere to the technical standards for data exchange between registry systems in accordance with relevant Conference of the Parties serving as the meeting of the Parties (CMP) to the Kyoto Protocol decisions.

13. The ERT encourages Norway to explore reporting its next annual submission using the annotated outline of the NIR, and guidance contained therein, that can be found on the UNFCCC website.[4]

14. In the course of the review, the ERT formulated a number of recommendations relating to: updating the uncertainty estimates (see para. 21 below); providing information on changes in the national system and the national registry (see paras. 114–115 below); strengthening the quality assurance/quality control (QA/QC) procedures (see para. 17 below); providing better explanations of the reasons behind the recalculations in certain sectors (see para. 52 below); elaborating the description of the methods used in certain sectors (see paras. 55, 56, 64, 67, 74, 75, 80, 92, 94 below); exploring the differences between the sectoral and reference approaches and the differences between the energy data submitted in the CRF and those submitted to the International Energy Agency (IEA) (see para. 36–37 below); and making publicly available all of the information referred to in paragraphs 45, 46 and 48 of the annex to decision 13/CMP.1 (see para. 110 below).

[4] <http://unfccc.int/files/national_reports/annex_i_ghg_inventories/reporting_requirements/application/pdf/annotated_nir_outline.pdf>.

E. A description of the institutional arrangements for inventory preparation, including the legal and procedural arrangements for inventory planning, preparation and management

1. Overview

15. The ERT concluded that the national system continued to perform its required functions.

16. The NIR described the national system for the preparation of the inventory. The Norwegian Pollution Control Authority (SFT) has overall responsibility for the national inventory. Statistics Norway (SSB) and the Norwegian Forest and Landscape Institute are the other core institutions involved. All three institutions have well-defined, specific responsibilities allocated to them in the inventory development process. SFT has the following main responsibilities: (a) submitting the inventory to the UNFCCC secretariat; (b) completing the NIR; (c) implementing and coordinating the QA/QC plan; (d) coordinating work between the core institutions; (e) approving the inventory before its official submission to the UNFCCC secretariat; (f) collecting point source data; and (g) ensuring that the different underlying emission models are based on sound and updated scientific knowledge. SSB has the following main responsibilities: (a) compiling the CRF tables; (b) maintaining the underlying emission models; (c) collecting the relevant basic data; and (d) carrying out the QA/QC of activities, and archiving the relevant data. Lastly, the Norwegian Forest and Landscape Institute has the following responsibilities: (a) compiling the emission/removal estimates for LULUCF (including information under Article 3, paragraphs 3 and 4); (b) collecting the relevant basic data; and (c) carrying out the QA/QC of activities, and archiving the relevant data. During the review, Norway reported that there had been no changes made to its national system.

2. Inventory planning

17. Norway has reported in its NIR its inventory production plan, including milestones for each deliverable and for each institution involved in the inventory preparation process. Norway has elaborated and implemented a QA/QC plan, which 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. However, the ERT noted that these QA/QC procedures should be strengthened in order to avoid errors identified during the review being repeated in the next annual submission (see para. 23 below).

3. Inventory preparation

Key categories

18. Norway has reported a tier 2 key category analysis, both level and trend assessment, and a tier 1 level assessment, as part of its 2009 inventory submission. However, the background tables in annex I to the NIR have not been updated with values for 2007. On the basis of the tier 2 key category analysis, 29 key categories were identified (excluding LULUCF). To this, seven key categories were added on the basis of the tier 1 analysis and two categories were added on the basis of a qualitative assessment . The key category analysis performed by the Party and that performed by the secretariat[5] produced similar results. Norway has included the LULUCF sector in its key category analysis, which was performed in accordance with the IPCC good practice guidance and the IPCC good practice guidance for LULUCF.

[5] The secretariat identified, for each Party, the categories that are key categories in terms of their absolute level of emissions, applying the tier 1 level assessment as described in the IPCC good practice guidance for LULUCF. Key categories according to the tier 1 trend assessment were also identified for 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.

The Party identified nine key categories for LULUCF. The results of the key category analysis have been documented in CRF table 7, but the transparency of this table could be improved. Thus, for the sake of transparency, the ERT recommends that, in CRF table 7, Norway tick "L" instead of "Q" for those key categories that were identified on the basis of the tier 1 level assessment. In addition, the ERT recommends that Norway update the background tables in annex I to the NIR in its next annual submission.

19. It is not evident from the NIR whether the results of the key category analysis are taken as a basis for prioritizing future improvements to the inventory. During the review, Norway informed the ERT that, each autumn, SSB, SFT and the Norwegian Forest and Landscape Institute plan the projects for the improvement of the inventory and that the key category analysis forms an important basis for this planning. The ERT recommends that Norway include this information in its next NIR.

20. Norway has not reported a key category analysis for activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol. The ERT recommends that Norway include such an analysis in its next annual submission.

Uncertainties

21. Norway has provided in its NIR a tier 2 uncertainty analysis for each category and for the inventory as a whole (both excluding and including LULUCF) in accordance with the IPCC good practice guidance and the UNFCCC reporting guidelines. However, the uncertainty analysis in chapter 1.7 of the NIR and annex II to the NIR has not been updated since the 2006 inventory submission. Furthermore, Norway has not followed the recommendations made in the previous reviews to include in its NIR table 6.2 from the IPCC good practice guidance and an explanation for its uncertainty estimates for CH_4. Therefore, the ERT reiterates the previous recommendations that the Party, in its next annual submission, update its uncertainty estimates, include the above-mentioned table 6.2 and provide a discussion of its uncertainty estimates for CH_4.

Recalculations and time-series consistency

22. Recalculations have been performed and reported in accordance with the IPCC good practice guidance. The ERT noted that recalculations reported by Norway of the time series 1990 to 2006 have been undertaken to take into account a number of improvements, in particular the revision of waste statistics data. These recalculations led to a decrease in the estimated CH_4 emissions from solid waste disposal by 20.52 Gg CO_2 eq (–1.2 per cent) in 1990 and by 152.77 Gg CO_2 eq (–11.3 per cent) in 2006. Overall, the major changes, and the magnitude of the impact, include a decrease in the total estimated GHG emissions for 1990 (by 0.01 per cent) and for 2006 (by 0.08 per cent). The rationale for these recalculations is in most cases provided in the NIR and in CRF table 8(b). However, the ERT noted that in some cases, such as for CO_2 from iron and steel production and CH_4 from unmanaged waste disposal sites, the explanations for the recalculations are not transparent enough. Therefore, the ERT recommends that Norway provide more detailed explanations of the rationale for its recalculations.

Verification and quality assurance/quality control approaches

23. Norway has elaborated a formal QA/QC plan in accordance with decision 19/CMP.1 and the IPCC good practice guidance. This plan 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. The NIR states that QA/QC reports are prepared by all three institutions involved in the inventory compilation process (SSB, SFT and the Norwegian Forest and Landscape Institute). Based on these reports, the three institutions decide in collaboration on what action to take to improve the QA/QC of the inventory. Some minor inconsistencies between the CRF and the NIR were identified by the ERT (e.g. in

relation to fugitive emissions from oil and natural gas) and not all parts of the NIR have been updated since the previous submission (e.g. annex I). Therefore, the ERT recommends that Norway strengthen its QA/QC procedures in order to avoid repeating errors identified during the present review in its next annual submission. The previous ERT recommended that, after each reporting cycle, Norway evaluate whether the quality objectives have been met and use the conclusions of this evaluation to establish the priorities for its improvement plan. Since it was not clear from information provided by the Party during the review whether this recommendation is being followed, the ERT reiterates this recommendation.

24. The NIR lists the Party's plans for improving QA/QC, including that: (1) independent peer review will be considered for the reporting of the 2008 data (in 2010), in particular for categories in which methods are changed; (2) the comparing of data with those of other countries will be considered for 2009/2010; and (3) a project to elaborate QA/QC procedures for the comparison of point source data with independent calculations has been established by SSB and is expected to be finalized in 2010. The ERT commends Norway for these plans and encourages the Party to implement them and report on their status of implementation in its next NIR.

Transparency

25. In response to recommendations made in previous reviews, Norway has reduced the number of categories reported as included elsewhere ("IE") in CRF table 9(a) and, in most cases, a satisfactory explanation has been provided. Nevertheless, the ERT encourages Norway to make efforts to further reduce this number of categories in order to increase the comparability and transparency of its inventory. In addition, the ERT found that the transparency of some sectoral chapters (those on industrial processes, agriculture and waste) should be improved. Therefore, the ERT recommends that Norway elaborate these sectoral chapters with a view to improving its descriptions of the methodologies used, where they are different from the IPCC methodologies. Some minor inconsistencies in the use of notation keys were observed in the energy sector (e.g. in relation to fugitive emissions from oil and natural gas) and the waste sector. Therefore, the ERT recommends that Norway improve its use of the notation keys in its future annual submissions.

4. Inventory management

26. Norway does not have a centralized archiving system. The Party's NIR states that all three core institutions involved in the inventory development process are responsible for archiving the data that they collect and the estimates that they calculate along with associated documentation on methodology and internal documentation on QA/QC. The NIR also states that, owing to the differences in the type of data collected, Norway has chosen to keep the separate archiving systems in the three core institutions; however, these archiving systems are consistent and they operate under the same rules. In addition, SFT will build up a library of the most important methodological reports. The ERT recommends that Norway report in its next NIR on the status of this effort.

F. Follow-up to previous reviews

27. As a result of recommendations provided in the previous review report, Norway has implemented some improvements to its inventory, including:

(a) The completion of CRF table 8(b) for all recalculations;

(b) The provision of estimates of emissions from bunker fuels;

(c) The reduction of the number of subcategories reported as "NE" in the LULUCF sector.

28. However, some recommendations from previous reviews were not implemented, such as:

(a) The update, and improvement of the transparency, of the uncertainty estimates;

(b) The reduction of the number of empty cells in the CRF tables related to industrial processes and waste;

(c) The reporting of changes in the national system.

G. Areas for further improvement

1. Identified by the Party

29. The 2009 NIR identifies several areas for improvement:

(a) The improvement of QA/QC and verification (see para. 22 above);

(b) The further reduction of the number of subcategories reported as "NE";

(c) The provision of a new uncertainty analysis in 2010 or 2011;

(d) The investigation of the large difference between the sectoral and reference approaches;

(e) The use of a new model for road transportation;

(f) The evaluation of the inventory for navigation;

(g) The improvement of the explanations in the NIR for the emission factors (EFs) and AD used in the agriculture sector;

(h) A number of improvements related to the LULUCF sector, such as further investigations of the extend of the area of forest and other wooded land at higher altitudes, and to expand the coverage of the Norwegian NFI system.

2. Identified by the expert review team

30. The ERT identifies the following cross-cutting issues for improvement:

(a) The update, and improvement of the transparency, of the uncertainty estimates;

(b) The further reduction of the number of empty cells in the CRF tables relating to industrial processes and waste;

(c) The provision in the NIR of information on changes in the national system and the national registry;

(d) The strengthening of QA/QC procedures;

(e) The provision of better explanations of the reasons behind recalculations in certain sectors, e.g. limestone and dolomite use, nitric acid production, iron and steel production, and manufacture of anodes;

(f) The elaboration of the description of the methods used in certain sectors, including industrial processes, agriculture, LULUCF and waste;

(g) Making publicly available all of the information referred to in paragraphs 45, 46 and 48 of the annex to decision 13/CMP.1.

31. Recommended improvements relating to specific categories are presented in the relevant sector chapters of this report.

II. Energy

A. Sector overview

32. The energy sector is the main sector in the GHG inventory of Norway. In 2007, emissions from the energy sector accounted for 40,030.51 Gg CO_2 eq, or 72.7 per cent of total GHG emissions. Between 1990 and 2007, emissions increased by 35.5 per cent. The key driver for this rise in emissions was the expansion in energy industries, namely oil and gas extraction and road transportation. In 2007, emissions from energy use in offshore oil and gas extraction contributed about 25 per cent of Norway's total GHG emissions. Also during the period 1990–2007, CO_2 emissions from manufacture of solid fuels and other energy industries increased from 5.4–11.0 million t.

33. Within the sector, 39.8 per cent of the emissions were from transport, followed by 32.0 per cent from energy industries, 8.9 per cent from manufacturing industries and construction, 7.8 per cent from other sectors and 0.5 per cent from the category other. Fugitive emissions from fuels accounted for 11.0 per cent.

34. Methodologies, AD and EFs have generally been described in a transparent manner in the NIR. Tier 1, 2 and 3 methods and country-specific EFs have been used across all categories. Plant-specific EFs have been used for energy industries. A few minor categories are missing from the 2009 inventory submission (CH_4 and N_2O from oil flaring). In response to questions raised by the ERT during the course of the review Norway submitted emission estimates for these source categories and indicated that these emissions would be included in next year's inventory.

35. Recalculations performed for the energy sector for 2006 were mainly associated with changes in the energy statistics, which now include final energy consumption on the basis of energy use in the manufacturing industries. Recalculations for 2006 resulted in a 0.16 per cent increase in the estimate for CO_2 emissions, a 0.09 per cent increase in the estimate for CH_4 emissions and a 4.97 per cent increase in the estimate for N_2O emissions. The ERT commends Norway on the detailed information provided on these recalculations in its NIR.

B. Reference and sectoral approaches

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

36. Norway continues to have difficulties reconciling the sectoral and reference approaches. For 2007, there is a difference of 8.22 per cent between the CO_2 emission estimates using the two approaches. The biggest differences between the approaches were identified for gaseous fuels (a difference of 18.52 per cent between the estimates for CO_2 emissions and of 17.19 per cent for energy consumption). AD and estimated CO_2 emissions reported using the reference approach are higher than those reported using the sectoral approach for most years, with the exception of CO_2 emissions from solid fuels. Some explanations have been given in the NIR: the large differences between energy supply and energy use in the Norwegian energy balance have been explained as the result of the large-scale production and export of natural gas; the frequent non-energy use of coal, coke and liquefied petroleum gas (LPG); and significant statistical errors. The ERT recommends that Norway make efforts to reduce the differences between the reference and sectoral approaches and provide more transparent explanations for any remaining differences. The ERT acknowledges the improvement made to the presentation of the energy balance tables in the NIR in response to a corresponding recommendation made in the previous review report. References should also be provided to the relevant sections of the NIR where any differences are explained in more detail.

37. There are also significant differences between the reference approach and the data from IEA. Norway has indicated that it is investigating this problem, pointing out that SSB has implemented a project with the aim of improving the energy supply data and removing possible sources of errors. The ERT recommends that Norway explore the reasons for these differences and reduce them in the future. Any remaining differences should be explained in Norway's next NIR.

2. International bunker fuels

38. The ERT noted that errors found in the AD and data on CO_2 emissions from international bunkers in the previous submission have been corrected in the 2009 inventory submission.

39. In order to estimate emissions from marine bunkers, sales figures of petroleum products used for international sea transport (marine gas oil, heavy distillates and heavy fuel oil) from SSB have been used. The consumption of aviation bunker fuel in Norway was estimated as the difference between total purchases of jet kerosene for civil aviation and reported domestic consumption. Figures for the total use of aviation fuel were derived from sales figures reported to SSB by oil companies. The data for domestic use of aviation fuel were collected from airline companies operating domestic flights in Norway. This is a bottom-up approach using the tier 2 core inventory of air emissions (CORINAIR) methodology.

3. Feedstocks and non-energy use of fuels

40. A brief description of feedstocks and non-energy use of fuels has been provided in section 3.6.2 of the NIR. Carbon storage factors were based on national conditions for LPG, natural gas, coal, coke-oven coke and petroleum coke. The ERT encourages the Party to provide in its next annual submission additional research materials in support of its country-specific fractions of carbon, in view of the large differences between these and the IPCC figures. By-product carbon monoxide (CO) gas, which is sold and combusted in some industrial plants, has been accounted for and reported under the energy sector.

4. Country-specific issues

41. Norway identified CO_2 from carbon dioxide capture and storage as a key category using qualitative criteria. The ERT acknowledges the additional details provided in the NIR and the annex to the NIR regarding Norway's carbon capture and storage project. By the end of 2007, 9.7 million t CO_2 had been injected and 0.2 million t CO_2 vented in the atmosphere. The ERT concluded that about 149.2 million t natural gas (or 205.9 billon nm^3) was manufactured in the period 1996–2007.

C. Key categories

1. Stationary combustion: solid, liquid and gaseous fuels – CO_2

42. The CO_2 implied emission factors (IEFs) for solid fuels are in the range of 172–997 t/TJ for the chemicals subcategory under manufacturing industries and construction for 1990–2007. They are the highest of the reporting Parties and considerably higher than the IPCC default range (94.6–106.7 t/TJ). Emission figures were reported direct from major plants and, in some cases, the only fuel used was CO gas derived from the use of coke as a reducing agent. The ERT recommends that Norway investigate the treatment and allocation of CO gas and provide more detailed documentation in the NIR of its next annual submission, making corrections where necessary.

43. In response to the recommendations made in previous reviews, the liquid fuels CO_2 IEFs for petroleum refining (44.15 – 54.86 t/TJ) have been revised but they are still outside the IPCC default range (63.07–100.83 t/TJ). The ERT recommends that Norway provides an explanation of the low CO_2 IEF for petroleum refineries in future annual submissions. The ERT also recommends that, in order to

improve transparency, the Party add the list of key categories identified on the basis of the tier 1 method in the annex to the NIR.

2. Oil and natural gas – CO_2 and CH_4

44. The ERT noted that AD for oil flaring have been reported as not occurring ("NO"), while emissions from oil flaring have been reported as not applicable and "NE". During the review, the Party indicated that this issue would be corrected in its next annual submission.

45. Production of oil and natural gas is the dominating source of emissions from combustion in energy industries. However, in CRF table 1.B.2, AD for exploration and production of oil and gas have been reported as "NE". The ERT recommends that Norway estimate emissions from these categories using country-specific EFs and the IPCC methods available, and include the estimates in its next annual submission.

46. AD for the subcategory oil transport have been reported in the CRF tables for the years 1990 and 1998–2001, but for all other years these AD have been reported as not applicable ("NA"). Meanwhile, CH_4 and CO_2 emissions have been reported for all years. During the review, the Party provided an explanation for the missing AD and indicated that AD which are available now would be reported in the next annual submission.

47. AD for the subcategory other leakage (natural gas) at industrial plants and power stations have been reported in the CRF tables as "NE"; however, CO_2 and CH_4 emissions have been reported. In response to questions raised by the ERT during the previous review, Norway stated that it would examine this issue with a view to ascertaining appropriate AD, but the issue remains unresolved in the latest annual submission. The ERT encourages Norway to ascertain appropriate AD and include these AD in its next annual submission.

48. The IEF for oil refining/storage is more than five times higher and the IEF for gas flaring more than 30 times higher than the default values provided in the IPCC good practice guidance. The ERT recommends that the Party revise these figures or provide reasons for the aforementioned differences. During the review, the Party provided an explanation for these differences. For the IEF for oil refining/storage the Party indicated that the reason for the high IEF is that the AD reported is crude oil used as feed stock in the refinery and not the throughput of crude oil. The Party indicated that this would be changed in its next annual submission. The IEF for gas flaring in 2007 was very high due to flaring in connection with start-up problems at a new LNG plant.

49. Norway has commonly used the "IE" notation key in the relevant CRF tables for reporting fugitive emissions from fuels for oil and natural gas. For example, emissions from oil and gas venting have been included under combined venting. For natural gas, the NIR provides a description of the activities included under the reported categories, while for oil a description has been provided of under which categories its exploration and production have been reported. The ERT considers that it would enhance the transparency of the inventory if Norway were to provide a description of the structure and relevant characteristics of its oil and gas industry in the NIR of its next submission. The ERT encourages the Party to explain not only where but also why the categories have been reported elsewhere.

III. Industrial processes and solvent and other product use

A. Sector overview

50. In 2007, emissions from the industrial process sector amounted to 9,197.61 Gg CO_2 eq, or 16.7 per cent of total GHG emissions, and those from solvent and other product use amounted to 187.86 Gg CO_2 eq, or 0.3 per cent of total GHG emissions. Since 1990, emissions have decreased by

32.9 per cent in the industrial processes sector, and decreased by 1.7 per cent in solvent and other product use. The key driver for the fall in emissions in the industrial processes sector was the decrease in PFCs from aluminium production and in SF_6 emissions from magnesium foundries. In the case of aluminium production, the reduction in PFCs resulted from the shift from the use of Soederberg to prebake technology, as well as Norway's efforts to reduce the anode effect frequency. The reduction in SF_6 emissions from magnesium foundries resulted from improvements in technology and process management. The primary magnesium production stopped in 2002 and only secondary production is retained. During 2006 also the production of remelting magnesium stopped and there were no emissions from this source in 2007. In addition, N_2O emissions from nitric acid production have decreased by 34 per cent since 1990, thanks to the introduction of abatement technologies. Within the industrial processes sector, 60.8 per cent of the emissions were from metal production, followed by 19.5 per cent from the chemical industry, 10.9 per cent from mineral production and 7.0 per cent from consumption of halocarbons and SF_6. The category other production and the category other collectively accounted for 1.8 per cent of sectoral emissions.

51. With regard to the industrial processes sector, Norway's 2009 inventory submission is generally complete. However, the ERT found that key AD were missing from the CRF tables (e.g. for lime production, and limestone and dolomite use) and, therefore, recommends Norway to include these data in its next annual submission.

52. The transparency of the inventory could be improved in respect of the documentation provided for any recalculations. Recalculations have been done for several categories (e.g. limestone and dolomite use, nitric acid production, iron and steel production, and manufacture of anodes); however, the effect of these recalculations on the level of and trends in the emission estimates, the reasons for the recalculations, and the approach used to recalculate previously submitted estimates have not been consistently documented. Providing such information would be consistent with the IPCC good practice guidance and would enhance the transparency of the inventory.

53. The ERT welcomes the introduction of a new methodology for estimating indirect CO_2 emissions from solvent and other product use, which improved both the accuracy and the time-series consistency of the emission estimates. Furthermore, the ERT commends Norway for enhancing the completeness of its inventory by including CO_2 emissions from a brick manufacturing plant in its latest submission.

B. Key categories

1. Iron and steel production – CO_2

54. There is one plant in Norway that produces pig iron as a by-product of the production of titanium slag and one that produces steel. The ERT identified that Norway's IEF for pig iron production (ranging from 3.0 to 3.5 t/t) was the highest of the reporting Parties (ranging 0.03 to 3.5 t/t). In response to questions raised by the ERT, Norway indicated that the emission estimate for pig iron production is based on the emissions from both plants, but the AD are based on just the one plant producing pig iron. The ERT encourages Norway to include emissions and AD from pig iron production in 2C1- Pig Iron, and emissions and AD from steel production under 2C1-Steel. In response to the draft review report, Norway indicated that they intend to report process emissions from steel production in 2C1-Steel in the next submission. The ERT welcomes this proposed change that will improve transparency and comparability among Parties.

55. The NIR indicates that emissions from iron and steel production are reported annually to SFT and are based on calculations. However, the approach to making these calculations is not transparently documented in the NIR. In response to a question from the ERT, Norway provided the background calculation spreadsheet and indicated their intent to elaborate on the methodology in their next inventory

submission. The ERT welcomes Norway's proposal to transparently document the calculation methodology in the next NIR.

2. Ferroalloys production – CO_2

56. The ERT commends Norway for the comprehensive discussion of this category which is presented in the inventory, particularly the transparent and complete discussion of the methods and EFs used. The ERT noted that Norway included CO_2 emissions from limestone and dolomite consumption in ferroalloys production under the category ferroalloys production. This practice is not consistent with the Revised 1996 IPCC Guidelines, which indicate that all emissive uses of limestone and dolomite, with the exception of limestone and dolomite consumed in cement and lime production, should be reported under the category 2A3 limestone and dolomite use. The ERT acknowledges that the allocation of emissions used by Norway is the one set out in the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, which encourage all emissions from carbonate consumption to be reported under the category in which they are consumed. In response to a draft version of this report, Norway suggested that their method leads to emissions estimates with at least comparable accuracy to those listed in the Revised 1996 Guidelines. The ERT agrees that the calculation approach leads to accurate estimates of emissions from ferroalloys production. In order to facilitate transparency and comparability among reporting Parties, however, the ERT recommends that Norway report all emissions from limestone and dolomite consumption under category 2A3. To enhance transparency, Norway might also consider including a note in either the CRF tables or the NIR to provide background information on emissions from limestone and dolomite consumption in ferroalloys production.

C. Non-key categories

Limestone and dolomite use – CO_2

57. The ERT encourages Norway to review the completeness of its reporting for this category, which should include all emissions from limestone and dolomite use, with the exception of carbonates consumed in cement and lime production. As described in paragraph 56 above, this category should include not only carbonates consumed in ferroalloys production, but also carbonates consumed in other industries (e.g. magnesium production). Furthermore, Norway is encouraged to include an appropriate description of the AD used for this category in the corresponding CRF table.

IV. Agriculture

A. Sector overview

58. In 2007, emissions from the agriculture sector amounted to 4,297.29 Gg CO_2 eq, or 7.8 per cent of total GHG emissions. Since 1990, emissions have decreased by 3.3 per cent. The key driver for this reduction in emissions was the decrease in the animal population. Within the sector, 46.1 per cent of the emissions were from agricultural soils, followed by 43.5 per cent from enteric fermentation and 10.2 per cent from manure management. The remaining 0.1 per cent were from the field burning of agricultural residues.

59. Generally, the information provided in the NIR on the agriculture sector has been presented in a transparent and complete manner; however, the information provided for some categories could be improved (see specific recommendations in paras. 61–68 below). For each category, there is a brief discussion of methodological issues, AD, EFs, uncertainties, completeness, QA/QC procedures and recalculations in the NIR.

60. Minor recalculations were reported in the 2009 inventory submission, which were due mainly to the availability of revised figures for AD in recent years. These recalculations resulted in a 0.02 per cent

increase in the total estimated sectoral emissions for 2006. No recalculations were reported for the base year.

B. Key categories

1. Enteric fermentation – CH_4

61. In 2007, enteric fermentation accounted for 1,871.27 Gg CO_2 eq, or 43.5 per cent of the total sectoral GHG emissions. Emissions from this category decreased by 3.9 per cent between 1990 and 2007. Mature dairy cattle, mature non-dairy cattle and sheep were the main sources of emissions (contributing 39.7, 29.6 and 23.5 per cent of the emissions, respectively). A tier 2 approach was used to estimate emissions from cattle and sheep. Norway's NIR and additional information received from the Party provide a good description of the country-specific parameters used to estimate the EFs. A tier 1 method with IPCC default EFs was used to estimate emissions from all other animals, with the exception of domestic reindeer, deer, ostrich and fur-bearing animals, for which EFs were 'scaled' from other IPCC values.

62. In applying the tier 2 approach to estimate emissions from cattle and sheep, Norway takes into consideration the lifetime of the animal, with the EF being estimated for a specific period (lambs live for only 143 days and beef cattle are slaughtered after 540 days). Explanations of and comprehensive information on lifetimes were provided by Norway during the review, and the ERT recommends Norway to provide this information, present detailed AD, and improve its explanations on calculations and definitions of what is estimated in the livestock statistics in its next NIR.

2. Manure management – N_2O

63. In 2007, manure management accounted for 122.99 Gg CO_2 eq, or 2.9 per cent of the total sectoral GHG emissions. Emissions from this category decreased by 7.8 per cent between 1990 and 2007. The solid storage and dry lot subcategory was the main source of emissions (accounting for 85.8 per cent).

64. The methodology provided in the IPCC good practice guidance was used with country-specific parameters (nitrogen (N) excreted by different categories of animals) to estimate emissions from this category. Norway could provide more detailed information in its NIR regarding the N excretion rates. During the review, in response to questions raised by the ERT, Norway stated that the country-specific N excretion parameters are currently believed to be more appropriate than the IPCC parameters, but that it will investigate this issue further. The ERT recommends that Norway increase the transparency of its estimated N excretion rates by providing more information or specific background documentation in its next NIR. In addition, as a quality control test, the ERT encourages Norway to investigate the consistency of data on intake as used in the tier 2 method for enteric fermentation with the N excretion rates.

65. Norway applies an ammonia (NH_3) model to estimate emissions of NH_3. The modelling results are used to verify the N_2O emissions from animal waste management systems. The ERT believes that more information is required on this model and recommends that Norway provide more details or background documentation on the NH_3 model in its next annual submission.

3. Agricultural soils – N_2O

66. In 2007, emissions of N_2O from agricultural soils accounted for 1,982.90 Gg CO_2 eq, or 46.1 per cent of the total sectoral GHG emissions. Emissions from this category decreased by 2.6 per cent between 1990 and 2007. Direct emissions from synthetic fertilizers and cultivation of

histosols, and indirect emissions (from leaching and run-off) were the main sources of emissions (accounting for 32.7, 16.7 and 17.1 per cent of emissions from this category, respectively).

67. The methodology from the IPCC good practice guidance has been used with country-specific parameters to estimate emissions from this category. The NH_3 model has been used to estimate NH_3 emissions, which are deducted from the emissions from synthetic fertilizers, animal manure applied to soils and pasture, and range and paddock manure. The ERT reiterates its recommendation that Norway provide more information on the NH_3 model in its next annual submission.

V. Land use, land-use change and forestry

A. Sector overview

68. In 2007, net GHG removals from the LULUCF sector amounted to 25,882.57 Gg. Since 1990, net removals have increased by 110.6 per cent. The key drivers for the rise in removals were the carbon sequestered in forest land remaining forest land and land converted to forest land. Cropland, grassland, wetlands and settlements are the net sources of CO_2 emissions. Emissions and removals of CO_2 from other land have been reported as "NA", "NE" and "NO".

69. Norway used land-use categories and methodologies which are consistent with the IPCC good practice guidance for LULUCF. For the sake of consistency with regard to the representation of its land, Norway used data from its National Forest Inventory to establish the total area of forest land, cropland, grasslands, wetlands, settlements and other land. These data, which have a five-year cycle starting from 1986, were supplemented by other statistical data, particularly data on agricultural areas collected by SSB.

70. In 2007, forest land covered 29 per cent of Norway's total land area, while 59 per cent was categorized as other land. The changes in the areas covered by the different land-use categories were small. For instance, the area of forest land increased by only 1.2 per cent between 1990 and 2007; the areas of grassland and settlements slightly increased, while the areas of cropland and wetlands decreased over the same period. Considering the proportion of Norway's land which is categorized as other land and the potential for this to become forest land, the ERT recommends that Norway continue its effort to improve its characterization of other land. The ERT suggests that, if possible, Norway provide in its next annual submission estimates of the proportion of the areas of other land that have the potential to become forest land.

71. In response to recommendations made in previous reviews, Norway has improved the LULUCF section of its inventory by providing more complete coverage of its carbon pools (i.e. living biomass, dead organic matter and soils (mineral and organic)).

B. Key categories

1. Forest land remaining forest land – CO_2

72. Norway used a tier 3 stock change method to estimate the change in carbon stocks in living biomass, which is consistent with the IPCC good practice guidance for LULUCF. The method combines the use of data from the National Forest Inventory with modelling. Norway used another tier 3 method for dead organic matter and soil, – a dynamic soil model called Yasso. The NIR does not provide a detailed description of the model, but makes a reference to published scientific literature (see NIR section 1.4.3). For the sake of transparency, the ERT recommends that Norway, in its next annual submission, include a description of its application of the dynamic soil model Yasso, including assumptions and limitations of the model used.

2. Land converted to forest land – CO_2

73. Consistent with the IPCC good practice guidance for LULUCF, Norway used a tier 3 methodology to estimate the change in carbon stocks in living biomass. For dead organic matter and soils, Norway used the Yasso model (tier 3 method). For the sake of transparency, the ERT recommends that Norway, in its next annual submission, include a description of its application of the dynamic soil model Yasso, including assumptions and limitations of the model used.

3. Cropland remaining cropland – CO_2

74. The CO_2 emissions from soils in Norway occurred mainly as a result of the cultivation of histosols (organic soils) and the application of lime to cropland soils (including the liming of lakes). Norway assumed the total area of organic soils to be 85,000 ha, of which 10 per cent is found in cropland.

75. Norway used a tier 1 method (with an IPCC default EF) to estimate the change in carbon stocks in organic soil, and CO_2 emissions from liming. Since this is a key category, the ERT suggests that Norway, in its next annual submission, explore using a tier 2 approach, which could be performed by differentiating between the different forms of lime and by applying country-specific EFs, if data are available. Different carbonate liming materials (limestone and other sources such as marl and shell deposits) are known to vary somewhat in terms of their carbon content and overall purity.

4. Grassland remaining grassland – CO_2

76. Around 90 per cent of the organic soil in Norway (76,500 ha) is assumed to be found in grassland. CO_2 emissions from histosols (organic soils) were considered to be a key category on the basis of the level and trend assessments. Therefore, the ERT recommends that Norway explain, in its next annual submission, why the net change in carbon stocks in organic soils (i.e. the loss of carbon) was constant from 1990 to 2007 (at –510.00 Gg C).

77. Norway used a tier 2 method, with country-specific EFs, to estimate CO_2 emissions from histosols. The country-specific EFs were stratified as to high and mixed organic soils with the corresponding values of 10 Mg C/ha/yr and 5 Mg C/ha/yr based on expert judgement. The IPCC default value for cold temperate is 1.0 Mg C/ha/yr, which is considerably lower than the country-specific values applied by Norway. Since this is a key category, the ERT shares Norway's view that improvements need to be made in this area, possibly by taking measurements of AD and country-specific EFs, using models or conducting a literature search. The ERT recommends that Norway report, in its next annual submission, on progress made in this area.

5. Land converted to settlements – CO_2

78. CO_2 emissions from living biomass in forest land converted to settlements were considered to be a key category on the basis of the trend assessment. Norway used a tier 3 method (modelling) to estimate the change in carbon stocks in living biomass in forest land converted to settlements. The model used was discussed to some extent in the NIR, with some assumptions and references provided. For the sake of transparency, the ERT recommends that Norway, in its next annual submission, include some basic assumptions and limitations of the model used.

C. Non-key categories

1. Direct emissions from nitrogen fertilization of forest land and other – N_2O

79. Norway used a tier 1 method and default IPCC EFs to estimate N_2O emissions from the N fertilization of forest land and other land use. The ERT appreciates Norway's reporting of emissions

from this category, as not many Parties included in Annex I to the Convention report emissions from this category.

2. Emissions from drainage of soils and wetlands – N_2O

80. Norway used the IPCC default EFs to estimate N_2O emissions from the drainage of soils and wetlands. The method used is consistent with the IPCC good practice for LULUCF. The estimated emissions reported were from organic soils in forest land and peatland areas in wetland. The ERT recommends that Norway report on N_2O emitted from flooded lands (wetlands) as soon as data become available.

3. Other land – CO_2

81. Norway assumed that all other land was unmanaged and that no changes in the carbon stocks occurred. As Norway reported in its NIR, this assumption may underestimate the carbon uptake, since vegetation is increasing in many areas owing to reduced grazing and forest growth. The ERT recommends that Norway continue its effort to improve its characterization of other land, as mentioned in paragraph 71 above, since this will affect the estimates of the country's carbon stocks, and that Norway report on the progress made in this effort in its next annual submission.

VI. Waste

A. Sector overview

82. In 2007, emissions from the waste sector amounted to 1,336.84 Gg CO_2 eq, or 2.4 per cent of total GHG emissions. Since 1990, emissions have decreased by 26.7 per cent. The key driver for the fall in emissions is the drop in CH_4 emissions from solid waste disposal on land, owing mainly to measures implemented to reduce the amount of organic waste deposited and to increase the collection and combustion of CH_4 from landfills, but also to the requirement to collect CH_4 from landfills, the introduction of a tax on the final treatment of waste introduced from 1999 and the ban on depositing easily degradable organic waste, which was gradually introduced from 2000. Within the sector, 88.5 per cent of the emissions were from solid waste disposal on land, and 11.5 per cent were from wastewater handling. The remaining 0.01 per cent were from waste incineration. In 2007, most of the sectoral emissions were CH_4, which accounted for 89.2 per cent, while N_2O accounted for 10.8 per cent of sectoral emissions.

83. With regard to the waste sector, the inventory is practically complete in terms of years, categories and gases covered. Emissions were estimated for all categories except N_2O emissions from industrial wastewater. The NIR is generally transparent. CRF tables have been provided for the years 1990–2007, with only minor inconsistencies, mainly in the use of notation keys. Emissions of CH_4 from, and AD for, both deep and shallow unmanaged solid waste disposal sites (SWDS) have been reported as "IE"; however, as no unmanaged landfills have existed in Norway since 1970, they should be reported as "NO". Relevant explanations for all categories have been included in the documentation boxes. The ERT recommends that Norway improve the consistency and accuracy of its use of notation keys in its next annual submission.

84. According to the NIR, CH_4 emissions from solid waste disposal on land were recalculated for the whole 1990–2006 period, particularly data on the distribution of the different types of waste, and waste statistics. The recalculated estimates indicate in a major reduction in CH_4 emissions, with annual reductions increasings over the period from 1.0 Gg in 1990 to 7.3 Gg in 2006. The relative annual reduction in emissions from landfills changed from 1.2 per cent in 1990 to 11.3 per cent in 2006. The impact of the recalculation on the estimate of total national CH_4 emissions rose from 0.3 per cent in 1990 to 3.5 per cent in 2006.

85. Other recalculations were applied for CH_4 from industrial wastewater handling, namely the methane conversion factor (MCF) was recalculated to take into account the use of sealed tanks for black water, and the AD for production of food articles revised for 2006, owing to the use of updated figures in the calculations. Further recalculations resulted in lower estimates for flared CH_4 from biogenic waste incineration during 2002–2006. Recalculations made in the waste sector have been reported in the CRF tables, where the changes in CH_4 from solid waste disposal on land made for the period 1990–2006 have also been summarized.

86. The general QA/QC procedures established for the waste sector have been described in the NIR. Internal checks are now applied for the key category of solid waste disposal on land.

87. The ERT recognizes Norway's effort to improve the quality of its inventory. At the moment, there are no activities planned with the aim of improving data quality for the 2010 NIR. During the review process, the ERT was provided with references, which were not included in the NIR, for managed waste disposal on land and wastewater handling. The ERT encourages Norway to include these references in its NIR in order to improve transparency.

B. Key categories

1. Solid waste disposal on land – CH_4

88. The method and variables used to estimate emissions from this category have been described in detail in the NIR. The emission parameters used in the calculations are a combination of country-specific EFs and IPCC default values. The distribution of the different types of waste has changed since the previous submission, leading to a major recalculation, and the ERT recommends that Norway explain this change in data in its future annual submissions. The series of data used for the calculations starts from 1945 and is appropriate, as are the values used for the methane generation constant.

89. In order to improve transparency in the waste sector, the ERT reiterates its recommendation that Norway, in the NIR of its next annual submission, include data regarding the amount of waste generated, the amount of waste deposited in SWDS and the waste composition used in the calculations, as well as improve the information provided about the procedure used to reconstruct the time series of waste composition for before 1990.

2. Wastewater handling – N_2O

90. The country-specific method, the sources of AD and the sources and values of the EFs used to estimate emissions from this category have been described in the NIR. Emissions of N_2O from domestic and commercial wastewater, for population connected to large wastewater treatment plants, were calculated using a country-specific method. The emissions from human sewage not treated in treatment plants were estimated using the IPCC tier 1 method.

91. In order to improve the transparency of the emission estimates in this category, the ERT recommends that Norway provide in its next annual submission the references given to the ERT during the review process.

C. Non-key categories

1. Wastewater handling – CH_4

92. The IPCC default methodology was used to estimate CH_4 emissions from domestic wastewater and from industrial wastewater. The information provided in the NIR is limited. During the review, the ERT requested the MCF assumptions, calculations and recalculations. In response, the Party referred the ERT to the section of the NIR where the MCF has been mentioned. The ERT recommends that Norway

improve the transparency of its EFs, particularly MCF assumptions, and of its calculations and recalculations, in its next annual submission.

2. Waste incineration – CH_4 and N_2O

93. This category includes emissions from the combustion of biogenic waste and cremation. In order to estimate emissions from this category, Norway used a simple method based on volumes and EFs. Information on AD and EFs used has been provided in the NIR.

VII. Supplementary information required under Article 7, paragraph 1, of the Kyoto Protocol

A. Information on activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol

1. Overview

94. Norway's 2009 annual submission includes an annex IX, which contains supplementary information on LULUCF activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol as required by decision 15/CMP.1. In addition, Norway submitted so called "KP LULUCF tables" which provided estimates of GHG emissions by sources and removals by sinks resulting from activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, using the common reporting format contained in annex II to decision 15/CP.10.

95. Norway provided the selected minimum values of the parameters used for defining forest land, which are consistent with the data from the Food and Agriculture Organization of the United Nations and the IPCC good practice guidance. It has chosen commitment-period accounting for the activities under Article 3, paragraph 3, and for forest management under Article 3, paragraph 4, of the Kyoto Protocol.

2. Information about the geographical location of the boundaries of the areas that encompass units of land subject to activities under Article 3, paragraphs 3 and 4

96. All forest land in Norway is defined as managed. Norway's National Forest Inventory provides data on LULUCF. The Party uses reporting method 2, which is based on spatially explicit and complete geographical identification of all units of land subject to activities under Article 3, paragraphs 3 and 4.

97. The information about the areas subject to afforestation, reforestation and deforestation is based on the National Forest Inventory, which has been carried out continuously since 1986. Data on land use obtained between 1986 and 1993 serve as the 1990-status. The land-use transition matrix is reported in the KP LULUCF tables (for land area and changes in land area subject to various activities during the inventory year) and the methodology used to develop the land-use transition matrix is described in the NIR submitted under the Kyoto Protocol. The ERT finds the methodology presented to be consistent with the IPCC good practice guidance for LULUCF.

3. Information on anthropogenic greenhouse gas emissions by sources and removals by sinks resulting from activities under Article 3, paragraphs 3 and 4, for all geographical locations reported in the current and previous years

98. Norway provided information on GHG emissions and removals under Article 3, paragraphs 3 and 4, in the CRF tables submitted under the Kyoto Protocol. Carbon stock changes in living biomass were estimated using the tier 3 stock change method, while carbon stock changes in dead organic matter and soils were estimated using the Yasso model (tier 3). The use of these models is consistent with the IPCC good practice guidance for LULUCF. However, for the purpose of the review, the ERT recommends that

Norway, in its future annual submissions, be more transparent in its presentation of these models (i.e. by providing information on the main drivers or controlling factors, basic assumptions, limitations, etc.).

99. For units of land harvested since the beginning of the first commitment period, in accordance with activities under Article 3, paragraph 3, Norway provided estimates of the changes in carbon stocks in above-ground and below-ground biomass. No estimates were provided for litter, dead wood and soil pools, since, according to Norway, it was not possible to provide such estimates with its current system. However, in line with the IPCC good practice guidance for LULUCF and in accordance with decision 15/CMP.1, the ERT encourages Norway to make efforts to provide estimates for these carbon pools in its future annual submissions.

100. With regard to the IEF for gains in carbon stocks in living biomass (i.e. the sum of above-ground and below-ground biomass) related to activities under Article 3, paragraph 3, the ERT found the values used (0.17–0.33 Mg C/ha) to be considerably low in comparison with the values used in the NIR submitted under the Convention (ranging from about 0.81–1.11 Mg C/ha). This could be due to regional variation in growth rates as a function of stand age, species, etc. However, this was not explained in either the NIR submitted under the Convention or that submitted under the Kyoto Protocol. For the sake of transparency, the ERT recommends that Norway, in its future annual submissions, explain the reasons for using these low values.

4. Information on factoring out the effect of elevated carbon dioxide concentrations above pre-industrial levels and indirect nitrogen deposition

101. Norway reported that the indirect and natural GHG emissions/removals have not been factored out in the 2009 annual submission.

5. Specific information for Article 3, paragraph 3

102. With regard to the information demonstrating that activities under Article 3, paragraph 3, began on or after l January 1990 and before 31 December 2012 and that these activities are directly human-induced, Norway reported that permanent plots were installed from 1986 until 1993, which made it possible to conduct continuous surveys and directly record land-use changes to and from forest land. Norway assumed that all afforestation, reforestation and deforestation activities since 1994 have been human-induced.

103. With regard to the information on how harvesting or forest disturbance that is followed by the re-establishment of a forest is distinguished from deforestation, Norway reported that its National Forest Inventory teams assess land cover and land use according to national criteria, which are defined in the field instruction, and that they are trained to distinguish between forest management operations and land-use changes. In order to increase transparency and assist the review process, the ERT encourages that Norway, in its future annual submissions, provide the basic steps or decision trees to explain how this is done.

104. With regard to the information on emissions and removals of GHGs from lands harvested during the first commitment period following afforestation and reforestation on these units of land since 1990, Norway presented this information in the CRF tables submitted under the Kyoto Protocol, but only for living biomass. Norway reported that estimating changes in carbon stocks in litter, dead wood and soils is not yet possible with its current system. However, in accordance with the IPCC good practice guidance for LULUCF and consistent with decision 15 CMP.1, Norway should report estimates for these pools in its future annual submissions.

6. Specific information for forest management

105. In order to demonstrate that forest management activities have occurred since 1 January 1990 and are human-induced, Norway reported that all of its forests are subject to forest management. Hence, all land-use changes to and from forest land that occurred after 1990 have been human-induced.

106. Norway has not yet reported any information that indicates to what extent the anthropogenic GHG removals by sinks offset the debit incurred in relation to activities under Article 3, paragraph 3. Norway is recommended to submit this information in its future annual submissions, consistent with the requirements set out in decision 16/CMP.1.

B. Information on Kyoto Protocol units

1. Standard electronic format and reports from the national registry

107. Norway has reported information on its accounting of Kyoto Protocol units in the required SEF tables, as required by decisions 15/CMP.1 and 14/CMP.1. The ERT took note of the findings and recommendations included in the SIAR on the SEF and the SEF comparison report.[6] The SIAR was forwarded to the ERT prior to the review, pursuant to decision 16/CP.10. The ERT reiterated the main findings and recommendations contained in the SIAR.

108. Information on the accounting of Kyoto units has been prepared and reported in accordance with section I.E of the annex to decision 15/CMP.1, and reported in accordance with decision 14/CMP.1 using the SEF tables. This information is consistent with that contained in the national registry and with the records of the international transaction log (ITL) and the clean development mechanism registry, and meets the requirements set out in paragraph 88(a) to (j) of the annex to decision 22/CMP.1. The transactions of Kyoto Protocol units initiated by the national registry are in accordance with the requirements of the annex to decision 5/CMP.1 and the annex to decision 13/CMP.1. No discrepancies have been identified by the ITL and no non-replacement has occurred.

109. The ERT also noted that Norway did not make publicly available all of the information referred to in paragraphs 45, 46 and 48 of the annex to decision 13/CMP.1. During the review, the Party informed the ERT that it had already made changes to the public reports section of its registry website and that it is waiting for a new release of the Greta registry software, expected for December 2009, which will include improved tools for public reporting. The Party indicated that all of the information relating to the findings in the SIAR would be available to the public by the end of 2009. The ERT recommends that Norway enhance, the user interface of its registry by providing the public information referred to above and reports thereon in its next annual submission. Norway should state clearly, in the user interface of its registry, whether this information is confidential or if there are no data to report, including data on Article 6 projects. In addition, Norway should report, in its next annual submission, on any changes made to the list of public information.

2. National registry

110. The ERT took note of the SIAR and its finding that the reported information on the national registry is complete and has been submitted in accordance with the annex to decision 15/CMP.1. The ERT further noted from the SIAR and its finding that the national registry continues to perform the functions set out in the annex to decision 13/CMP.1 and the annex to decision 5/CMP.1, and continues to adhere to the technical standards for data exchange between registry systems in accordance with

[6] The SEF comparison report is prepared by the administrator of the international transaction log (ITL) and provides information on the outcome of the comparison of data contained in the Party's SEF tables with corresponding records contained in the ITL.

decisions 16/CP.10 and 12/CMP.1. The national registry also has adequate security, data safeguard and disaster recovery measures in place and its operational performance is adequate.

111. The national registry has adequate procedures in place to minimize discrepancies. The reported information on the national registry is complete and has been submitted in accordance with the annex to decision 15/CMP.1.

112. The ERT noted that the recommendation made in previous reviews that Norway provide more complete and detailed information on its national registry in its future annual submissions has not been followed. During previous stages of the review process, Norway explained that this recommendation had been addressed by a combination of the original SIAR, the subsequent publication of test results associated with the connection to the ITL, and also the launch of a website to provide more detailed information. Nevertheless, the ERT reiterates the recommendation made in previous reviews that Norway provide more detailed information on its national registry in its future NIRs.

3. Calculation of commitment period reserve

113. In its 2009 submission, Norway has not reported its commitment period reserve. During previous stages of the review process, the Party reported that its commitment period reserve has not changed since the initial report review (225,519,117 t CO_2 eq), as it is based on the assigned amount and not on the most recently reviewed inventory. The ERT agrees with this figure. The ERT recommends that Norway include information on its commitment period reserve in its next annual submission.

C. Changes to the national system

114. In its 2009 annual submission, Norway did not report on changes in its national system. During previous stages of the review process, the Party informed the ERT that there had been no changes in the Norwegian national system since the previous annual submission. The ERT concluded that the Party's national system continues to be in accordance with the requirements of national systems outlined in decision 19/CMP.1. The ERT recommends that Norway, in its next NIR, report any change(s) in its national system in accordance with section I.F of the annex to decision 15/CMP.1.

D. Changes to the national registry

115. Norway reported no significant change in its national registry since the previous annual submission. The ERT concluded that the Party's national registry continues to perform the functions set out in the annex to decision 13/CMP.1 and the annex to decision 5/CMP.1, and continues to adhere to the technical standards for data exchange between registry systems in accordance with relevant CMP decisions. As the Party did not include, in its NIR, the information on whether there had been changes to the national registry, the ERT recommends that Norway, in its next NIR, report any change(s) in its national registry in accordance with section I.G of the annex to decision 15/CMP.1.

VIII. Conclusions and recommendations

116. Norway made its annual submission on 15 April 2009. The Party indicated that the 2009 annual submission is a voluntary submission under the Kyoto Protocol. The annual submission contains the GHG inventory (CRF tables and NIR) and supplementary information under Article 7, paragraph 1, of the Kyoto Protocol (information on Article 3, paragraphs 3 and 4, of the Kyoto Protocol, activities, and information on Kyoto Protocol units). This is in line with decision 15/CMP.1.

117. The ERT concludes that the inventory submission of Norway has been prepared and reported in accordance with the UNFCCC reporting guidelines, the Revised 1996 IPCC Guidelines, the IPCC good practice guidance and the IPCC good practice guidance for LULUCF. The Party has submitted a

complete set of CRF tables for the years 1990–2007 and an NIR; the inventory submission is in general complete in terms of geographical coverage, years, sectors, categories and gases, except for some minor categories: CH_4 and N_2O from oil flaring; potential emissions of SF_6; a number of carbon stock changes in different pools and subcategories in the LULUCF sector (e.g. carbon stock change in dead organic matter and carbon stock change in soils for land converted to forest land) and N_2O from industrial wastewater. The number of subcategories reported as "NE" in the LULUCF sector has decreased in relation to the number in the 2008 inventory submission. In response to questions raised by the ERT during the course of the review, Norway submitted emission estimates for CH_4 and N_2O from flaring of oil in well testing. The Party indicated that these emissions would be included in next year's inventory. The ERT recommends that Norway, in its next annual submission, continue to make efforts to estimate emissions from these categories and reduce the number of blank cells in the corresponding CRF tables.

118. The submission on a voluntary basis of information required under Article 7, paragraph 1, of the Kyoto Protocol has been prepared in accordance with decision 15/CMP.1. Norway has reported supplementary information on LULUCF activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol as required by decision 15/CMP.1. In addition, Norway submitted tables which provided estimates of GHG emissions by sources and removals by sinks resulting from activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, using the CRF. Norway has not reported on a voluntary basis information on the minimization of adverse impacts in accordance with Article 3, paragraph 14 of the Kyoto Protocol The NIR did not include information on changes to the national system or to the national registry. However, information on changes to the national registry was provided in Norway's SIAR submission. The ERT recommends that Norway include this information in its next NIR.

119. Norway has reported information on its accounting of Kyoto Protocol units in accordance with section I.E of the annex to decision 15/CMP.1, and used the required reporting format tables as required by decision 14/CMP.1. However, the ERT found that Norway was not making publicly available all of the information referred to in paragraphs 45, 46 and 48 of the annex to decision 13/CMP.1.

120. The national system continues to perform its required functions as set out in the annex to decision 19/CMP.1.

121. The national registry continues to perform the functions set out in the annex to decision 13/CMP.1 and the annex to decision 5/CMP.1, and continues to adhere to the technical standards for data exchange between registry systems in accordance with relevant CMP decisions.

122. In the course of the review, the ERT formulated a number of recommendations[7] relating mainly to transparency. The key recommendations are that Norway:

(a) Update, and improve the transparency of, its uncertainty estimates;

(b) Make efforts to further reduce the number of empty cells in the CRF tables relating to the industrial processes and waste sectors;

(c) Provide information in its NIR on changes in the national system and the national registry;

(d) Strengthen its QA/QC procedures;

(e) Provide better explanations of the reasons behind recalculations in certain sectors, e.g. limestone and dolomite use, nitric acid production, iron and steel production, and manufacture of anodes;

[7] For a complete list of recommendations, the relevant chapters of this report should be consulted.

(f) Elaborate on the description of the methods used in certain sectors, including industrial processes, agriculture, LULUCF and waste;

(g) Explore the differences between the sectoral and reference approaches, as well as the differences between the energy data submitted in the CRF and those submitted to the IEA;

(h) Make publicly available all of the information referred to in paragraphs 45, 46 and 48 of the annex to decision 13/CMP.1.

IX. Questions of implementation

123. No questions of implementation were identified by the ERT during the review.

Annex I

Documents and information used during the review

A. Reference documents

Intergovernmental Panel on Climate Change. Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories. Available at <http://www.ipcc-nggip.iges.or.jp/public/gl/invs1.htm>.

Intergovernmental Panel on Climate Change. Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories. Available at <http://www.ipcc-nggip.iges.or.jp/public/gp/english/>.

Intergovernmental Panel on Climate Change. Good Practice Guidance for Land Use, Land-Use Change and Forestry. Available at <http://www.ipcc-nggip.iges.or.jp/public/gpglulucf/gpglulucf.htm>.

"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/2006/9. Available at <http://unfccc.int/resource/docs/2006/sbsta/eng/09.pdf>.

"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>.

"Guidelines for national systems under Article 5, paragraph 1, of the Kyoto Protocol". Decision 19/CMP.1. Available at <http://unfccc.int/resource/docs/2005/cmp1/eng/08a03.pdf#page=14>.

"Guidelines for the preparation of the information required under Article 7 of the Kyoto Protocol". Decision 15/CMP.1. Available at <http://unfccc.int/resource/docs/2005/cmp1/eng/08a02.pdf#page=54>.

"Guidelines for review under Article 8 of the Kyoto Protocol". Decision 22/CMP.1. Available at <http://unfccc.int/resource/docs/2005/cmp1/eng/08a03.pdf#page=51>.

Status report for Norway 2009. Available at <http://unfccc.int/resource/docs/2009/asr/nor.pdf>.

Synthesis and assessment report on the greenhouse gas inventories submitted in 2009. Available at <http://unfccc.int/resource/webdocs/sai/2009.pdf>.

FCCC/ARR/2008/NOR. Report of the individual review of the greenhouse gas inventories of Norway submitted in 2007 and 2008. Available at <http://unfccc.int/resource/docs/2009/arr/nor.pdf>.

UNFCCC. *Standard Independent Assessment Report*, Parts I and II. Unpublished document.

B. Additional information provided by the Party

Responses to questions during the review were received from Mr. Eilev Gjerald (Norwegian Pollution Control Authority), including additional material on the methodologies and assumptions used.

Annex II

Acronyms and abbreviations

AD	activity data
C	carbon
ha	hectare
yr	year
CH_4	methane
CO_2	carbon dioxide
CO_2 eq	carbon dioxide equivalent
CRF	common reporting format
CORINAIR	core inventory of air emissions
EF	emission factor
ERT	expert review team
EU	European Union
GHG	greenhouse gas; unless indicated otherwise, GHG emissions are the sum of CO_2, CH_4, N_2O, HFCs, PFCs and SF_6 without GHG emissions and removals from LULUCF
HFCs	hydrofluorocarbons
IE	included elsewhere
IEA	International Energy Agency
IEFs	implied emission factors
IPCC	Intergovernmental Panel on Climate Change
ITL	international transaction log
kg	kilogram (1 kg = 1 thousand grams)
kgoe	kilograms of oil equivalent
LNG	liquefied natural gas
LPG	liquefied petroleum gas
LULUCF	land use, land-use change and forestry
MCF	methane conversion factor
Mg	megagram (1 Mg = 1 tonne)
Mt	million tones
N	nitrogen
NA	not applicable
NE	not estimated
NH_3	Ammonia
NO	not occuring
N_2O	nitrous oxide
NIR	national inventory report
PFCs	perfluorocarbons
QA/QC	quality assurance/quality control
SEF	standard electronic format
SF_6	sulphur hexafluoride
SFT	The Norwegian Pollution Control Authority
SIAR	standard independent assessment report
SSB	Statistics Norway
SWDS	solid waste disposal sites
TJ	terajoule (1 TJ = 10^{12} joule
UNFCCC	United Nations Framework Convention on Climate Change

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