



**UNITED  
NATIONS**



**Framework Convention  
on Climate Change**

Distr.  
GENERAL

FCCC/ARR/2008/NOR  
10 July 2009

ENGLISH ONLY

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**Report of the individual review of the greenhouse gas inventories of Norway  
submitted in 2007 and 2008<sup>\*</sup>**

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<sup>\*</sup> In the symbol for this document, 2008 refers to the year in which the 2008 inventory was submitted, and not to the year of publication.

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## **I. Overview**

### **A. Introduction**

1. This report covers the centralized review of the 2007 and 2008 greenhouse gas (GHG) inventory submissions of Norway, coordinated by the UNFCCC secretariat, in accordance with decision 22/CMP.1. In accordance with the conclusions of the Subsidiary Body for Implementation at its twenty-seventh session,<sup>1</sup> the focus of the review is on the most recent (2008) submission. The review took place from 22 to 27 September 2008 in Bonn, Germany, and was conducted by the following team of nominated experts from the UNFCCC roster of experts: generalist – Ms. Katarina Marečková (European Community) and Mr. Philip Acquah (Ghana); energy – Ms. Erasmia Kitou (European Community), Mr. Luis Conde (Mexico) and Mr. Steven Oliver (Australia); industrial processes – Ms. Natalya Parasyuk (Ukraine) and Mr. Riccardo de Lauretis (Italy); agriculture – Mr. Michael Anderl (Austria) and Mr. Marcelo Rocha (Brazil); land use, land-use change and forestry (LULUCF) – Mr. Atsushi Sato (Japan) and Mr. Harry Vreuls (Netherlands); and waste – Mr. Carlos Lopez (Cuba) and Mr. Davor Vešligaj (Croatia). Mr. Acquah and Mr. Vešligaj were the lead reviewers. The review was coordinated by Mr. Javier Hanna (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. Inventory submission and other sources of information**

3. The 2008 inventory was submitted on 15 April 2008; it contains a complete set of common reporting format (CRF) tables for the period 1990–2006 and a national inventory report (NIR). This is in line with decision 15/CMP.1. Norway indicated that the 2008 submission is also its voluntary submission under the Kyoto Protocol.<sup>2</sup> In its 2007 submission, Norway included a complete set of CRF tables for the period 1990–2005 and an NIR. Where needed the expert review team (ERT) also used the 2006 submission and additional information provided during the review. The full list of materials used during the review is provided in the annex to this report.

### **C. Emission profiles and trends**

4. In 2006 (as reported in the 2008 inventory submission), the main GHG in Norway was carbon dioxide (CO<sub>2</sub>), accounting for 80.8 per cent of national GHG emissions<sup>3</sup> expressed in CO<sub>2</sub> eq, followed by methane (CH<sub>4</sub>) (8.2 per cent) and nitrous oxide (N<sub>2</sub>O) (8.2 per cent). Hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF<sub>6</sub>) collectively accounted for 2.8 per cent of the total GHG emissions in the country. The energy sector accounted for 71.8 per cent of the total GHG emissions, followed by industrial processes (17.2 per cent), agriculture (7.9 per cent), waste (2.8 per cent), and solvent and other product use (0.3 per cent). Total GHG emissions amounted to 53,511.86 Gg CO<sub>2</sub> eq and increased by 7.7 per cent between the base year<sup>4</sup> and 2006.

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<sup>1</sup> FCCC/SBI/2007/34, paragraph 104.

<sup>2</sup> Parties may start reporting information under Article 7, paragraph 1, of the Kyoto Protocol, from the year following the submission of the initial report, on a voluntary basis (decision 15/CMP.1).

<sup>3</sup> In this report, the term “total GHG emissions” refers to the aggregated national GHG emissions expressed in terms of CO<sub>2</sub> eq excluding LULUCF, unless otherwise specified.

<sup>4</sup> “Base year” refers to the base year under the Kyoto Protocol, which is 1990 for CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O, HFCs, PFCs and SF<sub>6</sub>. The base year emissions do not include any possible emissions from deforestation; however, if applicable, these are taken into account when the assigned amount is calculated.

5. In 2005 (as reported in the 2007 inventory submission), total GHG emissions amounted to 54,152.89 Gg CO<sub>2</sub> eq. The shares of gases and sectors in 2006 (2008 inventory submission) were similar to those of 2005 (2007 inventory submission). The trends for the different gases and sectors are reasonable, are in most cases explained in the NIR and are similar in both submissions.

6. Tables 1 and 2 show the GHG emissions by gas and by sector in the period 1990–2006, respectively.

#### **D. Key categories**

7. Norway has applied a key category tier 2 analysis, both level and trend assessment, as part of its 2008 inventory submission, including an uncertainty assessment for emission factors (EFs) and activity data (AD), which is detailed in annex II of the NIR. The following four key categories were identified using qualitative criteria: CH<sub>4</sub> from coal mining and handling, CO<sub>2</sub> from clinker production, CO<sub>2</sub> from ammonia production and CO<sub>2</sub> from CO<sub>2</sub> capture and storage. Norway has also reported a tier 1 analysis in the NIR. Both analyses were performed with and without the LULUCF categories (results are provided in annex I of the NIR) and performed in accordance 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 IPCC *Good Practice Guidance for Land Use, Land-Use Change and Forestry* (hereinafter referred to as the IPCC good practice guidance for LULUCF).

8. Norway followed the recommendation made in the previous review report to aggregate categories by fuel type as per the IPCC default fuels: solid, liquid and gaseous. Norway also aggregated categories 1.A.1, 1.A.2 and 1.A.4 by fuels under stationary combustion. Norway considers CO<sub>2</sub> capture and storage as a key category since presently no methodology is defined in the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the Revised 1996 IPCC Guidelines) and these operations could be considered as country-specific.

9. The key category analyses (tier 1 and tier 2) performed by Norway and the secretariat<sup>5</sup> produced different results, which seem to be mainly due to the use of different levels of aggregation. In the secretariat's analysis, CH<sub>4</sub> from manure management (1990), N<sub>2</sub>O from road transportation (2005) and CO<sub>2</sub> from settlements (2005) were identified as key categories in the previous inventory submission, but not in the latest inventory submission. CO<sub>2</sub> from land converted to forest land (1990), CO<sub>2</sub> from other production (2.D) (2006), CO<sub>2</sub> from land converted to forest land (2006) and CO<sub>2</sub> from wetlands remaining wetlands (2006) became key categories in the latest inventory submission.

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<sup>5</sup> 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 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 Parties that provided a full set of CRF tables for their 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.

**Table 1. Greenhouse gas emissions by gas, 1990–2006**

Greenhouse gas emissions	Gg CO <sub>2</sub> eq								Change base year–2006 (%)
	Base year <sup>a</sup>	1990	1995	2000	2003	2004	2005	2006	
CO <sub>2</sub>	34 774.46	34 774.46	37 784.95	41 576.84	43 317.89	43 845.83	42 861.27	43 258.61	24.4
CH <sub>4</sub>	4 635.14	4 635.14	4 934.32	4 907.94	4 777.02	4 741.41	4 582.02	4 407.74	–4.9
N <sub>2</sub> O	4 718.48	4 718.48	4 404.06	4 517.69	4 467.00	4 624.70	4 734.59	4 372.49	–7.3
HFCs	0.02	0.02	25.82	238.36	402.84	439.42	481.68	518.44	2 828 646.1
PFCs	3 370.40	3 370.40	2 007.74	1 317.90	909.10	879.94	828.65	742.50	–78.0
SF <sub>6</sub>	2 199.78	2 199.78	607.79	934.42	234.86	275.68	312.09	212.09	–90.4

<sup>a</sup> “Base year” refers to the base year under the Kyoto Protocol, which is 1990 for CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O, HFCs, PFCs and SF<sub>6</sub>. The base year emissions do not include any possible emissions from deforestation; however, if applicable, these are taken into account when the assigned amount is calculated.

**Table 2. Greenhouse gas emissions by sector, 1990–2006**

Sectors	Gg CO <sub>2</sub> eq								Change base year–2006 (%)
	Base year <sup>a</sup>	1990	1995	2000	2003	2004	2005	2006	
Energy	29 551.89	29 551.89	32 285.99	35 615.74	38 327.74	38 334.60	37 661.74	38 403.38	30.0
Industrial processes	13 676.82	13 676.82	10 930.55	11 530.32	9 675.94	10 417.24	10 108.59	9 228.54	–32.5
Solvent and other product use	180.02	180.02	174.16	166.86	167.51	168.00	168.28	169.24	–6.0
Agriculture	4 444.57	4 444.57	4 534.23	4 489.09	4 364.27	4 321.01	4 343.53	4 208.99	–5.3
LULUCF	NA	–13 689.46	–13 087.09	–23 387.60	–31 705.23	31 066.16	–34 468.02	–27 829.97	NA
Waste	1 844.98	1 844.98	1 839.76	1 691.14	1 573.25	1 566.13	1 518.16	1 501.71	–18.6
Other	NA	NA	NA	NA	NA	NA	NA	NA	NA
<b>Total (with LULUCF)</b>	<b>36 008.82</b>	<b>36 008.82</b>	<b>36 677.60</b>	<b>30 105.55</b>	<b>22 403.49</b>	<b>23 740.82</b>	<b>19 332.28</b>	<b>25 681.89</b>	<b>–28.7</b>
<b>Total (without LULUCF)</b>	<b>49 698.28</b>	<b>49 698.28</b>	<b>49 764.69</b>	<b>53 493.15</b>	<b>54 108.72</b>	<b>54 806.98</b>	<b>53 800.30</b>	<b>53 511.86</b>	<b>7.7</b>

*Abbreviations:* LULUCF = land use, land-use change and forestry, NA = not applicable.

<sup>a</sup> “Base year” refers to the base year under the Kyoto Protocol, which is 1990 for CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O, HFCs, PFCs and SF<sub>6</sub>. The base year emissions do not include any possible emissions from deforestation; however, if applicable, these are taken into account when the assigned amount is calculated.

## **E. Main findings**

10. Norway has demonstrated sufficient capacity to comply with 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) and the IPCC good practice guidance. The inventory is in line with the Revised 1996 IPCC Guidelines, the IPCC good practice guidance and the IPCC good practice guidance for LULUCF. The 2008 submission is of a high quality, shows continuous improvements in the major issues and is complete in terms of coverage of years, sectors and gases. However, minor categories are missing in the 2008 submission (see para. 12 below). During the centralized review, the ERT identified a need for further improvements in the following areas: performance of quality assurance/quality control (QA/QC) activities, transparency of reporting and consistency between the CRF tables and the NIR. Major differences between the 2007 and 2008 inventory submissions were not identified.

## **F. Cross-cutting issues**

### **1. Completeness**

11. Norway has provided inventory data for the years 1990 to 2006 and included all required CRF tables, with the exception of table 7 (Key categories) for the years 1991–2005, and an NIR. Norway has provided the LULUCF reporting tables as required by decision 14/CP.11 for 1990–2006. Norway has also submitted its NIR covering all required information in line with IPCC good practice guidance and the UNFCCC reporting guidelines.

12. The inventory is complete in terms of years, sectors and gases, in line with the IPCC good practice guidance and the UNFCCC reporting guidelines. Some minor categories are missing in the 2008 inventory submission: CH<sub>4</sub> and N<sub>2</sub>O from flaring – oil, potential emissions of SF<sub>6</sub> (2.F(p)), 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<sub>2</sub>O from industrial waste water – waste water. The number of subcategories not estimated in the LULUCF sector has increased from the 2007 inventory submission.

13. The ERT recommends that in its next annual inventory submission Norway estimate emissions from these categories and make further efforts to reduce the number of blank cells in the CRF tables (e.g. AD of lime production and limestone and dolomite use), provide additional information on waste generation rates and population, and report emissions from bunker fuels (currently reported as not occurring (“NO”)) in order to improve the completeness of the inventory.

### **2. Transparency**

14. The NIR provides much of the information needed to assess the inventory, but the quality of the sectoral chapters varies. Some additional information could improve the transparency of the NIR, for example: more explanations of inter-annual variations and trends of emissions (e.g. in the energy and industrial processes sectors); and more information on important background data and the use of figures and graphs in the NIR (e.g. in the industrial processes sector).

15. In general, data contained in the Norwegian inventory are publicly available. Confidentiality could be an issue for some of the data collected by Statistics Norway (SSB) if there are three or fewer than three entities reporting for one category. Confidential data collected by SSB needed for the inventory are now almost entirely replaced by non-confidential data collected by the Norwegian Pollution Control Authority (SFT).

16. The notation keys are used throughout the CRF tables. However, they are not always used correctly (e.g. for some categories and pools in the LULUCF sector) and the information in the CRF tables is sometimes inconsistent with that provided in the NIR.

17. Based on the information included in CRF summary table 3, the data are largely consistent, with some inconsistencies noted for the oil and natural gas, mineral products, chemical industry, ammonia production, consumption of halocarbons and SF<sub>6</sub>, and enteric fermentation categories. During the centralized review, Norway provided information to the ERT on its plans to correct these inconsistencies in its next annual inventory submission.

18. Norway reports a relatively high number of categories as included elsewhere ("IE") in table 9(a). In most cases a satisfactory explanation has been provided. The ERT encourages Norway to reduce this list in order to increase the comparability and transparency of its inventory.

### 3. Recalculations and time-series consistency

19. Norway provided recalculated estimates for 1990 to 2005 in CRF table 8(a) and explanatory information in CRF table 8 (b) in its 2008 submission. The CRF table 8(b) does not contain explanations for all recalculated categories. The effect of the recalculations on national GHG emissions was a decrease of 0.11 per cent in the estimate for 1990 and a decrease of 0.65 per cent in the estimate for 2005. The ERT recommends that Norway complete table 8(b) for all recalculations in its next annual inventory submission to improve the completeness and transparency of its inventory.

20. The ERT noted that the recalculations reported by the Party of the time series 1990–2005 have been undertaken to take into account a number of improvements (e.g. revised AD in the energy sector, double counting removed and revised EFs for fuels used in navigation, revised method and inclusion of missing data in the LULUCF sector and new data on sewage treatment plants). The major changes in the 2005 emission estimates include a 99.7 per cent decrease in CO<sub>2</sub> emissions from the waste sector, a 62.7 per cent decrease in CH<sub>4</sub> emissions from the industrial processes sector, and a 26.6 per cent increase in CO<sub>2</sub> removals from the LULUCF sector. However, with the exception of the recalculations in the LULUCF sector, the magnitudes of changes are not significant. The rationale for these recalculations is provided in the sectoral chapters of the NIR. In general, the ERT considers these recalculations justified.

### 4. Uncertainties

21. Following the IPCC good practice guidance and the UNFCCC reporting guidelines, Norway has provided in its NIR an uncertainty analysis for each category and for the inventory in total. The NIR states that an IPCC tier 2 uncertainty analysis (using the Monte Carlo method) has been performed including and excluding LULUCF categories. The results of this analysis are presented both at a summary level and at the individual category level. 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, the recommendation from the previous review on the inclusion of table 6.2 of the IPCC good practice guidance has not been followed, which makes the uncertainty estimates less transparent and less comparable.

22. The ERT agrees with findings of the previous review<sup>6</sup> (the estimated uncertainty of CH<sub>4</sub> emissions is rather low) and recommends that Norway investigate this issue further and provide an

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<sup>6</sup> Norway reports in its NIR that in 2004 the total uncertainty decreased to 6 per cent compared with the previous uncertainty analysis (excluding LULUCF). This is mainly due to revisions of the uncertainty estimates of N<sub>2</sub>O emissions from soils, but also partly due to the use of improved methodologies. The uncertainty estimates for CO<sub>2</sub> have not changed, but the CH<sub>4</sub> 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<sub>4</sub> uncertainties seem to be rather low.



explanation or discussion in its next annual inventory submission. The ERT invites Norway to provide information on its plans to update the uncertainty analysis in its next annual inventory submission.

#### 5. Verification and quality assurance/quality control approaches

23. Norway has elaborated a formal QA/QC plan in accordance with decision 19/CMP.1 and 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 by all three institutions involved in the inventory compilation (SSB, SFT and the Norwegian Forest and Landscape Institute). The ERT acknowledges the submission to the ERT of the annual *2008 QA/QC Report for the Norwegian Greenhouse Inventory*, which was completed by the institutions cited above and provides information about checks completed during the latest inventory cycle.

24. The ERT noted that some review procedures were carried out by personnel who were not involved in the inventory preparation process (e.g. cross-checks between institutions), which is in line with the IPCC good practice guidance. The ERT also noted that some recommendations from the previous review have been implemented, but there are still inconsistencies appearing between the CRF tables and the NIR. At present, it seems that QA/QC performance has not ensured full consistency of reported data.

25. The ERT recommends that Norway address errors identified during the review and implement procedures to avoid them in the next annual inventory submission. The ERT recommends 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.

#### 6. Follow-up to previous reviews

26. As a result of recommendations provided in the previous review report, Norway has implemented numerous improvements, including:

- (a) Developing a brief inventory improvement plan;
- (b) Continuing to reduce empty cells in CRF tables;
- (c) Increasing transparency of sectoral chapters of the NIR by providing more explanatory information on trends, methods and AD.

### **G. Areas for further improvement**

#### 1. Identified by the Party

27. The national GHG inventory has undergone substantial improvements over recent years, and the inventory is now considered to be largely complete and transparent. Norway indicated in its NIR and in its responses to previous review stages that it is working to further improve its inventory reporting. Norway identified the following key elements for improvement:

- (a) Further reduce the number of not estimated ("NE") subcategories in the 2009 annual inventory submission;
- (b) Independent peer review and consultation with relevant associations and institutions when undertaking methodological changes;
- (c) Further elaboration of QA/QC routines to compare point-source data with independent calculations to be established by SSB;

- (d) Further elaboration of QA/QC reports, which are to be evaluated and enable the identification of possible improvements, including whether quality objectives have been met;
- (e) In improving the inventory management, all staff involved to become familiar with archiving and documentation structure;
- (f) Further investigations of CO<sub>2</sub> emissions from aluminium production;
- (g) Updating of the methodology for the solvent balance;
- (h) Improve information on the area of forest and other wooded land.

## 2. Identified by the ERT

28. The ERT acknowledges inventory improvements achieved by Norway and recommends that the Party continue in its efforts. The ERT identifies the following cross-cutting issues for improvement:

- (a) Further improve the QA/QC procedures and management system on the basis of the QA/QC plan to avoid inconsistent reporting;
- (b) Improve transparency in reporting results of the uncertainty analysis and the key category analysis in the overview tables included in the NIR, as recommended by the IPCC good practice guidance and the UNFCCC reporting guidelines;
- (c) Further elaborate sectoral chapters of the NIR by providing more precise descriptions of methodologies that differ from those provided or recommended by the IPCC.

29. Recommended improvements relating to specific source/sink categories are presented in the relevant sectoral chapters of this report. After the centralized review, Norway informed the ERT that it will implement some of the recommendations and improve the inventory in general in its 2009 submission (e.g. by updating the methodology for solvent balance, filling in empty cells with notation keys or with figures, reporting more AD and including emissions from bunker fuels). The ERT acknowledges this information and encourages Norway to implement as many recommendations as possible in its next annual inventory submission.

## II. Energy

### A. Sector overview

30. The energy sector is the main sector in the GHG inventory of Norway. In 2006, the energy sector accounted for 38,403.38 Gg CO<sub>2</sub> eq, or 71.8 per cent of total GHG emissions. Between 1990 (base year) and 2006, emissions increased by 30.0 per cent. The key driver for the rise in emissions is the expansion in energy industries and transport activities. Within the sector, 39.0 per cent of the emissions were from transport, followed by 32.7 per cent from energy industries, 10.3 per cent from manufacturing industries and construction, 9.0 per cent from other sectors, and 0.7 per cent from the category other. Fugitive emissions from fuels accounted for 8.1 per cent. CH<sub>4</sub> and N<sub>2</sub>O emissions from the category flaring – oil are reported as “NE”. The ERT recommends that Norway estimate emissions from these categories using country-specific EFs or the IPCC methods available, and include them in its next annual inventory submission.

31. Methodologies, AD and EFs are generally described in a transparent manner in the NIR. Tier 2 methods and country-specific EFs are used across a large number of categories. Plant-specific EFs are used for many emission sources under the oil and natural gas categories.

32. Norway commonly uses the notation key “IE” within the CRF tables for reporting fugitive emission from fuels – oil and natural gas categories. For example, emissions from oil exploration are included under oil flaring. Natural gas subcategories are included under other leakage, while venting includes emissions from oil and gas activities. The NIR provides a description of activities included in the reported categories for natural gas. However, for oil, a description is not provided of where exploration and production is reported. The ERT considers that it would be useful for understanding the estimates and to aid future reviewers in assessing their transparency that Norway provide a description of the structure and relevant characteristics of its oil and gas industry, and explain, not only where categories have been reported elsewhere, but also why. The ERT recommends that Norway provide this information in the NIR of its next annual submission.

33. Recalculations performed in the energy sector in 2005 are mainly associated with the availability of updated energy accounts. Other recalculations were conducted in the stationary, transport and fugitive categories. Recalculations for the year 2005 resulted in a 0.83 per cent decrease in the estimate for CO<sub>2</sub> emissions, a 0.10 per cent increase in the estimate for CH<sub>4</sub> emissions and a 0.61 per cent increase in the estimate for N<sub>2</sub>O emissions. The ERT commends Norway on the detailed information provided on recalculations in its NIR.

34. Some QC problems are evident in the inventory of the sector, for example in CRF table 1.A(a) Norway submitted old data that had been revised during the previous review. Submission errors are also present for international bunker fuels for which AD were reported in CRF table 1.C while CO<sub>2</sub> emissions were reported only in the NIR and not in the CRF tables, where the notation key “NO” was used. Norway has informed the ERT of its intention to resolve these errors. In addition to correcting these errors, the ERT recommends that Norway, in its next annual inventory submission, improve the implementation of QC measures to avoid such errors in the future.

## **B. Reference and sectoral approaches**

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

35. Norway continues to have difficulties reconciling the sectoral approach with the reference approach. For the year 2006, there is a difference of 21.79 per cent in the CO<sub>2</sub> emission estimates. The biggest differences are identified for liquid fuels (37.57 per cent in CO<sub>2</sub> emissions and 41.44 per cent in energy consumption). AD and CO<sub>2</sub> emissions reported using the reference approach are higher than those reported using the sectoral approach for most years. Some explanations are given in the NIR, in which large differences in energy supply and energy use in the Norwegian energy balance are proposed as a possible reason. Norway indicates that these differences may arise from problems in Norwegian oil and gas statistics. Norway acknowledges unsolved problems concerning the data used in the reference approach and has indicated its intent to investigate the issue further as a planned improvement. The ERT encourages Norway to pursue this course of action and acknowledges the improvement in the presentation of energy balance tables in the NIR made in response to a recommendation of the previous review report. The ERT also recommends that Norway follow the UNFCCC reporting guidelines by providing in the documentation box of table 1.A(c) a brief explanation of the cause of any differences in the two approaches greater than 2 per cent. A reference should also be provided, linking to the relevant section in the NIR where any difference is explained in more detail. Significant differences also exist between the reference approach and the International Energy Agency data; for 2006 there is a difference of 18 per cent in apparent consumption for liquid fuels. Norway has indicated that it is investigating this problem and points out that SSB has implemented a quality project with the aim of improving the supply data and removing possible sources of errors. The ERT recommends that Norway include relevant outcomes and progress on this work in the NIR of its next annual inventory submission.

## 2. International bunker fuels

36. For estimates of emissions from marine bunkers, petroleum product sales figures for international sea transport from SSB are used for marine gas oil, heavy distillates and heavy fuel oil. The consumption of aviation bunker fuel in Norway is estimated as the difference between total purchases of jet kerosene for civil aviation and reported domestic consumption. Norway has reported AD, but omitted CO<sub>2</sub> emissions for international bunker fuels in CRF table 1.C. However, emissions are included in table 3.26 of the NIR. The ERT notes that this problem also existed in the 2007 submission. Norway acknowledged this error and aims to rectify it for the next annual inventory submission. The ERT reiterates its recommendation contained in paragraph 34 above that Norway implement QC measures in order to avoid such mistakes in the future.

## 3. Feedstocks and non-energy use of fuels

37. A brief description of feedstocks and non-energy use of fuels is provided in section 3.6.2 of the NIR. Carbon storage factors are based on national conditions for liquefied petroleum gas (LPG), natural gas, coal, coke oven coke and petroleum coke. By-product carbon monoxide (CO) gas that is sold and combusted in some industrial plants is accounted for and reported under the energy sector. The ERT notes Norway's acknowledgement of a possible problem in the reporting of CO. This issue is discussed in paragraph 39 below. Carbon used as a reducing agent is accounted for in the industrial processes sector as per the IPCC good practice guidance.

## 4. Country-specific issues

38. Norway identified CO<sub>2</sub> from the CO<sub>2</sub> capture and storage category as key 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. To further enhance the transparency of these activities, the ERT recommends that Norway include in the NIR of its next annual inventory submission information on the quantity of natural gas (in PJ) associated with the captured and stored CO<sub>2</sub>.

## C. Key categories

### 1. Stationary combustion: solid, liquid and gaseous fuels – CO<sub>2</sub>

39. The CO<sub>2</sub> implied emission factors (IEFs) for solid fuels (143.90–831.01 t/TJ) for the chemicals category between 1990 and 2006 are the highest of the reporting Parties, and much higher than the IPCC default range (94.6–106.7 t/TJ). The CO<sub>2</sub> IEFs decreased by 45.9 per cent between 1990 (331.52 t/TJ) and 2006 (179.48 t/TJ). Emission figures are reported directly by major plants and in some cases the only fuel used is CO gas derived from use of coke as a reducing agent. During the centralized review, Norway, in its response to questions raised by the ERT, explained that the total consumption of fuel at a plant that uses CO gas has probably been under-reported due to confusion with CO gas used as feedstock. Norway has stated that the issue will be followed up and reported on in the NIR of its 2009 submission. The ERT recommends that Norway investigate the treatment and allocation of CO gas and detail the findings in the NIR of its next annual inventory submission, making corrections where necessary.

40. The liquid CO<sub>2</sub> IEFs (35.59–44.71 t/TJ) for petroleum refining are the lowest of the reporting Parties (34.25–87.12 t/TJ) and lower than the IPCC default range (63.07–100.83 t/TJ). This problem was rectified by Norway in the 2007 submission, following the recommendations of the previous review report. However, the problem has reappeared in the 2008 submission and affects allocation of emissions between solid and liquid fuels, but does not affect total subcategory emissions. Norway has stated that it will correct this in the next submission. In addition to making this correction, the ERT recommends that Norway implement specific QC measures to prevent such issues occurring in future submissions.

41. In 2002, AD for manufacturing industries and construction – gaseous fuels are around 25 per cent lower than the AD of preceding and following years. Norway conceded that this was an

error. During the previous review, Norway indicated that it intended to correct the error in the next submission; however, the problem still appears in the 2008 submission. The ERT recommends that Norway rectify this error in the next annual inventory submission.

## 2. Oil and natural gas – CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O

42. CH<sub>4</sub> and N<sub>2</sub>O emissions from the flaring – oil subcategory are reported as “NE”; however, AD and CO<sub>2</sub> emissions are reported. In its response to questions from the ERT during the centralized review, Norway indicated that it intends to report non-CO<sub>2</sub> emissions from this category using country-specific EFs in its next annual inventory submission. The ERT encourages Norway to report these emissions as indicated above.

43. AD for the oil – transport subcategory are reported in the CRF tables for the years 1990 and 1998–2001, but for all other years AD are reported as not applicable (“NA”). However, CH<sub>4</sub> and CO<sub>2</sub> emissions are reported for all years. The ERT recommends that Norway report the missing AD in its next annual inventory submission.

44. AD for the natural gas – other leakage at industrial plants and power stations subcategory are reported in the CRF tables as “NE”; however, CO<sub>2</sub> and CH<sub>4</sub> emissions are reported. In response to questions from the ERT, Norway has stated that it will examine this issue to ascertain appropriate AD to report within the CRF tables. The ERT encourages Norway to do this and include the relevant AD in its next annual inventory submission.

## **III. Industrial processes and solvent and other product use**

### **A. Sector overview**

45. In 2006, the industrial processes sector accounted for 9,228.54 Gg CO<sub>2</sub> eq, or 17.2 per cent of total GHG emissions, and the solvent and other product use sector accounted for 169.24 Gg CO<sub>2</sub> eq, or 0.3 per cent of total GHG emissions. Between 1990 and 2006, emissions from the industrial processes sector decreased by 32.5 per cent and emissions from the solvent and other product use sector decreased by 6.0 per cent. The key driver for the fall in emissions is the decrease of PFCs and SF<sub>6</sub> emissions in metal production. Most of the emissions in 2006 came from metal production, which accounted for 57.9 per cent of the sectoral emissions, while chemical production accounted for 22.7 per cent, mineral products for 10.1 per cent and consumption of halocarbon and SF<sub>6</sub> for 6.6 per cent. Emissions from other production and the category other combined accounted for 2.7 per cent.

46. In response to the recommendations of the previous review report, emissions from flaring of natural gas in the production of methanol are now reported under the category chemical industry – other – methanol (2.B.5). Moreover, Norway improved the transparency of the reporting for most of the categories in the sector, including more detailed information on methodologies and EFs used and a better explanation of emission trends. In the NIR, more details for CO<sub>2</sub> emissions from cement production and additional information regarding plant-specific EFs have been included; for ammonia production, the amount of CO<sub>2</sub> captured and sold to the food and drink industry has been reported; for nitric acid production, an explanation and justification of the level and trend of N<sub>2</sub>O IEFs have been provided; for CO<sub>2</sub> emissions from carbide production, additional information on methodologies and their choice, EFs and time series both for silicon and calcium carbide have been included; for CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O emissions from ferroalloys production, detailed information on methodologies and the trend in IEFs have been included; and for PFC emissions from aluminium production, detailed information regarding the trend in IEFs has been reported, as recommended in the previous review report. The ERT commends Norway for these improvements.

47. AD for some minor categories, such as lime production and limestone and dolomite use, have not been reported in the CRF tables because of confidentiality. During the centralized review, Norway

informed the ERT that it is working to solve the issue of confidentiality and it hopes to include the complete time series of AD in its next annual inventory submission. For other categories, such as food and drink and plastics, AD have not been reported or have been reported as “NA” because they comprise different activities with units that cannot be added together. The ERT encourages Norway to report the complete time series of AD for lime production and limestone and dolomite use in order to improve the transparency of the inventory. The ERT suggests that Norway report in the NIR detailed and complete time series information on AD for the categories, such as food and drink or plastic, for which the sum of AD is not possible.

48. In response to the recommendations of the previous review report, the complete time series of CH<sub>4</sub> and N<sub>2</sub>O emissions from ferroalloys have been recalculated and detailed information on EFs and methodology has been included in the NIR.

## **B. Key categories**

### **1. Nitric acid production – N<sub>2</sub>O**

49. In response to the recommendations of the previous review report, Norway provided more information in the NIR to explain and justify the values and changes over time of the IEF of N<sub>2</sub>O from nitric acid production. During the centralized review, Norway provided additional information regarding the plant-specific production technology and a relative comparison with the technologies provided in the Revised 1996 IPCC Guidelines and the IPCC good practice guidance. The ERT encourages Norway to include a summary of this information in the NIR of its next annual inventory submission.

### **2. Consumption of halocarbons – HFCs**

50. In response to the recommendations of the previous review report, Norway reported in the NIR more information regarding the IEFs of HFCs from leakage (“product life factor”) from commercial and industrial refrigeration, refrigerated transport and mobile air conditioning. This information covers leakage rates per application, justification of the leakage rates used and whether they are country-specific values. Further improvements are planned as new import statistics and information from users and sectors become available. The ERT commends Norway for these improvements and encourages it to continue collecting basic and detailed information for this key category.

## **C. Non-key categories**

### **Solvent and other product use – CO<sub>2</sub>**

51. The ERT observed that CO<sub>2</sub> from the category other – emissions from non-methane volatile organic compounds (3.D.5) has been kept constant since 1998, which Norway explained was due to a lack of recent monitoring data. The ERT reiterates the recommendation from the previous review report and encourages Norway to update emissions from this category in its next annual inventory submission.

# **IV. Agriculture**

## **A. Sector overview**

52. In 2006, the agriculture sector accounted for 4,208.99 Gg CO<sub>2</sub> eq, or 7.9 per cent of total GHG emissions. Emissions from this sector decreased by 5.3 per cent between 1990 and 2006. The key driver for this reduction was the decrease in animal population. Within the sector, 46.1 per cent of the emissions were from agricultural soils, followed by 43.7 per cent from enteric fermentation and 10.1 per cent from manure management. The remaining 0.1 per cent were from field burning of agricultural residues. There is no rice cultivation or prescribed burning of savannas in Norway.

53. The information on the sector in the NIR is generally presented in a transparent and complete way, but the information on some categories could be improved (see specific recommendations in paras. 55–64 below). For each category there is a brief discussion of methodological issues, AD, EFs, uncertainties, completeness, QA/QC procedures and recalculations.

54. Minor recalculations were reported in the 2008 submission, mainly because of the availability of revised figures for AD in recent years. For 2005, recalculations resulted in an increase of 0.01 per cent in total sectoral emissions.

## **B. Key categories**

### **1. Enteric fermentation – CH<sub>4</sub>**

55. In 2006, the enteric fermentation category accounted for 1,838.77 Gg CO<sub>2</sub> eq, or 3.4 per cent of total GHG emissions. Emissions from this category decreased by 5.5 per cent between 1990 and 2006. Mature dairy cattle, mature non-dairy cattle and sheep were the main sources of emissions in this category (40.9, 28.3 and 23.7 per cent, respectively).

56. The tier 2 approach is used for emission estimates for cattle and sheep. The NIR and additional information received from Norway provide a good description of the country-specific parameters used to estimate the EFs. The tier 1 with IPCC default EFs methodology is used for all other animals, with the exception of domestic reindeer, deer, ostrich and fur-bearing animals, for which EFs were ‘scaled’ from other IPCC values.

57. In applying the tier 2 approach, Norway takes into consideration the lifetime of the animal, with the EF being estimated for a specific period (“lambs living for only 143 days and beef cattle which are slaughtered after 540 days”). The approach could be better explained in the NIR and the ERT encourages Norway to provide further information on this issue in its next annual inventory submission.

### **2. Manure management – CH<sub>4</sub>**

58. This category accounted for 306.49 Gg CO<sub>2</sub> eq in 2006, or 0.6 per cent of total GHG emissions. Emissions from this category increased by 2.8 per cent between 1990 and 2006. Mature dairy cattle, mature non-dairy cattle and young cattle were the main sources of emissions in this category (30.4, 22.2 and 11.8 per cent, respectively).

59. The tier 2 approach is used for emission estimates for all animals. The ERT commends Norway for providing detailed information in its NIR on this key category.

### **3. Manure management – N<sub>2</sub>O**

60. This category accounted for 119.47 Gg CO<sub>2</sub> eq in 2006, or 0.2 per cent of total GHG emissions. Emissions from the category decreased by 10.4 per cent between 1990 and 2006. The solid storage and dry lot category is the main source of emissions (85.6 per cent).

61. The IPCC good practice guidance methodology is used with country-specific parameters (nitrogen (N) excreted by different categories of animals) for the emission estimates in this category. No detailed information is provided regarding the N excretion rates in the NIR. During the centralized review, Norway submitted additional information on this; however, it does not fully explain the estimates or allow clear understanding. The ERT recommends that Norway increase the transparency of the estimations of N excretion rates by providing more information or specific background documentation in the NIR of its next annual inventory submission.

62. Norway also applies an ammonia (NH<sub>3</sub>) model to estimate emissions of NH<sub>3</sub>. Such emissions are used to correct the N<sub>2</sub>O emissions from animal waste management systems. The ERT believes that more

information is required on the model and recommends that Norway provide more details or background documentation on the NH<sub>3</sub> model in its next annual inventory submission.

#### 4. Agricultural soils – N<sub>2</sub>O

63. In 2006, agricultural soils accounted for 1,938.51 Gg CO<sub>2</sub> eq, or 3.6 per cent of total GHG emissions. Emissions from this category decreased by 4.8 per cent between 1990 and 2006. Direct emissions (synthetic fertilizers and cultivation of histosols) and indirect emissions (leaching and run-off) are the main sources of emissions (32.4, 17.1 and 17.0 per cent, respectively).

64. The IPCC good practice guidance methodology is used with country-specific parameters for the emission estimates in this category. The NH<sub>3</sub> model is used to estimate ammonia emissions that are deducted from emission from synthetic fertilizers, animal manure applied to soils and pasture, range and paddock manure. The ERT repeats its recommendation that Norway provide more information on the NH<sub>3</sub> model in its next annual inventory submission.

### C. Non-key categories

#### Field burning of agricultural residues – CH<sub>4</sub> and N<sub>2</sub>O

65. This category accounted for 5.74 Gg CO<sub>2</sub> eq in 2006, or 0.01 per cent of total GHG emissions. Emissions from this category decreased by 81.3 per cent between 1990 and 2006. The methodology used was based on the Revised 1996 IPCC Guidelines with default EFs and parameters. The ERT commends Norway for providing detailed information in its NIR for this category.

## V. Land use, land-use change and forestry

### A. Sector overview

66. In 2006, the LULUCF sector accounted for net removals of 27,829.97 Gg CO<sub>2</sub> eq, offsetting 52.0 per cent of total emissions. Net removals from the sector increased by 103.3 per cent between 1990 and 2006. The key driver for the rise in removals is the increase of carbon stock in forest land remaining forest land (73.0 per cent).

67. The whole time series of reported values in the forest land, cropland, wetlands, settlements and other land categories have been recalculated, mainly because of the revision of the methods used to calculate forest biomass and land-use change, and the updating of AD. Consequently, between the 2007 submission and the 2008 submission the estimates of removals in the LULUCF sector decreased by 7.0 per cent for 1990 and increased by 26.6 per cent for 2005.

68. In 2006, within the LULUCF sector, most of the net CO<sub>2</sub> removals came from forest land remaining forest land, which accounted for 94.5 per cent of the net CO<sub>2</sub> sectoral removals. Land converted to forest land and land converted to settlements are also a net CO<sub>2</sub> sink; other categories were sources of emissions in 2006. The ERT notes that tier 2 and higher methodologies have been used for most of the key categories.

69. There are some inconsistencies in the information provided in the NIR and the CRF tables. In the NIR some emissions, including those from carbon losses in living biomass from conversion of forest land to other land-use categories, are reported as estimated, but are not reported in the CRF tables for most of the categories. The ERT recommends that Norway ensure that all emissions and removals are correctly calculated and reported in the CRF tables, including the use of notation keys and the description of methodologies in the NIR in its next annual inventory submission.

70. Norway has developed a framework for monitoring land area and land-use change based mainly on sample plot survey data from the National Forest Inventory. This work is ongoing and land area



assessment is expected to be updated in future inventory submissions. The ERT welcomes Norway's efforts and encourages it to develop a means to address suspected sampling errors for future annual inventory submissions.

71. Category-specific QA/QC procedures, uncertainty assessment and key category analysis have been conducted in the LULUCF sector.

72. As trial reporting, Norway provided some information on activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, in the annex of the NIR submitted in 2007. In this annex, Norway documented outstanding issues and potential difficulties relating to those activities. The ERT notes this effort and encourages Norway to continue making improvements in this area, in particular for the period when reporting of these activities becomes mandatory.

## **B. Key categories**

### **1. Land converted to forest land – CO<sub>2</sub>**

73. Norway reports the conversion area of a single year as the area of land converted to forest land. Norway confirmed to the ERT that it has chosen not to take into account land changes to forest land that may have occurred prior to 1990 because no data from permanent sample plots exist before 1986 and relatively small changes have been detected in total forest land according to the data taken from the Census of Agriculture and Forestry for 1967, 1979 and 1989. This suggests that the calculated soil carbon stock increase in forest land may be underestimated; however, the effect of this appears to be small. Norway also informed the ERT that it will report on the area of land converted to forest land taking into account land-use changes over the last 20 years after the 2010 submission. The ERT encourages Norway to implement this improvement in its future annual inventory submissions.

### **2. Grassland remaining grassland – CO<sub>2</sub>**

74. CO<sub>2</sub> emissions from carbon losses in organic soils under the grassland remaining grassland category are a significant source in the LULUCF sector. The emissions have been estimated by using a country-specific EF and constant area for the whole time series. In the NIR, Norway explained the rationale for assuming the land area of organic soils as constant, and also informed the ERT that it plans to provide new area values and an updated version of the method used in the NIR of its next annual inventory submission. The ERT welcomes this future improvement.

## **C. Non-key categories**

### **Cropland, grassland, settlements and other land – CO<sub>2</sub>**

75. Norway confirmed to the ERT that when forest land changes to the category of other land use, the assumption is that cleared dead organic matter (DOM) “disappears without a trace”, but that it is working on an improved DOM model for the entire LULUCF sector. The ERT welcomes this future improvement by Norway and looks forward to the implementation of this model in its next annual inventory submission.

# **VI. Waste**

## **A. Sector overview**

76. In 2006, the waste sector accounted for 1,501.71 Gg CO<sub>2</sub> eq, or 2.8 per cent of total GHG emissions. During the period 1990–1997 the total GHG emissions in this sector were relatively stable and decreased only from 1998 onwards. In 2006 they were 18.6 per cent lower than in 1990. The most important category in this sector is solid waste disposal on land, which accounts for 90.2 per cent of the

total sectoral emissions. Wastewater handling and waste incineration account for 9.7 per cent and 0.01 per cent, respectively.

77. In spite of increasing amounts of waste generated, the emissions from solid waste disposal on land decreased, and were 20.7 per cent lower in 2006 than in 1990. This is considered to be a consequence of the increase in recycling and incineration activities and the burning of landfill gas. In the same period, emissions from wastewater handling increased slightly (7.2 per cent). In 2006, most of the total sectoral emissions were of CH<sub>4</sub>, which accounted for 90.7 per cent, while N<sub>2</sub>O accounted for 9.3 per cent.

78. The main source of CH<sub>4</sub> emissions is solid waste disposal on land (99.5 per cent). Of the remainder, 0.49 per cent was from wastewater handling and 0.01 came from waste incineration. N<sub>2</sub>O emissions are almost entirely from wastewater handling.

79. The inventory in the waste sector is practically complete in terms of years, categories and gases. Emissions were estimated for all categories except N<sub>2</sub>O emissions from industrial wastewater. The NIR is generally transparent. The CRF tables were provided for the years 1990–2006, with only minor inconsistencies mainly in the use of notation keys. The emissions from the incineration of hospital waste are reported as “NA”, while AD are reported as “NO”. Norway provided information on this to the ERT and indicated that the notation key “IE” is the correct one to use, as hospital waste was incinerated in municipal waste incinerators. Emissions of CH<sub>4</sub> and AD from unmanaged solid waste disposal sites (SWDS) are reported as “IE”, but it is reported in the documentation box of table 6.A that no unmanaged landfills have existed in Norway since 1970. Relevant explanations for all categories are included in the documentation boxes. The ERT recommends that Norway improve consistency and accuracy in the use of notation keys in its next annual inventory submission.

80. The CRF tables report recalculated estimates performed in the waste sector and summarize the changes made for the period 1990–2005. Explanatory information related to the changes that result in recalculations of emissions is provided in the NIR and the CRF tables. According to this information, recalculations of CH<sub>4</sub> emissions from SWDS were due to revised figures from waste accounts of CH<sub>4</sub> emissions from wastewater handling. This is because CH<sub>4</sub> emissions from food processing industries were included in all years since 1990. Other new estimates of emissions are documented for N<sub>2</sub>O emissions from human sewage from the population that is not connected to wastewater treatment plants and for N<sub>2</sub>O emissions from incineration of hospital waste.

81. In the NIR, the general procedures established for QA/QC are described. Although there is no specific information on QA/QC activities for the waste sector, Norway is implementing the formal QA/QC procedures and the activities described are also applicable to this sector.

82. Norway identified CH<sub>4</sub> from managed waste disposal on land and N<sub>2</sub>O from wastewater handling as key categories. The key category analysis performed by Norway and the secretariat produced some different results, which is due to the different approaches used for the analyses.

83. Norway incorporated several improvements to the waste sector in the 2008 inventory submission, in several cases taking into account comments and recommendations made in the previous review report. The ERT especially recognizes Norway's effort to improve the completeness of the inventory, including the estimate of emissions from minor categories not considered in previous submissions (e.g. CH<sub>4</sub> from wastewater in food processing industries, N<sub>2</sub>O from human sewage, N<sub>2</sub>O from incineration of hospital waste). The major changes since the 2007 inventory submission include the reallocation of emissions from flaring of natural gas in the production of methanol activities (from waste incineration to the industrial processes sector), and the improvement of the information provided on the method, AD and EFs used to estimate N<sub>2</sub>O emissions from domestic and commercial wastewater. According to the information provided by Norway, no further improvements are expected in the waste sector in its 2009 submission.

## **B. Key categories**

### **1. Solid waste disposal – CH<sub>4</sub>**

84. For the estimation of CH<sub>4</sub> emissions for the managed waste disposal on land category, a country-specific method based on the first order decay (FOD) model and the waste composition with specific values for the different types of materials (food, waste, papers, wood and textile) was used. The method is an improvement of a previous version developed in 1999 and is the basis of the IPCC waste model included in the *2006 IPCC Guidelines for National Greenhouse Gas Inventories*. The characteristics and equations of the method and the variables used in the calculation are described in detail in the NIR. The emission parameters used in the calculations are a combination of country-specific factors and IPCC default values. The series of data used in calculations starts in 1945 and is appropriate to obtain reasonably accurate results with the values used for methane generation constant (k).

85. The NIR does not provide information on the composition of landfilled waste (municipal and industrial) or on how the series of data of waste composition was obtained (or reconstructed). In response to questions from the ERT during the centralized review, Norway provided additional information regarding the amount of waste deposited in SWDS and its composition since 1990. In order to improve the transparency of the inventory in the waste sector, the ERT recommends that Norway include data regarding the amount of waste generated, waste deposited in SWDS and waste composition used in the calculations, and improve the information and details about the procedure used for the reconstruction of the time series of waste composition before 1990, in the NIR of its next annual inventory submission.

### **2. Wastewater handling – N<sub>2</sub>O**

86. Emissions of N<sub>2</sub>O from domestic and commercial wastewater, for the population connected to large wastewater treatment plants, were calculated using a country-specific method based on a nitrification/denitrification process that occurs in pipelines and on N<sub>2</sub>O emissions produced as a by-product in biological removal plants. The emissions from human sewage that is not treated in treatment plants were estimated using the IPCC tier 1 method. In the NIR the main characteristics of this country-specific method, as well as the sources of AD used and the sources and values of the EFs used, are described. To improve the transparency of the results, the ERT recommends that Norway provide in its next annual inventory submission the figures of the annual estimates of the amount of nitrate supplied to the pipelines and the amount of N removed at the plants.

## **C. Non-key categories**

### **1. Wastewater handling – CH<sub>4</sub>**

87. CH<sub>4</sub> emissions from domestic wastewater were estimated using the IPCC default methodology. This method is also used for industrial wastewater. The information provided in the NIR on the wastewater treatment systems and discharged pathways in the country is limited. To improve the transparency of the results, the ERT recommends that Norway provide in the NIR of its next annual inventory submission information on the distribution of the total wastewater generated, the fractions of collected and uncollected wastewaters and the fractions of these wastewaters that are untreated and treated, including those treated on site (latrine, septic tanks or industrial on-site plants).

88. The information provided in the NIR regarding the generation, use and disposal of sludge is limited. During the centralized review, Norway provided additional information on this issue. The ERT recommends that Norway improve the information on sludge and the allocation of emissions between sectors in the NIR of its next annual inventory submission.

## 2. Waste incineration – CH<sub>4</sub> and N<sub>2</sub>O

89. This category included emissions from the combustion of hospital waste, cremation and landfill gas flaring without energy recovery. For the estimates, Norway used a simple method based on the volume of incinerated material and EFs. Information on AD and EFs used are provided in the NIR; however, some small inconsistencies were noted in the NIR within the text and table 8.4 regarding EFs. Norway reported flaring of landfill gas under the biogenic subcategory and included CH<sub>4</sub> and N<sub>2</sub>O emissions, while CO<sub>2</sub> was reported as “NA”. The ERT encourages Norway to include CO<sub>2</sub> emissions from landfill gas flaring in CRF table 6.C (noting that CO<sub>2</sub> of biogenic origin will not be included in national totals), to clarify in the documentation box of this table that flaring of landfill gas is reported under the biogenic subcategory, to report the values of landfill gas flared and used as AD in the NIR, and to correct small inconsistencies noted in the NIR of its next annual inventory submission.

## **VII. Other issues**

### 1. Changes to the national system

90. Norway has not reported any changes to its national system in the 2008 submission. In response to questions raised by the ERT during the centralized review, Norway confirmed that no changes to the national system have taken place. The ERT recommends that Norway include this information in its next annual submission, as appropriate.

### 2. Changes to the national registry

91. Norway has not reported any changes to its national registry in the 2008 submission. In response to questions raised by the ERT during the centralized review, Norway confirmed that no changes to the national registry have taken place, and informed the ERT that it has passed all steps in the initialization process with the international transaction log (ITL) administrator. The initialization process involved both technical and operational documentation review, connectivity testing and functional testing of the Norwegian registry. The ITL administrator has therefore given Norway's registry authorization to commence live operations with the production environment of the ITL, which started on 21 October 2008. The ERT considers these activities to be in accordance with the requirements of national registries as defined in decision 13/CMP.1. The ERT recommends that Norway include this information in its next annual submission and report on any changes to its national registry, as appropriate.

### 3. Commitment period reserve

92. Norway has not reported its commitment period reserve in the 2008 submission. In response to questions raised by the ERT during the centralized review, Norway reported that its commitment period reserve has not changed since the initial report review (225,519,117 t CO<sub>2</sub> eq). The ERT agrees with this figure and recommends that Norway include information on its commitment period reserve in its next annual submission.

## **VIII. Conclusions and recommendations**

93. Norway has submitted inventory data using a complete set of CRF tables for 1990–2006 and an NIR. The ERT concluded that Norway has demonstrated sufficient capacity to comply with the UNFCCC reporting guidelines. The inventory is in line with the Revised 1996 IPCC Guidelines, the IPCC good practice guidance and the IPCC good practice guidance for LULUCF. The 2008 inventory submission is of a high quality, shows continuous improvements in the major issues, and is complete in terms of years, geographical coverage, sectors and gases. Major differences between 2007 and 2008 submissions were not identified.

94. No changes in Norway's national system have been reported since the initial report review. Norway also reported that there are no changes in the national registry and that its commitment period reserve has not changed since the initial report review.
95. During the centralized review, the ERT identified a need for further improvements in the performance of QA/QC activities and verification, transparency of reporting and consistency between CRF and NIR, as well as consistency with the underlying documentation.
96. The key additional recommendations made by the ERT are that Norway:
- (a) Improve internal consistency and transparency of the NIR and further elaborate its sectoral chapters, for example by providing more precise descriptions of methodologies that differ from those provided or recommended by the IPCC, including explanations of the trends in emissions and IEFs, and important background data, figures and graphs;
  - (b) Improve transparency of its reporting of the uncertainty analysis and the key category analysis in the overview tables included in the NIR, as recommended by the IPCC good practice guidance and the UNFCCC reporting guidelines;
  - (c) Improve consistency in its use of notation keys and documentation boxes.
97. After the centralized review, Norway informed the ERT that it will implement some of the recommendations and improve the inventory in general in its 2009 submission (e.g. by updating the methodology for solvent balance, filling in empty cells with notation keys or with figures, reporting more AD and including emissions from bunker fuels). The ERT acknowledges this information and encourages Norway to implement as many recommendations as possible in its next annual inventory submission.

## **IX. Questions of implementation**

98. No questions of implementation have been identified by the ERT during the review.

Annex

**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/gp/landuse/gp/landuse.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>>.

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“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 2007. Available at <<http://unfccc.int/resource/docs/2007/asr/nor.pdf>>.

Status report for Norway 2008. Available at <<http://unfccc.int/resource/docs/2008/asr/nor.pdf>>.

Synthesis and assessment report on the greenhouse gas inventories submitted in 2007. Available at <<http://unfccc.int/resource/webdocs/sai/2007.pdf>>.

Synthesis and assessment report on the greenhouse gas inventories submitted in 2008. Available at <<http://unfccc.int/resource/webdocs/sai/2008.pdf>>.

FCCC/ARR/2006/NOR. Report of the individual review of the greenhouse gas inventory of Norway submitted in 2006. Available at <<http://unfccc.int/resource/docs/2007/arr/nor.pdf>>.

FCCC/IRR/2007/NOR: Report of the review of the initial report of Norway. Available at <<http://unfccc.int/resource/docs/2007/irr/nor.pdf>>.

**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 methodology and assumptions used. The following documents were also provided by Norway:

Norwegian Pollution Control Authority. 2008. *2008 QA/QC Report for the Norwegian Greenhouse Inventory*.

Norwegian Pollution Control Authority. 2008. Norway's response to the request made by the ERT for information on changes to its national system, changes to its national registry and commitment period reserve.

Norwegian Pollution Control Authority. 2008. Norway's responses to the requests of the ERT for additional information on the GHG inventory submission.

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