Advance Version

COMPLIANCE COMMITTEE **CC/ERT/ARR/2013/33**
22 August 2013

Report of the individual review of the annual submission of Norway submitted in 2012

Note by the secretariat

The report of the individual review of the annual submission of Norway submitted in 2012 was published on 16 May 2013. For purposes of rule 10, paragraph 2, of the rules of procedure of the Compliance Committee (annex to decision 4/CMP.2, as amended by decision 4/CMP.4), the report is considered received by the secretariat on the same date. This report, FCCC/ARR/2012/NOR, contained in the annex to this note, is being forwarded to the Compliance Committee in accordance with section VI, paragraph 3, of the annex to decision 27/CMP.1.

ADVANCE VERSION

United Nations

FCCC/ARR/2012/NOR

Framework Convention on Climate Change

Distr.: General
16 May 2013

English only

Report of the individual review of the annual submission of Norway submitted in 2012*

* In the symbol for this document, 2012 refers to the year in which the inventory was submitted, and not to the year of publication.

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Contents

I. Introduction and summary

1. This report covers the in-country review of the 2012 annual submission of Norway, coordinated by the UNFCCC secretariat, in accordance with decision 22/CMP.1. The review took place from 17 to 22 September 2012 in Oslo, Norway, and was conducted by the following team of nominated experts from the UNFCCC roster of experts: generalist – Ms. Riitta Pipatti (Finland); energy – Mr. Ole-Kenneth Nielsen (Denmark) and Mr. Michael Strogies (Germany); industrial processes – Ms. Ingrid Person (Brazil); agriculture – Ms. Junko Akagi (Japan); land use, land-use change and forestry (LULUCF) – Mr. Mattias Lundblad (Sweden); and waste – Mr. Ole-Kenneth Nielsen. Ms. Person and Ms. Pipatti were the lead reviewers. The review was coordinated by Ms. Xuehong Wang (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.

3. In 2010, the main greenhouse gas (GHG) in Norway was carbon dioxide (CO_2), accounting for 84.3 per cent of total GHG emissions[1] expressed in carbon dioxide equivalent (CO_2 eq), followed by methane (CH_4) (8.1 per cent) and nitrous oxide (N_2O) (5.7 per cent). Hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6) collectively accounted for 1.9 per cent of the overall GHG emissions in the country. The energy sector accounted for 75.6 per cent of total GHG emissions, followed by the industrial processes sector (13.9 per cent), the agriculture sector (7.9 per cent), the waste sector (2.3 per cent) and the solvent and other product use sector (0.3 per cent). Total GHG emissions amounted to 53,898.86 Gg CO_2 eq and increased by 8.2 per cent between the base year[2] and 2010. The trends for the different gases and sectors are reasonable when taking into consideration the specific circumstances of Norway.

4. Tables 1 and 2 show GHG emissions from Annex A sources, emissions and removals from the LULUCF sector under the Convention and emissions and removals from activities under Article 3, paragraph 3, and, if any, Article 3, paragraph 4, of the Kyoto Protocol (KP-LULUCF), by gas and by sector and activity, respectively. In table 1, CO_2, CH_4 and N_2O emissions included in the rows under Annex A sources do not include emissions and removals from the LULUCF sector.

5. Tables 3–5 provide information on the emissions and removals, and accounting parameters that will be included in the compilation and accounting database.

[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 include emissions from Annex A sources only.

Table 1
Greenhouse gas emissions from Annex A sources and emissions/removals from activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, by gas, base year to 2010[a]

			Gg CO_2 eq							*Change*
		Greenhouse gas	*Base year*[a]	*1990*	*1995*	*2000*	*2005*	*2008*	*2009*	*2010*	*Base year–2010 (%)*
Annex A sources		CO_2	34 806.14	34 806.14	37 777.90	41 744.12	43 052.01	44 370.31	42 893.71	45 454.99	30.6
		CH_4	4 666.88	4 666.88	4 868.79	4 733.40	4 460.28	4 351.35	4 324.28	4 345.84	–6.9
		N_2O	4 760.84	4 760.84	4 417.15	4 477.89	4 633.46	3 640.55	3 110.20	3 071.44	–35.5
		HFCs	0.02	0.02	25.82	238.36	481.80	623.92	707.70	746.66	4 073 893.6
		PFCs	3 370.40	3 370.40	2 007.74	1 317.90	828.65	772.74	376.76	205.12	–93.9
		SF_6	2 199.78	2 199.78	607.79	934.42	312.03	65.40	61.46	74.81	–96.6
KP-LULUCF	Article 3.3[b]	CO_2						756.46	368.64	935.49	
		CH_4						IE, NO	IE, NO	IE, NO	
		N_2O						IE, NO	IE, NO	IE, NO	
	Article 3.4[c]	CO_2	NA					–37 722.45	–29 939.49	–36 532.67	NA
		CH_4	NA					6.00	2.51	1.45	NA
		N_2O	NA					13.10	12.78	12.47	NA

Abbreviations: KP-LULUCF = land use, land-use change and forestry emissions and removals from activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, IE = included elsewhere, NA = not applicable, NO = not occurring.

[a] "Base year" for Annex A sources refers to the base year under the Kyoto Protocol, which is 1990 for all gases. The "base year" for activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol is 1990.

[b] Activities under Article 3, paragraph 3, of the Kyoto Protocol, namely afforestation and reforestation, and deforestation. Only the inventory years of the commitment period must be reported.

[c] Elected activities under Article 3, paragraph 4, of the Kyoto Protocol, including forest management, cropland management, grazing land management and revegetation. For cropland management, grazing land management and revegetation, the base year and the inventory years of the commitment period must be reported.

Table 2
Greenhouse gas emissions by sector and activity, base year[a] to 2010

			Gg CO_2 eq							*Change*
		Sector	*Base year[a]*	*1990*	*1995*	*2000*	*2005*	*2008*	*2009*	*2010*	*Base year–2010 (%)*
Annex A		Energy	29 567.00	29 567.00	32 225.28	35 660.08	37 822.24	39 040.29	38 940.67	40 726.35	37.7
		Industrial processes	13 703.41	13 703.41	10 960.62	11 571.47	10 062.11	9 033.55	6 841.85	7 478.68	–45.4
		Solvent and other product use	191.18	191.18	186.74	181.74	183.96	170.23	150.53	169.60	–11.3
		Agriculture	4 522.79	4 522.79	4 601.88	4 542.25	4 408.87	4 329.01	4 268.07	4 276.58	–5.4
		Waste	1 819.68	1 819.68	1 730.68	1 490.55	1 291.04	1 251.20	1 272.99	1 247.65	–31.4
		LULUCF	NA	–8 676.30	–11 431.82	–19 070.43	–29 889.93	–34 694.23	–26 985.33	–32 944.42	NA
		Total (with LULUCF)	**NA**	**41 127.76**	**38 273.36**	**34 375.66**	**23 878.28**	**19 130.05**	**24 488.77**	**20 954.43**	**NA**
		Total (without LULUCF)	**49 804.06**	**49 804.06**	**49 705.19**	**53 446.09**	**53 768.22**	**53 824.27**	**51 474.10**	**53 898.86**	**8.2**
		Other[b]	NA	NA	NA	NA	NA	NA	NA	NA	NA
KP-LULUCF	Article 3.3[c]	Afforestation and reforestation						–71.46	–200.73	–244.68	
		Deforestation						827.92	569.38	1 180.17	
		Total (3.3)						**756.46**	**368.64**	**935.49**	
	Article 3.4[d]	Forest management						–37 703.35	–29 924.20	–36 518.74	
		Cropland management	NA					NA	NA	NA	NA
		Grazing land management	NA					NA	NA	NA	NA
		Revegetation	NA					NA	NA	NA	NA
		Total (3.4)	**NA**					**–37 703.35**	**–29 924.20**	**–36 518.74**	**NA**

Abbreviations: LULUCF = land use, land-use change and forestry, KP-LULUCF = LULUCF emissions and removals from activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, NA = not applicable.

[a] "Base year" for Annex A sources refers to the base year under the Kyoto Protocol, which is 1990 for all gases. The "base year" for activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol is 1990.

[b] Emissions/removals reported in the sector other (sector 7) are not included in Annex A to the Kyoto Protocol and are therefore not included in the national totals.

[c] Activities under Article 3, paragraph 3, of the Kyoto Protocol, namely afforestation and reforestation, and deforestation. Only the inventory years of the commitment period must be reported.

[d] Elected activities under Article 3, paragraph 4, of the Kyoto Protocol, including forest management, cropland management, grazing land management and revegetation. For cropland management, grazing land management and revegetation, the base year and the inventory years of the commitment period must be reported.

Table 3
Information to be included in the compilation and accounting database in t CO_2 eq for the year 2010, including the commitment period reserve

	As reported	*Revised estimates*	*Adjustment*[a]	*Final*[b]
Commitment period reserve	225 519 117			225 519 117
Annex A emissions for current inventory year				
CO_2	45 454 986			45 454 986
CH_4	4 345 837			4 345 837
N_2O	3 068 266	3 071 444		3 071 444
HFCs	746 664			746 664
PFCs	205 117			205 117
SF_6	74 809			74 809
Total Annex A sources	**53 895 679**	**53 898 856**		**53 898 856**
Activities under Article 3, paragraph 3, for current inventory year				
3.3 Afforestation and reforestation on non-harvested land for current year of commitment period as reported	–241 216			–241 216
3.3 Afforestation and reforestation on harvested land for current year of commitment period as reported	–3 463			–3 463
3.3 Deforestation for current year of commitment period as reported	1 180 172			1 180 172
Activities under Article 3, paragraph 4, for current inventory year[c]				
3.4 Forest management for current year of commitment period	–36 518 743			–36 518 743
3.4 Cropland management for current year of commitment period				
3.4 Cropland management for base year				
3.4 Grazing land management for current year of commitment period				
3.4 Grazing land management for base year				
3.4 Revegetation for current year of commitment period				
3.4 Revegetation in base year				

[a] "Adjustment" is relevant only for Parties for which the expert review team has calculated one or more adjustment(s).
[b] "Final" includes revised estimates, if any, and/or adjustments, if any.
[c] Activities under Article 3, paragraph 4, are relevant only for Parties that elected one or more such activities.

Table 4
Information to be included in the compilation and accounting database in t CO_2 eq for the year 2009

	As reported	*Revised estimates*	*Adjustment*[a]	*Final*[b]
Annex A emissions for 2009				
CO_2	42 893 706			42 893 706
CH_4	4 324 281			4 324 281
N_2O	3 106 571	3 110 204		3 110 204
HFCs	707 700			707 700
PFCs	376 759			376 759
SF_6	61 455			61 455
Total Annex A sources	**51 470 472**	**51 474 105**		**51 474 105**
Activities under Article 3, paragraph 3, for 2009				
3.3 Afforestation and reforestation on non-harvested land for 2009 as reported	–200 735			–200 735
3.3 Afforestation and reforestation on harvested land for 2009 as reported	IE, NO			IE, NO
3.3 Deforestation for 2009 as reported	569 375			569 375
Activities under Article 3, paragraph 4, for 2009[c]				
3.4 Forest management for 2009	–29 924 196			–29 924 196
3.4 Cropland management for 2009				
3.4 Cropland management for base year				
3.4 Grazing land management for 2009				
3.4 Grazing land management for base year				
3.4 Revegetation for 2009				
3.4 Revegetation in base year				

Abbreviations: IE = included elsewhere, NO = not occurring.
[a] "Adjustment" is relevant only for Parties for which the expert review team has calculated one or more adjustment(s).
[b] "Final" includes revised estimates, if any, and/or adjustments, if any.
[c] Activities under Article 3, paragraph 4, are relevant only for Parties that elected one or more such activities.

Table 5
Information to be included in the compilation and accounting database in t CO_2 eq for the year 2008

	As reported	*Revised estimates*	*Adjustment*[a]	*Final*[b]
Annex A emissions for 2008				
CO_2	44 370 314			44 370 314
CH_4	4 351 353			4 351 353
N_2O	3 636 770	3 640 553		3 640 553
HFCs	623 915			623 915
PFCs	772 744			772 744
SF_6	65 395			65 395
Total Annex A sources	**53 820 491**	**53 824 274**		**53 824 274**
Activities under Article 3, paragraph 3, for 2008				
3.3 Afforestation and reforestation on non-harvested land for 2008 as reported	–71 458			–71 458
3.3 Afforestation and reforestation on harvested land for 2008 as reported	IE, NO			IE, NO
3.3 Deforestation for 2008 as reported	827 920			827 920
Activities under Article 3, paragraph 4, for 2008[c]				
3.4 Forest management for 2008	–37 703 353			–37 703 353
3.4 Cropland management for 2008				
3.4 Cropland management for base year				
3.4 Grazing land management for 2008				
3.4 Grazing land management for base year				
3.4 Revegetation for 2008				
3.4 Revegetation in base year				

Abbreviations: IE = included elsewhere, NO = not occurring.
[a] "Adjustment" is relevant only for Parties for which the expert review team has calculated one or more adjustment(s).
[b] "Final" includes revised estimates, if any, and/or adjustments, if any.
[c] Activities under Article 3, paragraph 4, are relevant only for Parties that elected one or more such activities.

II. Technical assessment of the annual submission

A. Overview

1. Annual submission and other sources of information

6. The 2012 annual inventory submission was submitted on 15 April 2012; it contains a complete set of common reporting format (CRF) tables for the period 1990–2010 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, accounting of Kyoto Protocol units, changes in the national system and in the national registry, and the minimization of adverse impacts in accordance with Article 3, paragraph 14, of the Kyoto Protocol. The standard electronic format (SEF) tables were submitted on 15 April 2012. The NIR, the CRF tables and the tables containing information on KP-LULUCF activities were resubmitted on 25 May 2012. The annual submission was submitted in accordance with decision 15/CMP.1.

7. Norway officially submitted revised emission estimates on 5 November 2012 in response to questions raised by the expert review team (ERT) during the course of the in-country visit. In response to questions raised by the ERT during the review, the Party submitted a revised estimate for N_2O emissions from sewage sludge used in agriculture on 19 October 2012 (see para. 105 below) and on 1 November 2012 Norway submitted an action plan aiming to resolve the large differences between the reference and the sectoral approaches in the energy sector, as well as the large statistical difference in the national energy balance (see paras. 16, 17 and 54–58 below). The values used in this report are those contained in the Party's submission of 5 November 2012.

8. The ERT also used the previous year's submission during the review. 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 tables and their comparison report) and on the national registry.[3]

9. 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 annex I to this report.

Completeness of the inventory

10. The inventory covers all mandatory[4] source and sink categories for the period 1990-2010 and is complete in terms of years and geographical coverage. However, some categories under the LULUCF sector (see para. 118 below) and under the KP-LULUCF

[3] The SIAR, parts I and II, is prepared by an independent assessor in line with decision 16/CP.10 (paras. 5(a), and 6(c) and (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 tables and their 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.

[4] Mandatory source and sink categories under the Kyoto Protocol are all source and sink categories for which the Intergovernmental Panel on Climate Change (IPCC) *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories*, the IPCC *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* and the IPCC *Good Practice Guidance for Land Use, Land-Use Change and Forestry* provide methodologies and/or emission factors to estimate GHG emissions (with the exception of the methodologies provided in the appendices as a basis for future methodological development).

activities (see para. 160 below) have not been reported. In addition, not all CO_2 emissions from soda ash use under the industrial processes sector have been reported for all years of the time series (see para. 87 below). The ERT recommends that Norway provide estimates for these categories/activities in its next annual submission.

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

Overview

11. The ERT concluded that the national system continues to perform its required functions. However, the ERT notes that Norway needs to resolve the large differences between the reference approach and the sectoral approach, as well as the large statistical difference in the national energy balance (see paras. 16 and 17 below), either by reducing these differences or by providing plausible explanations for the significant differences, in order to enable the national system to continue meeting the requirements of national systems outlined in decision 19/CMP.1.

12. The Party described the changes to the national system since the previous annual submission and these changes are discussed in chapter II.G of this report.

Inventory planning

13. During the in-country visit, Norway explained the national system for the preparation of the inventory, as described in the NIR. The Climate and Pollution Agency (KLIF) was appointed by the Ministry of the Environment as the single national entity with overall responsibility for the national inventory. Other organizations are also involved in the preparation of the inventory. KLIF is responsible for the compilation of the NIR, which is produced in close cooperation with Statistics Norway (SN) and the Norwegian Forest and Landscape Institute (NFLI). SN and NFLI are the principal contributors to the report on their respective sectors. SN is responsible for preparing the estimates for all sectors except the LULUCF sector, performing the key category and uncertainty analyses and compiling the CRF tables. The Norwegian Forest and Landscape Institute (NFLI) prepares the estimates for the LULUCF sector and for the KP-LULUCF activities. In addition, all organizations collect the activity data (AD) for the inventory preparation process in accordance with their defined responsibilities. KLIF has signed agreements with SN and NFLI to ensure that they comply with their responsibilities, which include, in addition to data collection and the calculation of emissions/removals, the implementation of quality assurance/quality control (QA/QC) and archiving procedures, the provision of documentation, making information available for review, and the delivery of data and information in a timely manner in order to meet the reporting deadlines under the Convention and its Kyoto Protocol.

14. Since the previous annual submission, the internal structure of SN has been reorganized so as to merge the unit responsible for preparing the GHG inventory with the unit responsible for preparing the energy statistics. The ERT believes that this change will strengthen the national capacity for the estimation of emissions from the energy sector. In view of the challenges related to the energy sector (see chapter II.B below) this change is very encouraging, although its impact on the inventory preparation process and on the quality of the inventory can only be evaluated at a later stage. In the NIR, Norway has also reported the implementation of new QC routines for comparison of emission estimates, emission factors (EFs), AD and implied emission factors (IEFs) for stationary combustion with the corresponding data for the previous year. The ERT welcomes this change.

15. In addition, Norway's NIR includes an inventory improvement plan. However, the ERT noted that the plan in most cases, does not include the reasons for the planned

improvements or a timetable for their implementation. The ERT encourages the Party to include more detailed information on planned inventory improvements, including objectives and timetables for their implementation, in the NIR of its next annual submission.

16. Overall, the capacity of the national system is sufficient and fulfils the requirements for the qualitative and timely performance of the functions of a national system. However, with respect to the energy sector (see paras. 54–58 below), the ERT concluded that Norway has not fully met the mandatory requirements for national systems in accordance with the annex to decision 19/CMP.1 in terms of: allocating sufficient capacity and resources to facilitate the QA in the energy sector; collecting sufficient AD; and resolving the problem related to large differences between the reference approach and the sectoral approach as well as the large statistical difference in the national energy balance. These differences could indicate an underestimation of the observed domestic energy consumption and hence an underestimation of CO_2 emissions according to the sectoral approach.

17. The ERT recommended that the Party submit revised estimates that incorporate the corrections to the errors identified in the reference and/or sectoral approaches and provide the ERT with a detailed action plan to ensure that Norway is able to demonstrate the complete accounting of fossil fuel consumption in its 2013 and future annual submissions. In response to this recommendation, the Party provided revised estimates incorporating the above-mentioned corrections and an action plan. The ERT welcomes the action plan and strongly recommends that Norway implement the plan accordingly. The ERT notes that the action plan contains a timetable until week 10 of 2013. The ERT recommends that the Party extend the action plan beyond this time frame if the issues have not been resolved by the expected deadline. The ERT also strongly recommends that Norway describe, in the NIR of its next annual submission, the results of the implementation of the action plan and any further actions needed to decrease the above-mentioned differences, or justify that the emissions from domestic consumption are not underestimated (see paras. 54–58 below).

18. In addition, the ERT identified minor technical errors in the CRF tables for the LULUCF sector and the updating of text in the NIR. The ERT encourages Norway to strengthen the collaboration in order to prevent these types of errors from occurring in future annual submissions.

Inventory preparation

Key categories

19. Norway has reported key category tier 1 and tier 2 analyses for 1990 and 2010, both level and trend assessment, as part of its 2012 annual submission. The Party uses the tier 2 key category analysis as the basis for key category identification, and the results are further complemented through a qualitative assessment. Based on this qualitative assessment, those categories that have been identified as key in the tier 1 analysis are added to the list of key categories owing to their relative importance to the level of emissions. In addition, a category for which the country-specific EF differs significantly from the Intergovernmental Panel on Climate Change (IPCC) default value (e.g. CH_4 emissions from coal mining) as well as a country-specific category (carbon capture and storage (CCS)) have been identified as key based on the qualitative assessment. The ERT commends Norway for the comprehensive key category analyses, including the qualitative assessment.

20. Norway has made a change to the allocation of emissions between categories in the industrial processes sector: CO_2 emissions from titanium dioxide production, which were previously reported under iron and steel production, were reallocated to the subcategory other (chemical industry). In the NIR and during the review, Norway explained that this change has not been reflected in the key category analysis due to a reallocation after the key category analysis was performed.

21. The key category analysis performed by Norway and that performed by the secretariat[5] produced different results owing to the different methods used and the key category qualitative assessment conducted by the Party. Although the key category analysis plays a role in prioritizing inventory improvements, at present the prioritization of inventory improvements is predominantly driven by the needs identified by the experts performing the emission/removal calculations.

22. Norway has included the LULUCF sector in its key category analysis, which was performed in accordance with the 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).

23. Norway has identified forest management as a key category for activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol. However, the basis for the identification is not provided in the NIR (either in section 11.6.1 or in section 7.1.3). In addition, the key categories identified for the LULUCF sector indicate that afforestation/reforestation and deforestation should also be included as key categories for the KP-LULUCF activities. The ERT reiterates the recommendation from the previous review report that Norway clearly indicate, in its next annual submission, which activities are identified as key categories under Article 3, paragraphs 3 and 4, of the Kyoto Protocol and provide the rationale for including them as key categories, following the guidance on establishing the relationship between the activities under the Kyoto Protocol and the associated key categories in the UNFCCC inventory as provided in chapter 5.4.4 of the IPCC good practice guidance for LULUCF.

Uncertainties

24. Norway has provided the results of a tier 2 uncertainty analysis in its NIR for each category and for the inventory as a whole (including and excluding LULUCF) for the base year and 2009. In addition, the Party provided the results of a tier 1 uncertainty analysis for 2010 during the review week. The analyses were performed in accordance with 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). The ERT recommends that Norway provide the results of the uncertainty analysis for the latest year of submission in all future annual submissions (the analysis need not be performed using the tier 2 method for each annual submission).

25. According to the results of the tier 1 uncertainty analysis for 2010, the total uncertainty for the GHG inventory is ± 3.5 per cent for the national total excluding the LULUCF sector and ± 25.2 per cent for the national total including the LULUCF sector. The principle for deriving the uncertainties is explained in the NIR and in the report (Sandmo 2011) provided to the ERT during the review week. Although the methodology used to calculate the uncertainty estimates is adequately described, the method used to derive the country-specific uncertainties and their changes over time could have been more fully described, especially with regard to the energy sector. The ERT reiterates the recommendation from the previous review report that Norway provide the rationale for the

[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.

low uncertainty estimates for the AD used to estimate the CO_2 emissions from the energy sector, noting the very large differences between the sectoral and reference approach estimates as well as the large statistical difference in the national energy balance (see paras. 54–58 below).

26. According to the NIR and the Sandmo 2011 report, the uncertainty estimates are updated annually for those categories for which methodological changes or changes to data sources have occurred. The tier 2 uncertainty analysis for the whole inventory is updated periodically, on average every five years.

27. The uncertainty estimates for the LULUCF sector require improvement. The ERT noted that the uncertainty estimates for activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol were not included in the 2012 annual submission. According to the NIR, Norway has implemented a project which aims to improve the uncertainty estimates for the LULUCF categories and provide uncertainty estimates for the KP-LULUCF activities. The Party anticipates that the uncertainty estimates will be available for the 2013 annual submission, or at the latest for the 2014 annual submission. The ERT welcomes this information and encourages Norway to provide the updated and missing uncertainty estimates as soon as possible, at the latest in the 2014 annual submission.

28. Although the uncertainty analysis plays a role in prioritizing inventory improvements, the prioritization of inventory improvements is predominantly driven by the needs identified by the experts performing the emission/removal calculations and the recommendations from ERTs.

Recalculations and time-series consistency

29. Recalculations have been performed and reported in accordance with the IPCC good practice guidance. The ERT noted that the recalculations reported by the Party of the time series 1990–2009 have been undertaken to take into account updated AD, correct errors across all sectors and address the changes to the allocation of categories across the energy and industrial processes sectors. The major changes, and the magnitude of the impact, include the following: an increase in estimated total GHG emissions without LULUCF for the base year (0.07 per cent) and an increase for 2009 (0.35 per cent). The rationale for these recalculations is generally provided in the NIR or in CRF table 8(b), which is an improvement compared to the previous annual submission. In the LULUCF sector, the recalculations have had a more significant effect (at least for the latest reported years), with a net decrease in estimated total GHG emissions with LULUCF of 0.20 per cent for 1990 and a decrease of 5.68 per cent for 2009. However, the rationale for the recalculations and the information on the changes made in the LULUCF sector have not been described in sufficient detail in the NIR (see para. 115 below). The ERT recommends that Norway describe the reasons and provide justification for all recalculations in the next and future annual submissions.

30. The recalculations have resulted in improvements in the accuracy of the inventory and in time-series consistency.

Verification and quality assurance/quality control approaches

31. Norway has elaborated a QA/QC plan in accordance with the IPCC good practice guidance and the annex to decision 19/CMP.1. Although the QA/QC plan is comprehensive and includes information on the new QC checks conducted as part of the inventory preparation process (see para. 14 above), the implementation of the QA/QC plan and the documentation on the QA/QC measures performed annually require improvement. Section 1.6 of the NIR on QA/QC procedures and the sections on category-specific QA/QC and verification approaches do not provide information on whether and how the QA/QC measures have been implemented in relation to the latest annual submission (see para. 134

below). The descriptions provided in the NIR are in many cases related to checks and comparisons which should have been or were implemented several years ago. The descriptions are often so general in nature that it is not possible to evaluate if or when the QA/QC measures were implemented. During the review week, the ERT also noted that not all of the experts were familiar with the QA/QC plan or with which measures they should implement. The ERT recommends that Norway enhance the implementation of the QA/QC plan and ensure that all experts understand the QA/QC plan and its aims and that the Party implement the plan through improved coordination and definition of responsibilities. The implementation of the plan could also be enhanced by setting annual QA/QC objectives, agreeing on the measures needed to achieve these, and evaluating the measures when the inventory is being prepared, with the participation of all experts involved in the inventory preparation process. The ERT also recommends that Norway document the measures implemented on an annual basis as well as the results of these measures, in order to build confidence in its QA/QC management practices.

32. The ERT identified many errors and inconsistencies in the data used in the calculations (see paras. 65, 67, 69, 76, 82, 117 and 134 below). The ERT also noted that the Party had not systematically performed annual updates of the descriptions provided in the NIR and background data in the CRF tables. The ERT therefore recommends that Norway ensure that additional checks are conducted by the experts when finalizing the CRF tables in order to ensure the correctness of the data and the consistency between the data provided in the NIR and in the CRF tables.

33. The ERT notes that the verification studies reported in the NIR were undertaken approximately 10 years ago. During the review week, Norway provided the ERT with additional information on the more recent verification studies, including those that are on-going or planned. The ERT recommends that the Party provide updated information on verification measures in the NIR of its next annual submission.

34. Norway also describes in the NIR the QA procedures for plant-specific data; however, the ERT noted that this information is partly outdated as it does not include the data sources introduced into the inventory preparation process in recent years, including the use of the European Union emissions trading scheme (EU ETS) data. During the review, Norway provided the ERT with comprehensive information on the QA/QC procedures applied to plant-specific data, which showed that the QA/QC procedures are robust and comprehensive. The ERT recommends that the Party include a summary of this information in its next annual submission.

35. For several years, Norway has reported significant differences between the reference and sectoral approach estimates in the energy sector, with the reference approach estimates being higher for most years of the time series. In addition, the statistical difference in the national energy balance is exceptionally high, with production and import being larger than export and consumption. These differences indicate that the emissions from energy consumption could be underestimated. Since 2004 at least, the ERT has recommended that Norway take action to reconcile the differences between the sectoral and reference approaches and/or transparently explain the main causes for the differences. In previous review reports, the ERT had recommended that the Party undertake a project to better understand the differences between the two approaches as well as to identify whether there are any problems with the fuel consumption or carbon content data.

36. In response to the recommendations contained in the 2011 review report, Norway undertook a project to investigate the differences between the sectoral and reference approaches. The Party has reported the results of the project in the 2012 NIR and presented them to the ERT in further detail during the review week. The project resulted in a number of improvements to the accuracy of the data used in the inventory. However, the differences between the sectoral and reference approaches in the most recent years of the time series have increased in spite of these improvements (see para. 54 below). The project has not

been able to reduce or explain the large differences between the two approaches (see para. 55 below).

37. The ERT therefore sought further clarification from Norway as part of the list of potential problems and further questions raised by the ERT during the review week, noting that Norway had not: ensured sufficient capacity for data collection; collected sufficient AD; improved the quality of the AD; facilitated the QA/QC procedures in the energy sector; or ensured sufficient capacity to resolve the problem regarding the large differences between the reference and sectoral approaches. This issue is addressed in further detail in paragraphs 16 and 17 above and paragraphs 54–58 below.

Transparency

38. The Party has provided limited information in the NIR to enable the ERT to assess how the inventory calculations have been made, for example:

(a) The information on the time series for the AD is very scarce in the NIR;

(b) The country-specific methods and the derivation of the country-specific EFs and other parameters are often not described or justified and references to relevant documentation are in some cases missing (see paras. 133, 140 and 143 below);

(c) Some categories are not addressed at all in the NIR (e.g. subcategories under manufacturing industries and construction);

(d) Numerous erroneous text/data entries or text/data that had not been updated from the previous year.

39. The ERT strongly recommends, in line with previous review reports, that Norway prioritize the improvement of the transparency of the NIR, taking into account the detailed comments under the cross-cutting and sectoral sections of the review report. The recommendation encompasses including in the NIR the time series of emissions/removals and AD at an appropriate level as well as country-specific methods, the EFs and relevant parameters used in the estimation of the emissions, the reasons for the use of country-specific methods, the rationale for the recalculations in the LULUCF sector and information on how the recommendations from the previous review reports have been addressed.

Inventory management

40. Norway has an archiving system, which includes the archiving of disaggregated EFs and AD, and documentation on how these factors and data have been generated and aggregated for the preparation of the inventory. The archived information also includes internal documentation on QA/QC procedures, external and internal reviews, and documentation on annual key categories and key category identification and planned inventory improvements. The core institutions responsible for the inventory, KLIF, SN and NFLI, all archive the materials within their responsibilities at their premises. KLIF is currently developing a physical and electronic library to archive the most important methodology reports. During the review week, Norway provided the archived documents requested by the ERT; however, the ERT noted that not all of the information relevant to the inventory calculations (e.g. how the indirect non-methane volatile organic compound (NMVOC) emissions or the EFs for CH_4 emissions from manure management have been derived) has been documented. The ERT welcomes the development of the physical and electronic library and recommends that Norway ensure, when developing the library, that all necessary information on country-specific methods, disaggregated EFs, parameters and AD is documented.

3. Follow-up to previous reviews

41. The NIR lists more than 20 improvements in the inventory implemented since the 2011 annual submission. Most of these improvements are related to changes in the sectoral estimates, including improvements in transparency. In addition, the NIR lists changes and continuous improvements to the national registry, national system and inventory preparation.

42. Despite the above improvements, the ERT notes that Norway should improve its description in the NIR on whether and how it takes into account the specific recommendations from previous review reports in the improvement of its inventory. The ERT notes with concern that the Party has not acted on or addressed many of the recommendations from previous review reports (e.g. regarding the improvement of transparency and QA/QC measures). The ERT recommends that Norway respond to these recommendations by taking the appropriate action or by providing reasons for not taking any action, and that the Party better document its responses and clearly indicate how it has responded to the recommendations or how and when it will address them in future annual submissions. This information should be provided in the sectoral sections of the NIR addressing category-specific recalculations and planned improvements. The ERT also encourages Norway to provide a summary of how it has responded to or plans to respond to the recommendations of the ERT, preferably in tabular format, in the chapter on recalculations and planned inventory improvements.

4. Areas for further improvement identified by the expert review team

43. During the review, the ERT identified several issues for improvement. These are listed in table 6 below.

44. Recommended improvements relating to specific categories are presented in the relevant sector chapters of this report and in table 6 below.

B. Energy

1. Sector overview

45. The energy sector is the main sector in the GHG inventory of Norway. In 2010, emissions from the energy sector amounted to 40,726.35 Gg CO_2 eq, or 75.6 per cent of total GHG emissions. Since 1990, emissions have increased by 37.7 per cent. The key drivers for the rise in emissions are the increases in oil and gas extraction, due to increased recovery at oil fields and new oil and gas fields being discovered on the continental shelf, increased emissions from road transportation due to the increased number and greater use of cars following the 15 per cent growth in the economy and the population during 1990–2010, and increased emissions from public electricity and heat production, especially due to the establishment of two gas-fired power plants in 2007 and 2010. Within the sector, 37.2 per cent of the emissions were from transport, followed by 36.6 per cent from energy industries, 8.9 per cent from manufacturing industries and construction and 8.8 per cent from other sectors. Fugitive emissions from fuels accounted for 7.9 per cent. The remaining 0.7 per cent were from other fuel combustion.

46. Norway has made recalculations for the energy sector between the 2011 and 2012 submissions following changes in AD and EFs, due to the reallocation of emissions and in order to rectify identified errors. The impact of these recalculations on the energy sector is an increase in emissions of 0.2 per cent for 2009. The main recalculations took place in the following categories:

(a) Other sectors (an increase in CO_2 emissions of 2.3 per cent for 2009);

(b) Manufacturing industries and construction (a decrease in CO_2 emissions of 2.1 per cent for 2009);

(c) Transport (an increase in CO_2 emissions of 0.5 per cent for 2009).

Transparency

47. The ERT noted that the methodological descriptions, especially those regarding the emission calculations performed at the plant level, and the descriptions of the AD are not provided in sufficient detail in the NIR to allow the ERT to conduct a thorough review of the energy sector, specifically for the energy industries and manufacturing industries and construction categories. During the review, Norway provided the relevant descriptions and explanations, thereby resolving most of the issues identified by the ERT. The ERT strongly recommends that the Party improve the transparency of the NIR by including more detailed information on the AD, for example by providing a more detailed national energy balance (e.g. by adding more significant digits and by disaggregating fuel groups such as "other gases") and by including in the NIR tables that cross-reference the fuels and sectors in the national energy balance with the fuel groups and categories in the CRF tables. Further, the ERT strongly recommends that Norway provide information on the methodologies used by the companies to estimate emissions and documentation to justify that those methods are in line with the IPCC good practice guidance. In response to the draft review report, Norway informed the ERT that the guidelines for measuring and reporting within the emissions trading system, the voluntary agreement between industry and the authority, and the guidelines for reporting that all plants with a permit have to follow, will be included in the 2013 annual submission.

48. As also identified in the previous review reports, the ERT noted a lack of transparency in the explanations provided for the variations in the comparison of the apparent energy consumption and the CO_2 emissions between the reference and sectoral approaches (see paras. 16, 17 and 35–37 above and paras. 54–58 below).

QA/QC procedures

49. The information provided in the NIR on the QC procedures performed for the energy sector is, in several cases, limited. For example, the ERT identified several errors, albeit minor, in multiple categories (see paras. 65, 67, 69, 70 and 76 below). Norway reports in the NIR that there are no category-specific QC procedures for several categories (e.g. manufacturing industries and construction and other sectors). During the review, Norway informed the ERT that the description is not correct and provided documentation for extensive QC activities within manufacturing industries and the construction. The ERT also noted that several of the recalculations performed in the energy sector are due to the correction of errors. Norway is commended for correcting the identified errors, revisions and reallocation of data. Efforts should also be made in the future to ensure that the number of errors is reduced. The ERT therefore recommends that Norway continue to strengthen the QC procedures with the aim of detecting errors prior to submitting the inventory. Further, the ERT notes that the Party has not performed any QA activities for the energy sector. The QA/QC plan developed for the Norwegian inventory states that: "The inventory and its documentation will be published annually, and industry associations, relevant research institutions, directorates and environmental organizations are invited to review and suggest improvements in the inventory. Any results of this review will be used by the cooperating institutions to improve the inventory". The ERT encourages Norway to consider implementing QA procedures for the energy sector, in line with its QA/QC plan.

50. Norway makes extensive use of plant-specific emissions data, which cover a high share of emissions from the energy sector, in particular for energy industries, manufacturing industries and construction and fugitive emissions from fuels. The NIR does not provide information on the measures implemented to ensure the quality of the

emissions data reported by the plants or operators. During the review, Norway provided detailed information on the QC procedures performed, including examples that demonstrated a well-functioning QC system regarding the use of plant-specific data. The ERT recommends that the Party provide information on the QC procedures in place for plant-specific data and report the results of the QC measures (e.g. by providing examples of the issues identified and the action taken to resolve the identified problems).

51. The ERT further notes that AD are independently collected under the EU ETS and other data sources (e.g. statistical data and the national energy balance). In line with the previous review report, the ERT recommends that Norway compare the plant-specific AD reported under different reporting obligations and report the results in the next annual submission. The comparisons should also include explanations of how the AD are reconciled to ensure that there is no double-counting or omission of emissions data in the inventory in cases where EU ETS data have been used.

Time-series consistency

52. In the NIR, Norway does not provide information on time-series consistency for any categories in the energy sector. This, combined with the lack of transparent information on the AD used, severely hampers the ability of the ERT to review the inter-annual changes. The ERT recommends that the Party include a discussion in the NIR on time-series consistency, for example in situations where methodological changes cannot be applied to the whole time series, and where sudden changes in the fuel mix cause significant changes in the resulting IEFs.

Planned improvements

53. The 2012 NIR identifies the following planned improvements:

(a) The implementation of a project with the aim of improving the consistency between the different sources of energy data and between the GHG emissions estimated using the sectoral and reference approaches;

(b) A further investigation of the AD used for road transportation and the time series for the consumption of liquid fuels used in road transportation;

(c) The preparation and provision of a report to describe the new model used for road transportation;

(d) The improvement of the accuracy of the estimate for the fuels used in navigation, including the possibility of using Automatic Identification System data and/or data from the national accounts. In response to the draft review report, Norway informed the ERT that there are no plans to use Automatic Identification System data in the near future;

(e) The implementation of a project with the aim of improving the methodology used for non-road machinery;

(f) The evaluation of the EF for coal mining based on measurements. Several recommendations from the previous review reports have not yet been addressed (e.g. paras. 37, 39, 44, 45 and 46 from the 2011 review report). In general, Norway does not provide any references to the recommendations from the previous review reports, either in the section on recalculations or in the section on planned inventory improvements in the NIR. To increase transparency, the ERT recommends that Norway track the recommendations made in the previous review reports and address their status of implementation, either in the section on recalculations or in the section on planned inventory improvements, in future annual submissions.

2. Reference and sectoral approaches

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

54. The difference in the CO_2 emission estimates between the reference approach and the sectoral approach was 27.3 per cent in 2008, 22.4 per cent in 2009 and 41.0 per cent in 2010. These large differences are also observed for other years of the time series (e.g. 12.7 per cent for 1991, 13.7 per cent for 1998, 26.8 per cent for 1999, 51.2 per cent for 2000, 28.3 per cent for 2001, 34.0 per cent in 2004, 27.1 per cent for 2005 and 31.0 per cent for 2006) and have been noted in previous review reports. The inter-annual fluctuations vary considerably and the reference approach yields the higher estimate in all cases showing the largest divergence (above 12 per cent). This issue seems to be affecting all fuels (e.g. a 55.8 per cent difference in the CO_2 emission estimate for liquid fuels, a 71.3 per cent difference for solid fuels and a 19.2 per cent difference for gaseous fuels for 2010). There are also large differences in the apparent energy consumption between the sectoral and reference approaches; the trend in the difference is similar to that of the CO_2 emission estimates. In section 3.6.1 of the NIR, Norway explains that the reason for these inter-annual variations is primarily due to the large statistical differences in Norway's national energy balance.

55. The comparison of the CO_2 emission estimates between the sectoral approach and the reference approach is an important QA measure in the inventory preparation process. Since 2004 at least, the ERT has recommended that Norway take appropriate action to reconcile the differences between the two approaches and/or transparently explain the main reasons for the differences. In response to the 2011 review report, Norway undertook a project to investigate the differences between the sectoral and reference approaches. In the 2012 NIR, the Party has reported the results of the project, including a number of improvements to the data used (e.g. taking into account natural gas exports from a number of new fields that were previously omitted from the foreign trade statistics). However, the differences in the more recent years of the time series have increased, even following these improvements. The ERT concluded that, even though Norway has provided additional information in the 2012 NIR, this has neither reduced nor explained the large differences between the sectoral and reference approaches.

56. The ERT therefore sought further clarification from Norway as part of the list of potential problems and further questions raised by the ERT during the review week, noting that Norway had not: ensured sufficient capacity for data collection; collected sufficient AD; improved the quality of the AD; facilitated the QA/QC procedures in the energy sector; or ensured sufficient capacity to resolve the problem regarding the large differences between the reference and sectoral approaches. In its response to the list of potential problems and further questions raised by the ERT during the review week, Norway provided an action plan aimed at resolving the issues identified and strengthening the QC checks carried out for the reference and sectoral approaches. The action plan includes the establishment of a liaison group between KLIF and SN as well as separate working groups to address the quality of the data used in the reference and sectoral approaches. The working groups consist of members from all relevant organizations under the management of SN. The plan presents a detailed timetable of action between October 2012 and March 2013 and provides information on specific QC checks to be undertaken for both the sectoral and the reference approaches. In addition, Norway provided revised CRF tables in which the difference in CO_2 emissions between the sectoral and reference approaches was reduced for the years 2007–2010; however, the ERT notes that the difference remained large.

57. The ERT considered the action plan provided by Norway and concluded that it addressed all of the relevant issues identified in the list of potential problems and further questions. However, the ERT notes that without the full and effective implementation of the action plan, the underlying problems will not be resolved.

58. The ERT strongly recommends that Norway, in its 2013 annual submission, transparently and comprehensively report on the outcomes of the action plan, including the results of all the QC checks carried out for both the sectoral and the reference approaches and for all fuel groups (i.e. solid, liquid and gaseous).

International bunker fuels

59. Emissions from international bunkers are calculated in accordance with an IPCC tier 2 approach. In particular, Norway calculates its bunker fuel emissions based on the origin and destination of flights and the categorization of fuels within its energy balance. This allows for an accurate distinction between the fuels used for domestic purposes from those used for international travel. No issues were identified by the ERT with regard to the methodology used.

Feedstocks and non-energy use of fuels

60. Norway reports CO_2 emissions from the non-energy use of coal, coke, petroleum coke, natural gas and liquefied petroleum gas under the industrial processes sector. The Party has not completed CRF table 1.A(d) on the sectoral background data used for the energy sector; hence, there is no indication as to where the non-energy use of fuels occurs and where the associated emissions are reported under the industrial processes sector. During the review, in response to questions raised by the ERT, Norway provided information showing the balances for the five most used fuels in terms of non-energy use. The ERT recommends that the Party complete CRF table 1.A(d) in its next annual submission. Further, the ERT recommends that Norway provide, to the extent possible, balances showing that all non-energy use of fuels is accounted for under the industrial processes sector, in the NIR of its next annual submission.

61. In the previous review report, the ERT recommended that Norway include the carbon balances in the NIR. During the review, and in response to a question raised by the ERT, the Party provided carbon balances for iron and steel production, pig iron production and ferroalloys production. The ERT reiterates the recommendation from the previous review report that Norway prepare carbon balances on an annual basis for these categories as part of its QC measures and report on the results in the NIR.

Country-specific issues

62. Norway identified CCS as a key category using qualitative criteria. The ERT notes that the Party has monitoring and measurement processes in place to determine and report (under the category fugitive emissions from oil and natural gas) whether fugitive emissions from CCS sites occur. The ERT acknowledges the detailed information provided in the NIR and additionally during a presentation during the review week. The ERT commends Norway for the transparent and comprehensive information provided on this country-specific activity.

63. Norway reports indirect CO_2 emissions from the atmospheric oxidation of CH_4 and NMVOCs for several categories in the energy, industrial processes and solvent and other product use sectors. To convert the emissions to CO_2, Norway uses the carbon content of CH_4, and for the NMVOC emissions, Norway assumes a carbon content of 82 per cent. However, Norway could not provide a reference or the underlying assumptions used for this conversion factor. The ERT recommends that Norway provide a reference in the NIR in the energy, industrial processes and solvent and other product use chapters and include a discussion on the applicability of the same conversion factor for all sources of NMVOCs.

3. Key categories

Stationary combustion: gaseous, liquid, solid, biomass and other fuels – CO_2, CH_4 and N_2O[6]

64. Norway does not divide the emissions from waste incineration into the fossil and biogenic fractions, but reports all fossil emissions under other fuels. The emissions from the biogenic fraction of the waste should be reported under biomass in accordance with the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the Revised 1996 IPCC Guidelines). The ERT therefore recommends that Norway split the consumption of waste and emissions from waste incineration into the fossil and biogenic fractions and report them under biomass and other fuels, respectively, in the relevant CRF tables in the next annual submission.

65. During the review, the ERT identified that the CO_2 IEF for gaseous fuels for public electricity and heat production varied significantly during the more recent years of the time series (e.g. 44.71 t/TJ in 2004, 39.27 t/TJ in 2005, 48.53 t/TJ in 2008, 62.08 t/TJ in 2009 and 60.47 t/TJ in 2010). In response to questions raised by the ERT during the review, Norway explained that this was due to a combination of the incorrect allocation of emissions and errors in the calculation of the residual fuel consumption when combining the EU ETS data with the national energy balance. Norway provided a corrected time series for gaseous fuels during the in-country review. The errors caused a slight overestimation of emissions for the more recent years of the time series. The ERT recommends that Norway correct this error in the next annual submission.

66. As also identified in the 2011 review report, the ERT noted significant inter-annual variations in the CO_2 IEFs for other fuels for public electricity and heat production; for example, the 1996 value (51.50 t/TJ) is 115.8 per cent higher than the 1995 value (23.90 t/TJ). This issue was not addressed by the Party in the 2012 annual submission. Therefore, the ERT reiterates the recommendation that Norway revise the CO_2 EFs for other fuels used in the calculation of the emission estimates for this category in accordance with the IPCC good practice guidance, in order to ensure time-series consistency in its next annual submission, and that the Party explain any significant differences between the country-specific IEFs and the default values contained in the Revised 1996 IPCC Guidelines.

67. During the review, the ERT identified that the CO_2 IEF for liquid fuels for iron and steel in 2010, 53.59 t/TJ, is low compared to the IPCC default values for the most common liquid fuels (e.g. 74.07 t/TJ for gas oil) and to the values used by other reporting Parties (ranging from 64.35 to 93.66 t/TJ) and has decreased from 70.72 t/TJ in 2009. The value for 1990 is also very low, 41.26 t/TJ. In response to questions raised by the ERT during the review, Norway explained that this significant fluctuation was due to the incorrect allocation of emissions between fuel types. The ERT recommends that the Party correct this error in its next annual submission and improve the QC procedures performed, in order to minimize the risk of this type of error from occurring in the future.

68. As also identified in the previous review report, the ERT noted significant inter-annual fluctuations in the CO_2 IEFs for gaseous fuels for chemicals in CRF table 1.A(a) and very high values (56.06–102.9 t/TJ), especially for the latest years of the times series (2005–2010) (81.62–102.9 t/TJ), compared to the IPCC default value for natural gas (56.1 t/TJ). During the review, Norway provided the ERT with access to the reports from

[6] Not all emissions related to all gases under this category are key categories, particularly N_2O emissions. In addition, the CH_4 emissions relate to biomass. However, since the calculation procedures for issues related to this category are discussed as whole, the individual gases are not assessed in separate sections.

companies that combust fuel gas from ethylene crackers, which provide information on the methods used to calculate the EFs. Based on the information provided by the Party, the ERT concluded that the methods used to calculate the EFs were correct and that the inter-annual fluctuations and high value of the EF for the recent years of the time series are explained by the composition of the fuel gas. The ERT recommends that Norway include, in its next annual submission, additional information on this issue, including references to the company reports in the NIR.

69. The values of the CO_2 IEFs for liquid, solid and other fuels under other (manufacturing industries and construction) are unusual, considering the fuel mix reported in the energy balance and the inter-annual fluctuations (e.g. liquid fuels (69.65–76.28 t/TJ), solid fuels (84.16–106.49 t/TJ) and other fuels (40.88–48.27 t/TJ)). During the review, Norway explained that this is caused by the incorrect allocation of fuels between the IPCC fuel categories, primarily in cement production. The ERT recommends that the Party correct this error in the next annual submission and improve its QC procedures to avoid this type of error in the future.

70. During the review, the ERT identified that the value of the IEF for liquid fuels under residential in 2010 (79.91 t/TJ) was very high compared to the IPCC default values for the most common liquid fuels (e.g. 74.07 t/TJ for gas oil) and to other reporting Parties (ranging from 62.44 to 74.69 t/TJ). Norway explained that the emissions from paraffin wax use had been included, but not the consumption. Further, the Party explained that the emissions from paraffin wax use were allocated to the stationary combustion category and were not allocated to the industrial processes sector (the subcategory other (industrial processes)) due to confidentiality reasons, since there is only one producer of paraffin wax in Norway. The ERT recommends that the Party report, in its next annual submission, the consumption of and emissions from paraffin wax use together. Further, the ERT encourages Norway to report this category under the industrial processes sector, in accordance with the Revised 1996 IPCC Guidelines.

Road transportation: gasoline and diesel oil – CO_2

71. The use of bioethanol and biodiesel is reported together with gasoline and diesel use in road transportation. This means that the CO_2 IEFs reported in CRF table 1.A(a) have shown a decreasing trend in the more recent years of the time series; for example, the CO_2 IEF for gasoline has decreased from 71.30 t/TJ in 2007 to 70.85 t/TJ in 2010 and the CO_2 IEF for diesel oil has decreased from 73.55 t/TJ in 2005 to 69.43 t/TJ in 2010. Consumption of and emissions from biofuels should be reported under biomass in the CRF tables, in accordance with the Revised 1996 IPCC Guidelines. During the review, Norway confirmed that data were available to allow the consumption and emissions to be split. The current practice impacts the comparability of the data with those of other reporting Parties. The ERT recommends that, in its next annual submission, Norway report the consumption of and emissions from biofuels separately under biomass in the CRF tables. Further, the ERT recommends that the Party include, in the NIR of its next annual submission, information on the amount of bioethanol and biodiesel used and on the applied EFs.

Fugitive emissions from oil and natural gas: CO_2 and CH_4

72. The reporting of fugitive emissions from oil and gas is not fully transparent. There is a substantial use of the notation key "IE" (included elsewhere) in the CRF tables, including for: exploration and production of oil; exploration, production/processing and transmission of natural gas; venting in oil and gas; and flaring in combined production. During the review, the Party explained the methodology and reasons for the aggregated reporting of categories. The ERT recommends that Norway improve the description provided in the NIR, including the rationale for reporting under the current categories instead of using the more detailed disaggregation according to the CRF categories.

73. The national energy balance contains data on losses in addition to specific fuel consumption for flaring in oil and gas extraction. During the review, Norway clarified that the losses are due to flaring in several categories and provided information on the relevant categories where the consumption and emissions are reported. The ERT recommends that Norway include this information in the description of the energy balance in the NIR of its next annual submission.

4. Non-key categories

Road transportation: gaseous and liquid fuels – CH_4 and N_2O

74. For non-CO_2 gases, Norway uses a bottom-up model to estimate the emissions. The fuel consumption estimated using the bottom-up approach is not scaled to match the registered fuel sales, contrary to good practice. The ERT notes that this has a very minor effect on the direct GHG emissions and that the current estimate leads to a slight overestimation of emissions. However, the impact on the indirect GHG emissions could be significant. The ERT encourages Norway to reconcile the fuel consumption estimated using the bottom-up approach with the registered fuel sales in its next annual submission. In response to the draft review report, Norway stated that no clear correlation has been found between changes in emission factors for CO_2 and non-CO_2 pollutants between different traffic situations and driving modes and that Norway disagreed with the encouragement by the ERT.

75. As noted in the previous review report, there is a significant inter-annual variation in the N_2O IEF for gasoline in road transportation between 2004 (3.31 kg/TJ) and 2005 (1.88 kg/TJ). At the request of the ERT, Norway provided during the review the relevant input data for the model. The change in the IEF was linked to a lower sulphur content of gasoline which leads to a reduced deactivation of the catalyst and reduced N_2O formation. This finding is backed up by several international peer-reviewed papers. The ERT recommends that Norway include this information in the discussion on time-series consistency within the road transportation category in the NIR. In response to the draft review report, Norway informed the ERT that the information has been included in the 2013 annual submission.

Other: biomass – CO_2

76. The ERT noted that CO_2 emissions from biomass under other (stationary combustion) (1.A.5.a) had been reported as not occurring ("NO") in 2010 even though the fuel consumption had been reported. Norway confirmed that this was an error and that the emissions had erroneously been allocated to the category commercial/institutional. The ERT recommends that Norway correct this error in the next annual submission.

C. Industrial processes and solvent and other product use

1. Sector overview

77. In 2010, emissions from the industrial processes sector amounted to 7,478.68 Gg CO_2 eq, or 13.9 per cent of total GHG emissions, and emissions from the solvent and other product use sector amounted to 169.60 Gg CO_2 eq, or 0.3 per cent of total GHG emissions. Since 1990, emissions have decreased by 45.4 per cent in the industrial processes sector, and decreased by 11.3 per cent in the solvent and other product use sector. The key drivers for the fall in emissions in the industrial processes sector are the reduction in PFC emissions from aluminium production due to technology improvements (–93.9 per cent); the decrease in CO_2 emissions from both silicon and calcium carbide production (–81.3 per cent) due to the closure of plants in 2006 and 2003, respectively; and the reduction in SF_6 emissions from aluminium and magnesium foundries, as a result of production ceasing in

2002 and casting in 2006 (–100.0 per cent). In addition, an agreement between the Ministry of the Environment and the users and producers of electrical gas insulated substation equipment to reduce SF_6 emissions, together with a significant reduction in N_2O emissions from nitric acid production as a result of the use of abatement technology (–82.9 per cent), contributed to the decreasing emissions trend. Within the industrial processes sector, 56.7 per cent of the emissions were from metal production, followed by 16.1 per cent from chemical industry, 13.8 per cent from mineral products and 11.0 per cent from consumption of halocarbons and SF_6. The remaining 2.4 per cent were from the category other (industrial processes).

Recalculations

78. The Party has made recalculations for the industrial processes sector between the 2011 and 2012 submissions following changes in AD for lime production (for the years 1990–2007), iron and steel production, ferroalloys production (for the years 2007 and 2008), aluminium production and SF_6 emissions from electrical equipment, and in order to rectify identified errors. CO_2 emissions from titanium dioxide production were reallocated from iron and steel production to other (chemical industry) and CO_2 emissions from combustion reported under the energy sector were reallocated to process emissions under plastics production. The impact of the recalculations on the industrial processes sector is an increase in emissions of 0.2 per cent for 2009. In the 2012 NIR, Norway provided justification for every category recalculation or reallocation, in line with the recommendations from the previous review reports. The main recalculations took place in the following categories:

(a) Iron and steel production: CO_2 emissions increased by 2.0 Gg for 2009 due to the use of revised data. At the same time, CO_2 emissions from titanium dioxide production were reallocated from iron and steel production to titanium dioxide production under other (chemical industry);

(b) Plastics production: CO_2 emissions increased by 1.5–2.0 Gg annually during the period 1990–2008 due to the reallocation of emissions from combustion to process emissions.

79. The Party has made recalculations for the solvent and other product use sector between the 2011 and 2012 submissions following changes in AD, and in order to rectify identified errors. The impact of these recalculations on the solvent and other product use sector is a decrease in emissions of 5.5 per cent for 2009. The main recalculations took place in the following category:

(a) Solvent and other product use: indirect CO_2 emissions for 2009 decreased by 8,798 t due to the use of revised data on the formic acid used for ensilage and cosmetics, resulting in a decrease in emissions of 7.6 per cent for 2009.

Completeness

80. The reporting on the industrial processes sector is almost complete. However, some additional uses of soda ash have not been reported (see para. 87 below).

Transparency

81. During the review, Norway clearly explained the sources of the AD and EFs used for the reporting under the EU ETS, voluntary agreements and environmental permits, and how these sources are cross-checked and used in the calculation of the inventory estimates. Such explanations have previously been attached as an annex to the NIR, but this was not done for the 2010 and 2012 NIR due to there being very few changes from one year to another. The ERT recommends that the Party improves the descriptions of the methods used to calculate the emission estimates in order to allow the ERT to review the consistency

of the methods used by the Party with the IPCC default methodologies. The ERT also recommends that Norway includes more information about the AD and EFs and a discussion on the inter-annual fluctuations in the IEFs, at least for the key categories.

QA/QC and verification approaches

82. In the 2012 annual submission, nearly all GHG emissions from industrial processes are calculated by SN or using data from annual plant-specific reports, and the ERT assessed the estimates as accurate. The ERT found several minor errors in the NIR, including editing errors and inconsistencies in the information provided in the CRF tables. For example, according to the overview text in the NIR, the contribution of chemical industry to the overall sectoral emissions is 12.0 per cent, while the CRF tables contain a value of 16.1 per cent. Similarly, the share of emissions from metal production in total sectoral emissions is 60.8 per cent and amounts to 8.4 per cent of total national estimated GHG emissions according to the NIR, while CRF table summary 2 contains corresponding values of 56.7 per cent and 7.9 per cent, respectively. These and other similar errors identified by the ERT were minor when analysed individually, but when combined, they demonstrate the need to improve the sector-specific QC procedures. The Party explained that the reason for the different numbers was due to the late reallocation of emissions from the production of titanium dioxide, which were moved from iron and steel production to other (chemical industry). Nevertheless, the ERT recommends that Norway improve the sector-specific QC procedures, in order to avoid similar errors from occurring in the next and future annual submissions.

2. Key categories

Lime production – CO_2

83. The methodology used to estimate CO_2 emissions from lime production is in accordance with the IPCC good practice guidance. Plant-specific AD and EFs were used in the calculations. The previous review report identified large inter-annual variations in the CO_2 IEFs, thereby indicating a discrepancy between the data used for the emissions and those used for the AD. This inconsistency was corrected in the 2012 annual submission. The ERT commends Norway for taking into consideration the recommendation from the previous review report to include lime production values in the 2012 NIR.

Iron and steel production – CO_2

84. Based on the information provided by Norway during the review, the ERT concludes that the methodology used to calculate the CO_2 emission estimates for iron and steel production is in accordance with the IPCC good practice guidance. However, the methodology used is not well described in the NIR. There is a lack of transparency in the NIR regarding the AD and a lack of sufficient detail in the description of the carbon inputs and outputs. The ERT recommends that the Party includes this information in its next annual submission, in order to improve the transparency of its reporting. In addition, the wide variation in the reported CO_2 IEF for steel production since 2005 (e.g. a decrease of 14.6 per cent between 2006 and 2007 and an increase of 17.4 per cent between 2007 and 2008), identified by the previous ERT as an area for improvement, has not been sufficiently well explained in the 2012 NIR. Nevertheless, the ERT commends Norway for following the recommendation from the previous review report regarding the reallocation of CO_2 emissions from titanium dioxide, previously included under iron and steel production, to other (chemical industry) (see para. 20 above for the impact of the reallocation on the key category analysis).

Ferroalloys production – CO_2

85. The methodologies used to estimate CO_2 emissions from ferroalloys production plants (i.e. the carbon balance (tier 3) or the calculation based on the carbon content in reducing agents (tier 2)) are in accordance with the IPCC good practice guidance as each plant uses the same method for the entire time series. The plant-specific carbonaceous AD and IEFs used in the calculations were provided in the NIR. The reason for the significant increase in CO_2 emissions (50.2 per cent) from 2009 to 2010 was not explained in the NIR, but the ERT was informed during the review that the increase is due to a low production level for ferroalloys in 2009. The ERT recommends that Norway provide this information, as well as justification for the significant inter-annual fluctuations in the AD and IEFs, in its next annual submission.

3. Non-key categories

Limestone and dolomite use – CO_2

86. The ERT noted that the CO_2 emissions from limestone and dolomite use are reported under several different categories according to the NIR (i.e. lime production, limestone and dolomite use, calcium carbide production, ferroalloys production, and pulp and paper production). The description provided in the NIR is unclear as to whether CO_2 emissions from all uses of limestone and dolomite are accounted for under ferroalloys production (only ferroalloys as a consumer is cited in the NIR). During the review, glass production under other (mineral production) was also identified as a consumer. The ERT recommends that Norway provide a balance of the limestone and dolomite use, including details of the various uses and information on where the corresponding CO_2 emissions are reported in the NIR and in the CRF tables. During the review, the Party investigated whether flue gas desulphurization is used in Norway in the environmental controls for SO_2 emissions.

Soda ash production and use – CO_2

87. Norway reports CO_2 emissions from soda ash use in nickel production in the NIR; these estimates are in line with the IPCC methodologies. Norway has not reported any other soda ash use, but the Party informed the ERT during the review that imports indicate that there is other soda ash use in Norway. The ERT strongly recommends that the Party further investigate the remaining uses of soda ash and report them in the 2013 annual submission. In addition, the ERT recommends that Norway provide information on imports and on the different uses of soda ash in the NIR, as well as on the categories under which the emissions from soda ash use are reported, in order to enhance transparency.

Other (chemical industry) – CH_4 and NMVOCs

88. CH_4 emissions from methanol production were reported as constant over the entire time series during the period 1997–2010 (90 t/year). NMVOC emissions have also remained constant for the last three years (2008–2010). However, in the NIR, the Party stated that these emissions were estimated based on plant-specific measurements. During the review, Norway acknowledged that the constant value of the emissions over the time series was not based on plant-specific measurements but on estimates calculated by KLIF; hence, the statement in the NIR was incorrect. The Party further clarified that unexplained fluctuations in the plant-specific measurements were found during the QA/QC checks and, therefore, to avoid inconsistencies in the reporting, a constant value was used for the entire time series. The ERT recommends that Norway include this justification in the next annual submission and undertake an investigation in cooperation with the plants, in order to understand the fluctuations in the measurements so as to allow them to be used in future annual submissions.

D. Agriculture

1. Sector overview

89. In 2010, emissions from the agriculture sector amounted to 4,276.58 Gg CO_2 eq, or 7.9 per cent of total GHG emissions. Since 1990, emissions have decreased by 5.4 per cent. The key driver for the fall in emissions is the decline in the animal population, especially cattle, whose population has declined by 11.4 per cent since 1990. Within the sector, 45.2 per cent of the emissions were from agricultural soils, followed by 44.2 per cent from enteric fermentation and 10.4 per cent from manure management. The remaining 0.1 per cent were from field burning of agricultural residues. While CH_4 emissions accounted for 51.7 per cent of sectoral emissions, N_2O emissions accounted for 48.3 per cent.

90. Norway has made recalculations for the agriculture sector between the 2011 and 2012 submissions in order to rectify identified errors in the estimation of emissions from manure management, and due to the inclusion of oil seed in the estimation of emissions from field burning of agricultural residues. The impact of these recalculations on the agriculture sector is an increase in emissions of 1.6 per cent for 2009. The main recalculations took place in the following categories:

(a) Manure management (an increase in N_2O emissions of 2.8 per cent for 2009);

(b) Agricultural soils (an increase in N_2O emissions of 3.3 per cent for 2009);

(c) Field burning of agricultural residues (an increase in CH_4 and N_2O emissions of 0.7 per cent for 2009).

91. The ERT considered that the inventory for the agriculture sector was essentially complete in terms of categories, gases, geographical coverage and years. However, during the review week, the estimates and the reporting of enteric fermentation, manure management and agricultural soils were not completely in line with the Revised 1996 IPCC Guidelines and the IPCC good practice guidance (see paras. 95, 98, 101 and 105 below). In response to the list of potential problems and further questions raised by the ERT during the review week, Norway submitted revised estimates for agricultural soils in accordance with the IPCC good practice guidance (see para. 105 below). With regard to enteric fermentation (see para. 95 below), the number of beef cattle was reported under mature dairy cattle in the CRF tables, although the corresponding CH_4 emissions were appropriately reported under mature non-dairy cattle. With respect to manure management (see para. 98 below), the AD used for the estimation of CH_4 emissions from mature dairy cattle included beef cattle, thereby leading to a potential overestimation of emissions. The amount of nitrogen (N) used in the calculation of the N_2O emission estimates for manure management (see para. 101 below) was corrected and the corrected N was accounted for under atmospheric deposition. As a result, the estimates of N_2O emissions from manure management and those from atmospheric deposition were considered to constitute a potential overestimation of emissions. Although these issues were not included in the list of potential problems and further questions raised by the ERT during the review week, they still need to be addressed. The ERT recommends that Norway review the agriculture inventory (i.e. enteric fermentation and manure management) and report the AD and emission estimates calculated in accordance with the IPCC good practice guidance.

92. The ERT found that the transparency of the agriculture inventory in the NIR was limited. Additional information is required to support the use of the data contained in the CRF tables. The ERT is concerned that Norway has not improved the transparency of its reporting despite reiterated recommendations regarding enteric fermentation and agricultural soils made in several previous review reports. The ERT is of the view that the transparency of these categories would be enhanced through the inclusion of the information suggested in paragraphs 94 and 103 below, respectively. The ERT strongly recommends that Norway improve the transparency of the agriculture inventory in the NIR in its next annual submission by taking into account the recommendations included in this

and previous review reports.

93. During the review week, Norway informed the ERT that a number of improvements are planned (e.g. updates to the share of each manure storage system, the N excretion factors, the maximum CH_4-producing capacity (B_o) for cattle manure and the methane conversion factors (MCFs) for manure storage systems under manure management; and the fraction of N input to soils that is lost through leaching and run-off ($Frac_{LEACH}$) under agricultural soils) and that some of the results would be reflected in the next annual submission. After the review week, Norway further notified the ERT that B_o for cattle manure and the MCFs would be updated in the 2014 NIR and updates of the share of each manure storage system would be made when the results of a survey conducted in 2013–2014 became available. The ERT welcomes the Party's efforts and recommends that Norway document and archive the information on the improved parameters and AD and report the impact of the recalculations of the emissions from the agriculture sector in its next annual submission. In addition, the ERT recommends that the Party document the QA/QC activities conducted for the data incorporated into the most recent inventory in the "source-specific QA/QC and verification" sections in the next NIR. Norway explained during the review week that it will implement additional QA/QC activities, such as a data comparison study among Scandinavian countries, prior to incorporating new data into the inventory for its next annual submission.

2. Key categories

Enteric fermentation – CH_4

94. In the NIR, Norway provided a reference to "Appendix H of the Norwegian Emission Inventory 2012", which includes detailed information on the tier 2 methodology used to estimate emissions from cattle and sheep. This reference increased the transparency of the inventory emission calculations, to some extent. However, the ERT encourages the Party to include the equations for the gross energy intake (GE) and CH_4 conversion rate (Y_m) in the NIR and cite the aforementioned reference for further information, since the equations support the use of the tier 2 methodology for cattle and sheep and indicate how the lifetime of beef cattle and sheep were taken into account in the calculations. The ERT is of the view that, by doing so, Norway will be able to better address the recommendations related to the improvement of transparency contained in the previous review reports. In addition, the ERT recommends that Norway provide a table in the NIR containing disaggregated data on the population numbers, GE and Y_m for respective animals at the subcategory level, in order to increase transparency, since such data are currently provided for 2004 only in "Appendix H of the Norwegian Emission Inventory 2012". Further, it is difficult to assess the adequacy of the data reported in the CRF tables without using the supplementary calculation spreadsheets provided by Norway during the review week.

95. Norway reported the number of beef cattle under the mature dairy cattle subcategory in CRF table 4.A. During the review week, however, the Party provided a calculation spreadsheet showing that CH_4 emissions from dairy cattle and those from beef cattle were estimated separately, which is in line with the IPCC good practice guidance. The ERT recommends that Norway report the number of cattle under the appropriate subcategories in its next annual submission.

96. The population data for deer and ostrich were reported as "NO" for the years 1990 to 1997. During the review week, Norway explained that it could not ascertain whether those animals existed for agricultural purposes in the early 1990s. The ERT recommends that Norway use the notation key "NE" (not estimated) instead of the notation key "NO" if there is a lack of data, or provide justification for using the notation key "NO" in its next annual submission, in order to ensure time-series consistency.

97. Norway did not explain why it changed the uncertainties of some of the EFs in the NIR. During the review week, the Party explained that this was due to updates of some

uncertainty estimates for EFs that were used in a tier 2 uncertainty analysis performed in 2011. The ERT recommends that Norway document in the NIR any changes made to the inventory for the agriculture sector compared with the previous annual submission.

Manure management – CH_4 and N_2O

98. The ERT found that the CH_4 emissions from manure management of cattle were overestimated, since the CH_4 emissions from mature dairy cattle were estimated based on the aggregated number of dairy and beef cattle. The ERT recommends that Norway correct this estimate by estimating CH_4 emissions separately for dairy cattle and beef cattle in its next annual submission.

99. Norway used a single MCF value for all animal types, irrespective of the manure management system used. The ERT found that this could lead to a potential overestimation of CH_4 emissions from manure management. Norway informed the ERT that it would update the parameters used, including the MCF, and would reflect those parameters in its 2014 annual submission. The ERT welcomes this planned improvement and recommends that the Party document the method used to derive the new parameters in the NIR and archive the source of the parameters.

100. During the review week, Norway informed the ERT that it was planning to review the number of animals in relation to the development of new parameters for manure management. The ERT recommends that the Party provide the definitions for the respective subcategories for each animal type and describe how the AD are obtained for the respective animals in the NIR of its next annual submission, in order to increase the transparency of its reporting. The ERT notes that this will also have an impact on the accuracy of the enteric fermentation CH_4 emission estimates.

101. Norway used an ammonia (NH_3) model to estimate N_2O emissions from manure management and agricultural soils. The amount of N, which was adjusted by subtracting N loss as NH_3 from total N as manure, was accounted for under the manure management category, and the corrected N was accounted for under atmospheric deposition under the agricultural soils category. The ERT found that this was not in line with the IPCC good practice guidance and could lead to a potential overestimation of emissions in the total estimated N_2O emissions from manure management and from atmospheric deposition. The ERT recommends that Norway correct the method used to estimate the emissions and report thereon in its next annual submission.

102. Norway informed the ERT that it would revise the grazing time and the share of each manure management system when the results of a survey conducted in 2013–2014 become available. The ERT recommends that the Party document the method used to derive the new parameters in the NIR and archive the source of the parameters.

Agricultural soils – N_2O

103. In Norway, N_2O emissions from manure are estimated with an N_2O side model. As input to this model, results from Statistics Norway's NH_3 model are used with regard to manure distribution and how much of the nitrogen in the manure is lost as NH_3 during storage. In previous review reports, the ERT recommended that the Party increase the transparency of the NH_3 model. However, the ERT found that the information provided in the 2012 NIR has not been improved compared to the 2011 NIR. The ERT found that the description of the NH_3 model was not sufficiently transparent to allow the ERT to understand how the NH_3 emissions were estimated. During the review week, the ERT made some suggestions to increase transparency by: (a) referring to the checklist compiled by the IPCC; (b) providing further detail on the concept of the model; (c) providing the equations; and (d) providing detailed information on the parameters used in the equations, preferably in a tabular format. The ERT also suggested that Norway provide detailed information in

the NIR on the AD reported in the CRF tables for each category. Further, the ERT suggested that the Party present all of the information on the model in one section of the NIR. The ERT reiterates the recommendations from the previous review reports that Norway address this transparency issue.

104. During the review week, Norway informed the ERT that the parameters (e.g. the share of each manure management system, the grazing time) used in the NH_3 model were not regularly updated; however, some parameters would be obtained through a detailed investigation conducted in 2013–2014. The ERT commends Norway for this planned improvement and encourages the Party to update the parameters periodically (e.g. every five years).

105. Norway has reported direct N_2O emissions from sewage sludge application. However, the Party did not report the indirect N_2O emissions for the whole time series, even though the estimation methodologies for indirect emissions from sewage sludge are provided in the IPCC good practice guidance. The ERT considered that this could lead to a potential underestimation of emissions; therefore, the ERT asked Norway to provide the estimates of indirect N_2O emissions for the whole time series. In response to the list of potential problems and further questions raised by the ERT during the review week, the Party submitted revised estimates for the entire time series and provided a description of the method used to calculate the emissions, including all of the parameters used for the year 2010. Norway calculated the indirect N_2O emissions based on the AD (the amount of N in sewage sludge) reported for the direct N_2O emissions from sewage sludge in its original submission, and using country-specific parameters of the fraction of livestock N excretion that volatizes as NH_3 and NO_x ($Frac_{GASM}$), the fraction of N input to soils that is lost through leaching and run-off ($Frac_{LEACH}$), and IPCC default EFs. Consequently, the direct N_2O emissions from sewage sludge were also recalculated. The ERT confirmed that these calculations were in accordance with the IPCC good practice guidance; therefore, the ERT accepted the revised estimates. As a result, the indirect N_2O emissions have increased by 1.2 per cent, while the direct N_2O emissions (sewage sludge) have decreased by 18.4 per cent for 2010. In total, the N_2O emissions from agricultural soils have increased by 0.07 per cent for 1990 and by 0.16 per cent for 2010, compared to the original submission.

106. During the review week, the ERT noted that the estimates of the areas of histosols are based on projections described in the NIR. The ERT recommends that Norway periodically verify the estimated areas using measured data (e.g. every 10 years).

107. Norway has used a country-specific parameter (0.18 kg N/kg of fertilizer or manure N) for leaching and run-off; this was found to be lower than the IPCC default value (0.3 kg N/kg of fertilizer or manure N). During the review week, Norway explained that the parameter used was developed based on the results of measurements conducted in Norway. The Party also informed the ERT that it was anticipating the incorporation of new $Frac_{LEACH}$ data into future inventories. The ERT welcomes the Party's efforts and encourages Norway to update the parameter for leaching when the new data become available.

3. Non-key categories

Field burning of agricultural residues – CH_4 and N_2O

108. Norway applied the methodology contained in the *2006 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the 2006 IPCC Guidelines) to estimate CH_4 and N_2O emissions in the 2011 and 2012 annual submissions without providing a justification for the change in the EFs. During the review week, the Party informed the ERT that it would revert back to the methodology provided in the Revised 1996 IPCC Guidelines. The ERT recommends that Norway revise the estimates and update the NIR accordingly in its next annual submission.

E. Land use, land-use change and forestry

1. Sector overview

109. In 2010, net removals from the LULUCF sector amounted to 32,944.42 Gg CO_2 eq. Since 1990, net removals have increased by 279.7 per cent. The key driver for the rise in net removals is the steadily increasing growth in living biomass due to an effective forest management policy over the last 60–70 years, which has led to an intensive planting of trees. There has also been a slightly decreasing trend in the annual harvest over the last 20 years, which has also contributed to the increase in net removals. Within the sector, forest land resulted in net removals of 35,862.40 Gg CO_2 eq in 2010, followed by net emissions of 1,680.21 Gg CO_2 eq from grassland and net emissions of 1,154.75 Gg CO_2 eq from settlements. Cropland accounted for net emissions of 67.54 Gg CO_2 eq and wetlands accounted for net emissions of 3.43 Gg CO_2 eq. The remaining net emissions of 12.04 Gg CO_2 eq were from liming of lakes.

110. The main data source for the LULUCF sector is the National Forest Inventory (NFI). Information from permanent sample plots, reassessed every fifth year, are used to estimate areas of land use and land-use change as well as to calculate the net carbon stock changes in living biomass. The NFI data are also used as input data to calculate the carbon stock changes in dead organic matter (DOM) and mineral soils using the Yasso and Yasso07 models.

111. The NFI data set for the period 1986–1993 is used to set the land-use status for 1990 and successive data sets are used to calculate the time series of land use and standing stock in living biomass. Since 2005, the inventory has been expanded to include areas previously not included in the NFI (e.g. mountainous areas and the county of Finnmark). These estimates will be incorporated into future annual submissions (see para. 114 below). In response to a recommendation from the previous review reports, the land-use data have been provided in the 2012 NIR in two detailed land-use change matrices. The first represents the land-use changes for the period 1990–2010, and the second represents the changes between 2009 and 2010. Based on the information contained in these matrices, the land-use changes in Norway are small. The land area is dominated by forest land (12,250.97 kha) followed by other land (14,714.22 kha), wetlands (3,622.37 kha), cropland (930.52 kha), settlements (645.95 kha) and grassland (212.13 kha). However, the data used for these matrices are preliminary. During the review, Norway informed the ERT that a consistent time series representing all land-use changes from 1990 to the latest reported year will be calculated as soon as updated data from the NFI become available, complemented with maps and aerial photos (including the county of Finnmark and mountainous areas). The ERT reiterates the recommendation from the previous review reports that Norway provide a consistent time series of land-use changes as soon as the relevant data become available.

112. Norway has performed recalculations for most of the categories in the LULUCF sector between the 2011 and 2012 submissions, mainly due to the use of updated AD from the NFI. The impact of these recalculations on the LULUCF sector is an increase in net removals of 1.4 per cent for 1990 and an increase of 6.5 per cent for 2009. The main recalculations for 2009 took place in the following categories:

(a) Land converted to cropland (a decrease in net emissions of 45.46 per cent);

(b) Cropland remaining cropland (a decrease in net emissions of 43.30 per cent);

(c) Land converted to forest land (an increase in net removals of 32.67 per cent);

(d) Grassland remaining grassland (a decrease in net emissions of 13.45 per cent).

113. Norway has applied a tier 2 uncertainty analysis for the estimates for the LULUCF sector. The current uncertainty analysis is mainly based on a report from 2005 intended to describe the implementation of the IPCC good practice guidance for LULUCF (NIJOS report 11/2005). Preliminary results from an ongoing project which aims to enhance the uncertainty estimates for the LULUCF sector were presented during the review. Norway plans to use the results in its uncertainty analyses for the LULUCF sector in its next annual submission. The ERT encourages Norway to make every effort to provide updated uncertainty estimates in the next annual submission.

114. During the review, Norway informed the ERT about planned improvements for the 2013 and 2014 annual submissions. The ERT welcomed the Party's efforts to improve the reporting but at the same time expressed concern that the improvements are to be implemented at a very late stage of the first commitment period of the Kyoto Protocol (see chapter II.G.1 of this report). The ERT encourages Norway to report on the progress made in the next annual submission and to prioritize resources efficiently. The planned improvements include:

(a) The inclusion of land use and carbon stock changes for areas at higher altitudes as well as the county of Finnmark in northern Norway;

(b) An update of the land-use data from 1990 by reclassifying the sample plots using, for example, orthophotographs, old aerial photographs and maps;

(c) Improvements to the accuracy of the estimates of the carbon stock changes in mineral soils for forest land remaining forest land and land converted to and from forest land using the Yasso07 model;

(d) The inclusion of the dead wood pool in the reporting of the LULUCF sector;

(e) Improvements to the methods used, including the updating of AD and EFs, to calculate the emissions and removals from mineral and organic soils for cropland and grassland;

(f) The separate calculation of liming for limestone and dolomite;

(g) The improvement of the uncertainty estimates.

115. Many of the reported categories are recalculated annually due to the provision of updated information from the NFI. The recalculations are only briefly explained in the NIR, mainly with reference to "updated AD" without any information on the type of AD or on the magnitude and impact of the recalculations other than on a sectoral level. Due to this lack of transparency and the fact that the planned improvements will result in many recalculations due to the use of updated data, as well as altered definitions and improvements in the methods used, the ERT recommends that Norway improve the description of the recalculations in the NIR and describe them at the level of aggregation where they appear (i.e. at the subcategory and pool level, if necessary, in order to enhance transparency).

116. The time series of the reported categories for the LULUCF sector is generally consistent. However, the ERT identified inconsistencies regarding the estimation of living biomass on forest land remaining forest land (see para. 120 below).

117. During the review week, the ERT identified several issues which imply that the sector-specific QA/QC procedures require further improvement. For example, the ERT identified the incorrect use of the notation keys and inconsistencies between the information in the NIR and in the CRF tables. The categories and subdivisions where errors or inconsistencies were identified include: grassland converted to cropland (related to the use of the notation keys) and drained organic soils (related to the use of the notation keys) under forest land remaining forest land. In addition, living biomass in forest land converted to grassland was not reported in the CRF tables, which is not consistent with the

information reported in the NIR. The ERT recommends that Norway strengthen its QA/QC procedures for the LULUCF sector in order to avoid these types of errors from occurring in future annual submissions.

118. Since the previous annual submission, Norway has re-evaluated the use of the notation keys for many of the reported categories in the LULUCF sector. Norway no longer uses the notation key "NA" (not applicable) and instead a large number of categories are now reported using the notation keys "NO" or "NE". During the review, Norway provided a list assessing the use of the notation keys for categories where no value is provided. The ERT commends the Party for its efforts to improve the transparency of its reporting and found the list useful when assessing the NIR and the CRF tables. The ERT found that some categories where net removals or net emissions were previously reported are now reported using the notation keys. Norway explained that the AD have been assessed and are judged to be too uncertain; therefore, the estimates had been removed from the reporting of the LULUCF sector. The Party will consider reporting these categories when the results from the on-going update of the NFI database become available. The ERT notes that the reporting of the LULUCF sector is not complete, when considering the large number of categories reported using the notation key "NE". Missing categories include living biomass in forest land converted to grassland, organic soils in land converted to forest land, organic soils in cropland remaining cropland and land converted to cropland. The ERT also noted that Norway does not report emissions and removals for land-use conversions from forest land and from grassland in CRF table 5 under "information items", even though the relevant categories are reported in CRF tables 5.A to 5.F. Taking into consideration the planned improvements to many categories and the fact that default methods are available for some categories in the IPCC good practice guidance for LULUCF, the ERT recommends that Norway provide estimates for the mandatory categories currently reported using the notation key "NE" and also provide estimates for forest land and grassland converted to other land-use categories in CRF table 5 under "information items".

2. Key categories

Forest land remaining forest land – CO_2

119. In 2010, net removals from forest land remaining forest land amounted to 35,445.62 Gg CO_2 eq. There has been an increase in the carbon stocks in living biomass and in mineral soils since 1990. Norway used the stock change method to estimate the carbon stock changes in living biomass based on annual statistics from the NFI. The NFI data set for the period 1986–1993 was used to estimate the carbon stocks in living biomass and the land-use status for 1990. Consecutive data sets were used to estimate the annual changes.

120. To reflect the inter-annual variations in the carbon stock changes, Norway modifies the net removals for the years 1990–1997 based on the annual changes between the NFI data set for the period 1994–1998 and the NFI data set for the period 1986–1993, using statistics on the average increment and annual drain. From 1998 onwards, a five-year running mean was used to calculate the net removals (i.e. the difference between the mean of two consecutive five-year periods (e.g. 2005–2010 and 2004–2009)). While the method used for the period 1990–1997 may reflect the inter-annual variations related to harvesting, the time series may not be fully consistent with that for the subsequent years of the time series (1998–2010). This is because the 1998–2010 time series is estimated based on the carbon stock changes between consecutive inventory years, where the inter-annual variations are significantly affected by randomness in the sampling. The ERT therefore recommends that Norway further explore different methods to estimate the annual values based on consecutive NFI data sets, with a view to reducing the influence of random variations for the more recent years of the reported time series.

121. The carbon stock changes in mineral soils and dead organic matter were estimated using the dynamic soil model Yasso. As mentioned above, the Yasso model will be replaced by the Yasso07 model in the near future. Organic forest soils are assumed to be in balance (in line with the IPCC good practice guidance for LULUCF), except for drained organic soils, for which Norway applies the tier 1 default factor for boreal forests of 0.16 Mg C ha^{-1} $year^{-1}$ from the IPCC good practice guidance for LULUCF. The ERT recommends that the Party consider updating the EF to one that more accurately represents the Nordic conditions. With regard to undisturbed organic forest soils, the ERT encourages Norway to justify that these soils are in balance, for example by providing references to published research.

Land converted to forest land – CO_2

122. Land converted to forest land was a net sink of 430.69 Gg CO_2 eq in 2010, mainly due to the increase in carbon stocks in living biomass. The Yasso07 model was applied to estimate the carbon stock changes in dead wood, litter and soil. Emissions and removals have been estimated for all land-use changes. According to the information provided during the review week, Norway is planning to disaggregate the estimates calculated using the Yasso07 model for each carbon pool using the NFI data for the period 1988–1992 and the chemical fractions. The net carbon stock changes in organic soils are reported as "NE" because the Yasso07 model presents processes for mineral soils only. The Party is planning to estimate mineral and organic soils separately in its next annual submission. The ERT welcomes the planned improvement and reiterates the recommendation from previous review reports that Norway provide the results in its next annual submission.

Cropland remaining cropland – CO_2

123. In Norway, CO_2 emissions from soils occur mainly as a result of the cultivation of histosols (organic soils) and the application of lime (including the liming of lakes). Of the total area of organic soils, 10.0 per cent is assumed to be part of cropland. The ERT notes that the issue of inconsistency regarding the reported area of organic soils between the agriculture sector and the LULUCF sector due to the use of different data sources in previous annual submissions has been resolved (see also para. 125 below).

124. The ERT notes that in chapter 7.4 of the NIR, the carbon stock changes in land converted to cropland were estimated using a 25-year transition period, whereas, according to chapter 7.2.1 of the NIR, a 20-year conversion period was used to calculate the land-use transfers. Although Norway explained that the 25-year period refers to the method used to calculate the carbon stock changes in cropland remaining cropland under reduced tillage, the ERT encourages the Party to enhance the description of the methods used in the NIR of its next annual submission, in order to increase transparency.

Grassland remaining grassland – CO_2

125. Norway reports the carbon stock changes in living biomass, DOM and mineral soils as "NO". However, the Party reports the net carbon stock changes in organic soils based on country-specific EFs of 10 Mg C ha^{-1} $year^{-1}$ for high organic matter soils and 5 Mg C ha^{-1} $year^{-1}$ for mixed organic soils, respectively. As recommended in the previous review report, Norway corrected the reported areas of organic soils (both cropland and grassland) in order to ensure consistency with the areas reported under the agriculture sector, thereby leading to a recalculation of the whole time series which resulted in in a decrease in emissions from organic soils in grassland of 251.56 Gg CO_2 for 2009.

126. The ERT noted that the distinction between the definitions of cropland and grassland are rather vague with respect to organic soils. According to the description of the method used to estimate emissions from organic soils, grassland on organic soils could be characterized as cropland. Norway informed the ERT that the definition of cropland and

grassland, as well as the AD and methods used, will be revised in the near future. The ERT recommends that the Party provide the new definitions and estimates in its next annual submission.

3. Non-key categories

Other land – CO_2

127. Under other land, Norway has included land that is not managed, such as bare rocks, wasteland, land with shallow soils or unfavourable climatic conditions, and unmanaged heath or land with sparse tree cover. Other land represents 45.4 per cent of the total land area of Norway. In the previous review reports, the ERT recommended that the Party make efforts to disaggregate the category and reclassify the areas that have the potential to become forests. As stated in the NIR and explained to the ERT during the review, Norway has initiated a project with the aim of revising its land-use classification. The ERT welcomes this effort and recommends that the Party report on any progress made and/or on the revised land-use classification in its next annual submission. Norway provided estimates of the carbon stock changes in living biomass for cropland, wetlands and settlements converted to other land in its previous annual submission; however, these estimates were not included in the 2012 annual submission. The ERT reiterates the recommendations from the previous review reports that the Party make further efforts to utilize the new NFI data, in order to provide estimates for all land-use conversions from and to other land, and include the carbon stock changes for all relevant categories, where appropriate.

Liming – CO_2

128. Norway has reported the emissions from the lime application of cropland (and lakes) for limestone only. During the review, the Party informed the ERT that disaggregated data for limestone and dolomite are available for agriculture land. The ERT recommends that Norway report the emissions from liming for limestone and dolomite separately for agricultural land (cropland and/or grassland) in the next annual submission. The ERT also notes that the default EF of 0.122 Mg CO_2–C/Mg for dolomite provided in the IPCC good practice guidance for LULUCF is incorrect. Based on the stoichiometric formula, this value should be 0.13. The updated EF can be found in section 11.3.1 of the 2006 IPCC Guidelines. The ERT recommends that the Party use this value to calculate the emissions from dolomite use in future annual submissions.

129. Norway has reported the liming of lakes using the assumption that all CO_2 is released (the same approach as for cropland). The ERT encourages the Party to verify and justify this assumption by providing additional information from scientific literature or from other sources of information in future annual submissions.

Biomass burning – CH_4 and N_2O

130. The ERT notes that the AD for biomass burning are divided between productive and unproductive forest, but Norway has used an average biomass volume of 80 m^3/ha for all forests (according to the spreadsheet provided to the ERT during the review week). The ERT recommends that the Party derive separate values for the biomass volume for productive and unproductive forest, in order to increase the accuracy of the estimated emissions, and use these values in the calculations in its next annual submission.

F. Waste

1. Sector overview

131. In 2010, emissions from the waste sector amounted to 1,247.65 Gg CO_2 eq, or 2.3 per cent of total GHG emissions. Since 1990, emissions have decreased by 31.4 per cent. The key driver for the fall in emissions is the decrease in emissions from solid waste disposal on land due to the decrease in the landfilling of organic waste. The ban implemented on the landfilling of organic waste since 1 July 2009 will contribute to a continuous decrease in emissions from the waste sector. Within the sector, 86.6 per cent of the emissions were from solid waste disposal on land, followed by 13.4 per cent from wastewater handling. The remaining 0.01 per cent were from waste incineration.

132. Norway has made recalculations for the waste sector between the 2011 and 2012 submissions following changes in AD and in order to rectify identified errors. The impact of these recalculations on the waste sector is an increase in emissions of 3.1 per cent for 2009. The main recalculation took place in solid waste disposal on land due to the correction of several errors and the use of new AD.

Transparency

133. The ERT noted that the methodological descriptions and the descriptions of the AD and parameters used in the calculations were not provided in sufficient detail in the NIR to allow the ERT to conduct a thorough review of the waste sector. During the review week, Norway provided the necessary descriptions and explanations. This lack of transparency concerned all categories in the waste sector and is detailed in the category-specific findings. The ERT recommends that the Party improve the transparency of the NIR by including information on AD, calculation parameters and country-specific methodologies used.

QA/QC procedures

134. The QC checks performed in the NIR are, in several cases, limited. For example, the references used for the key parameters for solid waste disposal on land are incorrect and table 8.3 of the NIR was not updated to include the data for 2010. Further, the ERT discovered during the review that separate industrial wastewater handling facilities had not been considered in the inventory (see para. 145 below). The Party has reported in the NIR that there are no category-specific QC procedures for wastewater handling and waste incineration. The ERT also noted that many of the recalculations in the waste sector are due to the correction of errors. While it is commendable that the Party has corrected the identified errors, efforts should also be made to ensure that the number of errors is limited through the implementation of effective QC measures. The ERT therefore recommends that Norway make further efforts to enhance the QC procedures for the waste sector, including by analysing the reasons why it is not possible to detect the errors through the application of the current QC procedures. Further, the ERT notes that Norway has not performed any QA activities for the waste sector. The QA/QC plan developed for the Norwegian inventory states that: "The inventory and its documentation will be published annually, and industry associations, relevant research institutions, directorates and environmental organizations are invited to review and suggest improvements in the inventory. Any results of this review will be used by the cooperating institutions to improve the inventory." The ERT encourages Norway to consider implementing QA procedures for the waste sector, in line with its QA/QC plan.

Planned improvements

135. The 2012 NIR does not contain any planned improvements for the waste sector, in spite of the recommendations made in the previous review reports. In general, Norway does not make any references to the recommendations from the review reports, either in the section on recalculations or in the section on planned inventory improvements in the NIR.

To increase transparency, the ERT recommends that the Party track the recommendations made in the previous review reports, and address their status of implementation, either in the section on recalculations or in the section on planned inventory improvements, in future annual submissions.

2. Key categories

Solid waste disposal on land – CH_4

136. As noted in the previous review report, the key variables used to estimate CH_4 emissions from landfills, such as the half-life values and the degradable organic carbon (DOC) content shown in table 8.1 of the NIR, are not discussed or properly referenced in the NIR. The NIR lists two Norwegian reports as the sources of these key parameters. However, after analysing the two listed references, the ERT could not reproduce the values as reported by Norway. In response to questions raised by the ERT during the review, the Party explained that the values were in fact default values from the 2006 IPCC Guidelines. The ERT notes that the current values provide a higher emission estimate compared to the default DOC contents in the Revised 1996 IPCC Guidelines and half-life values provided in the country-specific studies. The ERT recommends that Norway correct the references in the NIR. Further, the ERT recommends that the Party provide, in the next annual submission, justification for the use of the default values from the 2006 IPCC Guidelines and the rationale for not using the results of the country-specific studies.

137. The NIR does not provide any of the AD used in the calculation model, which causes a lack of transparency and impedes the review of the emission estimates. The necessary information was provided to the ERT during the review. The ERT recommends that Norway include, in the next annual submission, the AD in a tabular format. Further, the ERT recommends that the Party describe, in the NIR, the assumptions used when converting the data from the waste statistics to be used in the emission model.

138. Norway has reported a significant share of CH_4 recovery from landfills. The description of the methodology used to estimate the recovered amount is not provided in sufficient detail in the NIR and simply states that recovery data are provided by the landfill operators. During the review, the Party explained that the recovery data are based on measurements both of the amount of gas and of the CH_4 content. The ERT recommends that Norway include this information in the NIR. Further, the ERT recommends that the Party include, in the NIR, information on the method used to estimate the CH_4 content in landfill gas at Norwegian landfills, including the frequency of data collection.

139. The recovered CH_4 is used both for energy production and for flaring. Emissions from energy production are allocated to the energy sector and the emissions from flaring are allocated to waste incineration. However, the NIR does not provide information on the specific amounts that are flared and used for energy production, respectively, which means that the consistency between the information provided in the waste sector and the energy sector cannot be assessed. During the review, Norway provided the ERT with the relevant information. The ERT recommends that the Party provide information in the next annual submission, preferably in tabular format, on the landfill gas recovered, the CH_4 content of landfill gas, the amount flared and the amount used for energy production.

140. For the waste fraction other (solid waste disposal on land), Norway has estimated a country-specific DOC content of 13 per cent. The NIR does not include any explanations as to how this factor was derived. During the review, the Party explained that the DOC content is based on a country-specific study. The ERT recommends that Norway include this reference in the NIR as well as documentation on the assumptions used to derive the DOC value, in its next annual submission.

141. The ERT noted that the Norwegian waste statistics include sludge, but that the emissions from the landfilling of sewage sludge are not estimated. During the review, the Party explained that sewage sludge has been landfilled in Norway and that the emissions will be included in the next annual submission. The ERT recommends that Norway include these emissions. Furthermore, the ERT recommends that Norway include, in the next annual submission, a table containing information on the end-uses of sewage sludge, either in the overview of the waste chapter or in the section on wastewater handling.

142. The Norwegian waste statistics do not take into account any waste that is imported to Norway for landfilling or incineration. In response to questions raised by the ERT during the review, the Party explained that no organic waste is imported for landfilling and no waste is imported for incineration. Norway further explained that a significant amount of waste is exported for incineration in Sweden. The ERT recommends that the Party include, in the NIR, a description of the data used in the emission calculations and describe any differences between the waste statistics and the inventory data.

Wastewater handling – N_2O

143. The description of the method used to estimate N_2O emissions from wastewater handling is not fully transparent in the NIR. The estimation of emissions from the part of the population not connected to sewage systems is transparently described, but the methodology used to estimate N_2O emissions from large wastewater treatment plants is not transparent. During the review, Norway provided the ERT with the AD used in the calculation of the estimates along with a description of the underlying assumptions. The ERT recommends that the Party include, in its next annual submission, the relevant AD, at least for the latest reported year, to enable the ERT to reproduce the reported emissions. Further, the ERT recommends that Norway provide additional information (e.g. references and assumptions) on the country-specific EF used to estimate emissions from the biological treatment of wastewater.

144. The ERT noted that the data for protein consumption had not been updated for the most recent years of the time series and that the value had been kept constant since 2007. For the years prior to 2007, there had been an increase in protein consumption. In response to questions raised by the ERT during the review, Norway informed the ERT that updated protein intake values had become available since the 2012 annual submission and that the data show lower protein consumption in the years where the 2007 value is currently applied. The ERT commends Norway for updating the data for protein consumption and recommends that the Party include the updated values in the next annual submission.

3. Non-key categories

Wastewater handling – CH_4

145. As noted in the previous review report, separate wastewater handling in multiple industrial facilities has not been considered in the inventory. During the review, it became clear that several of these industries have separate wastewater treatment facilities. However, the processes used are either anaerobic or have CH_4 recovery, hence there are no net emissions. The ERT recommends that Norway provide, in the next annual submission, information on the industries with separate wastewater treatment facilities, including details on the specific plants with anaerobic processes and CH_4 recovery. Further, the ERT recommends that Norway report on the recovery of CH_4 from wastewater handling in CRF table 6.B and include information in the NIR to document how the recovered biogas has been considered in the energy sector.

146. The previous review report noted that the information in the NIR regarding the estimation of CH_4 from wastewater handling in general is limited and could be improved by providing a time series for the AD and MCF values used. The ERT agrees with this

assessment and strongly recommends that Norway implement this recommendation in the next annual submission.

147. Norway uses a country-specific MCF value to estimate emissions from wastewater handling. The method used to derive the MCF value is not documented in the NIR. During the review, Norway provided relevant information and explanations, including on the decreasing trend of the MCF value. The ERT recommends that the Party include, in its next annual submission, a description of the method used to derive the MCF value supported by all the relevant data, in order to allow the ERT to reproduce the MCF calculation, at least for the latest reported year.

148. Norway uses the IPCC default value for biological oxygen demand (BOD_5) from the Revised 1996 IPCC Guidelines. During the review, the ERT noted that wastewater treatment plants report values for BOD_5. The ERT encourages Norway to explore the possibility of using the country-specific data to improve the accuracy of the emission estimates, taking into account the need to ensure completeness and time-series consistency.

Waste incineration – CO_2, CH_4 and N_2O

149. Most waste incineration in Norway is carried out with energy recovery and is therefore reported under the energy sector. Only emissions from cremations, the incineration of hospital waste and the flaring of landfill gas are reported under the waste incineration category. The ERT noted that there is no description of the incinerated amount of waste either in the energy chapter or in the waste chapter of the NIR. The ERT recommends that Norway include a description in the NIR, either in the energy chapter or in the waste chapter, and cross-reference the information. The information should include the time series for the amount of waste incinerated. Further, the ERT recommends that the Party provide information in the NIR, explaining that the incinerated waste is collected from the plants and that the waste statistics are not used as the data source for the emission calculations, since the waste statistics include the amount of waste exported for incineration.

Other (waste) – CH_4

150. Biological treatment of waste (composting) is increasing in Norway. However, the emissions have not been estimated for this activity. While there are no methodologies available in the Revised 1996 IPCC Guidelines or in the IPCC good practice guidance, methodologies are available in the scientific literature (e.g. the 2006 IPCC Guidelines). The ERT encourages Norway to explore the possibility of estimating and reporting emissions from waste composting, in order to increase the completeness of the inventory.

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

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

Overview

151. Norway has reported estimates for activities under Article 3, paragraph 3, of the Kyoto Protocol (afforestation, reforestation and deforestation) as well as estimates for forest management under Article 3, paragraph 4, of the Kyoto Protocol for the years 2008-2010. The reporting has been prepared in line with the IPCC good practice guidance for LULUCF and the emissions/removals reported are clearly differentiated from the emissions from the categories included under Annex A to the Kyoto Protocol. Norway has elected to account for activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol at the end of the commitment period.

152. Norway has reported net removals from afforestation and reforestation activities of 244.68 Gg CO_2 for 2010, of which 3.46 Gg CO_2 represents net removals on land harvested since the beginning of the commitment period. The Party has reported net emissions of 1,180.17 Gg CO_2 from deforestation. This results in net emissions of 935.49 Gg CO_2 for activities under Article 3, paragraph 3. Forest management, the Party's elected activity under Article 3, paragraph 4, resulted in net removals of 36,518.74 Gg CO_2 for 2010.

153. Norway clearly describes the land area related information for the KP-LULUCF activities and the process used to detect the land use and land-use changes. For afforestation, reforestation and deforestation activities, Norway detects the changes using information from permanent NFI sample plots which are assessed every five years. This system corresponds to approach 1 of the IPCC good practice guidance for LULUCF. The Party does not stratify the country area, and uses the boundaries of the whole country as the boundaries of areas that encompass units of land subject to activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol. In the NIR, Norway has provided maps to illustrate the locations of the sample plots representing afforestation, reforestation and deforestation activities and a map to illustrate the forest management area. The scattered pattern of the scarce number of plots representing afforestation, reforestation and deforestation activities over the country justifies the use of national boundaries for the calculation of afforestation, reforestation and deforestation activities. As the uncertainty increases with a reduced number of plots, stratifying the country into two or more areas would lead to larger uncertainties in the land-use change estimates. To advance the ERT's understanding of the uncertainties related to the number of plots included in the land area estimates for afforestation, reforestation and deforestation activities, the ERT recommends that Norway include such information in the same manner as that reported for the LULUCF sector under the Convention in section 7.2.1.3 of the NIR.

154. In the NIR and during the review, Norway informed the ERT about forthcoming improvements to the land-use information, such as the inclusion of areas not currently included in the NFI database (e.g. mountainous areas and the county of Finnmark) and a reassessment of the historical land use back to 1990. The ERT welcomes these efforts and recommends that Norway report on activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol using the updated data in its next annual submission.

155. The reporting under the Kyoto Protocol is generally consistent with the reporting under the Convention. The same definitions are used for the land-use categories and the corresponding activities and the same methodologies are used to estimate the carbon stock changes and emissions. To enhance transparency, the ERT recommends that Norway provide additional information in the NIR (including on the methods and quantitative estimates) under each reported activity, to include all sinks and sources (such as liming, fertilization and biomass burning). The ERT also recommends that the Party provide, in the NIR of its next annual submission, additional information on how the land-use changes accounted for under the KP-LULUCF activities relate to the land-use changes reported under the Convention, including a time series of the land areas under afforestation and reforestation, deforestation and forest management. The information should also include uncertainty estimates for the emissions/removals as well as for the land areas.

156. Norway accounts for all carbon pools for the reported KP-LULUCF activities. However, the ERT notes that the Party does not separate the reporting of the dead wood, litter and mineral soils pools for afforestation, reforestation and deforestation activities since the model used (Yasso07) only provides aggregated results for these pools. Norway is planning to disaggregate the estimates from the Yasso07 model for each pool for afforestation, reforestation and deforestation activities using measurements from the NFI (for the period 1988–1992). Under forest management, Norway reports all pools separately, but it is not clear how the separation of the results was accounted for by the Yasso model. To improve transparency, the ERT reiterates the recommendation from previous review

reports that the Party provide information on how the Yasso and Yasso07 models estimate the emissions/removals for the aggregate of soil organic matter and DOM. The ERT further encourages Norway to report all pools (including organic soils) separately for all KP-LULUCF activities in future annual submissions.

157. Norway fulfils most of the requirements set out in paragraphs 5–9 of the annex to decision 15/CMP.1. However, the Party does not report the information related to paragraph 9(c) "information that activities under Article 3, paragraph 4, are not accounted for under Article 3, paragraph 3". The ERT recommends that Norway provide all of the information related to the requirements set out in paragraphs 5–9 of the annex to decision 15/CMP.1 in its next annual submission.

158. The ERT noted that the key category analysis in the NIR does not include some of the key categories identified by the secretariat's key category assessment of KP-LULUCF activities. In addition, the key categories identified for the LULUCF sector under the Convention reporting indicate that afforestation, reforestation and deforestation should also be included as key categories for activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol. The ERT therefore recommends that Norway improve the analysis and description of the key categories in the NIR and in table NIR-3 in its next annual submission (see also para. 23 above).

159. The ERT noted inconsistencies in the use of the notation keys in table NIR-1 and in the respective activity tables (e.g. for liming under forest management and biomass burning under deforestation). The ERT therefore recommends that Norway improve its QA/QC procedures, in order to avoid inconsistencies in the use of the notation keys in its next annual submission.

160. During the review, some errors related to the allocation of emissions and missing estimates were identified, including: liming under deforestation (currently reported as "IE"); N_2O emissions associated with land-use conversion to cropland under deforestation (currently reported as "NO"); biomass burning under afforestation and reforestation (currently reported as "IE"); and fertilization under afforestation and reforestation (currently reported as "IE"). The ERT notes that incomplete reporting (e.g. the exclusion of N_2O emissions associated with land conversions under deforestation) or the inclusion of estimates under the LULUCF sector for the Convention reporting only (e.g. CO_2 emissions from liming) constitutes an underestimation of emissions from KP-LULUCF activities, in some of these cases. The ERT recommends that Norway include the emissions (if they occur) under the relevant activities in the next annual submission.

161. The Party has made recalculations for the KP-LULUCF activities between the 2011 and 2012 submissions following changes in AD. The impact of these recalculations on each KP-LULUCF activity for 2009 is as follows:

(a) A decrease in net removals from afforestation and reforestation of 1.1 per cent (38.5 Gg CO_2);

(b) A decrease in net emissions from deforestation of 52.4 per cent (8.4 Gg CO_2);

(c) An increase in net removals from forest management of 7.5 per cent (2,806.4 Gg CO_2).

Activities under Article 3, paragraph 3, of the Kyoto Protocol

Afforestation and reforestation – CO_2

162. Similarly to the previous reviews, the ERT noted that Norway applies a broad definition of directly human-induced afforestation and reforestation activities. Norway considers all land-use changes to forest as afforestation and reforestation activities,

including land conversions from unmanaged other land, without demonstrating that all conversions are directly human-induced. In previous review reports, the ERT questioned whether parts of the area considered to be afforestation and reforestation land should be classified as such, as no information was provided to fully justify the assumption that all land-use changes to forest land are human-induced. The issue mainly relates to other land converted to forest land due to the disruption of grazing, which leads to the establishment of forest on those areas of land. The ERT considers that a land-use change from a managed land-use category (i.e. from cropland, grassland and settlements) to managed forest land can usually be considered to be human-induced, while a change from unmanaged land to managed forest land may not be directly human-induced and therefore needs to be justified. To qualify as land under afforestation and reforestation, an observed conversion from non-forest land to forest land should be supported by appropriate documentation demonstrating that only conversions in accordance with the annex to decision 16/CMP.1 are considered as afforestation and reforestation. If it is not possible to justify the land-use change to afforestation and reforestation though the provision of documentation, these land-use changes should be considered as activities under forest management. The ERT therefore recommends that Norway reconsider its interpretation of human-induced afforestation and reforestation, and if no information can be provided to justify that the land-use changes from unmanaged land are human-induced, the Party should consider the land-use changes from unmanaged land to forest land as activities under forest management.

Activities under Article 3, paragraph 4, of the Kyoto Protocol

Forest management – CO_2

163. Norway used the same methodology (tier 3) to estimate the carbon stock changes in living biomass for forest management and for forest land remaining forest land under the Convention. The net removals from forest management (as well as from afforestation, reforestation and deforestation) are based on a running five-year average (i.e. the difference between the mean of two consecutive five-year periods). For example, the data set for the periods 2005–2010 and 2004–2009 was used to calculate the 2010 value. This method, which is used to estimate the annual values, is also used for the estimates included in the land-use change matrix.

164. The ERT notes that the inter-annual variations for the reported years are considerable and are, to a large extent, influenced by the random variation in the different subsamples within the NFI. The ERT recommends that Norway explore different methods of estimating the annual values (including interpolation and extrapolation techniques) and make efforts to reduce the influence of random variation in the annual estimates for living biomass and land use in future annual submissions.

2. Information on Kyoto Protocol units

Standard electronic format and reports from the national registry

165. 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 included in the SIAR on the SEF tables and the SEF comparison report.[7] The SIAR was forwarded to the ERT prior to the review, pursuant to decision 16/CP.10. The ERT reiterated the main findings contained in the SIAR.

166. Information on the accounting of Kyoto Protocol units has been prepared and reported in accordance with decision 15/CMP.1, annex, chapter I.E, and reported in

[7] The SEF comparison report is prepared by the ITL administrator 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.

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 decision 22/CMP.1, annex, paragraph 88(a–j). 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 discrepancy has been identified by the ITL and no non-replacement has occurred. The national registry has adequate procedures in place to minimize discrepancies.

167. Norway provided access to information from its national registry that substantiated or clarified the information reported in its annual submission.

National registry

168. 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 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. The national registry has fulfilled all of the requirements regarding the public availability of information in accordance with decision 13/CMP.1, annex, chapter II.E.

Calculation of the commitment period reserve

169. Norway has reported its commitment period reserve in its 2012 annual submission. 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 the most recently reviewed inventory. The ERT agrees with this figure.

3. Changes to the national system

170. Norway reported two changes to its national system since the previous annual submission in the NIR. The changes relate to the internal reorganization at SN, the merge of the unit responsible for preparing the GHG inventory with the unit responsible for preparing the energy statistics (see para. 14 above) and the implementation of new QC routines (i.e. the emission estimates, EFs, AD and IEFs for stationary combustion are routinely compared with the corresponding data for the previous year) to enhance the quality management of the inventory. In addition, KLIF has started to compile a physical and electronic library to archive the most important methodology reports (see para. 39 above). The ERT welcomes the changes to the national system and concluded that Norway's national system continues to be in accordance with the requirements of national systems outlined in decision 19/CMP.1.

4. Changes to the national registry

171. Norway reported changes to its national registry since the previous annual submission. The Party reported that a change in the message flow for external transfers was made, thereby ensuring that the Norwegian registry cannot transfer units received by external transfer until the ITL has completed the transaction. In addition, a new rule was introduced whereby the transactions for all existing and new accounts must be approved by two people, and the security enhancements related to the updated version of the registry software (Greta v.5.2) were implemented. Norway described these changes in its NIR. The ERT concluded that, taking into account the confirmed changes to the national registry, Norway's national registry continues to adhere to the technical standards for data exchange

between registry systems in accordance with the relevant decisions of the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol (CMP).

5. Minimization of adverse impacts in accordance with Article 3, paragraph 14, of the Kyoto Protocol

172. Norway provided general information in the NIR on how it strives to minimize adverse impacts in accordance with Article 3, paragraph 14, of the Kyoto Protocol. However, the Party did not report information on changes in its reporting of the minimization of adverse impacts in its annual submission. The ERT reiterates the recommendation from the previous review report that Norway, in its next annual submission, report any change(s) in its information provided under Article 3, paragraph 14, in accordance with decision 15/CMP.1, annex, chapter I.H.

173. During the review, Norway presented a summary of the information included in the NIR and also provided additional information on new initiatives and programmes (e.g. International Energy and Climate Initiative +, Clean Energy for Development, the parliament decision regarding the Carbon Neutral Norway programme, and the related clean development mechanism and joint implementation purchasing programme) linked to Article 3, paragraph 14, of the Kyoto Protocol. The ERT welcomes the information provided by the Party and concluded that, taking into account the confirmed changes in the reporting, the information provided is complete and transparent.

III. Conclusions and recommendations

A. Conclusions

174. Norway made its annual submission on 15 April 2012. The annual submission contains the GHG inventory (comprising CRF tables and an NIR) and supplementary information under Article 7, paragraph 1, of the Kyoto Protocol (information on: activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, Kyoto Protocol units, changes to the national system and the national registry, and information on the minimization of adverse impacts in accordance with Article 3, paragraph 14, of the Kyoto Protocol). This is in line with decision 15/CMP.1.

175. The ERT concludes that the inventory submission of Norway has been prepared and reported in accordance with the UNFCCC reporting guidelines. The inventory submission is complete and the Party has submitted a complete set of CRF tables for the years 1990–2010 and an NIR; these are complete in terms of geographical coverage, years and sectors, and generally complete in terms of categories and gases. Some of the categories, particularly in the LULUCF sector (see para. 118 above), were reported as "NE". In addition, the reported CO_2 emissions from soda ash use under the industrial processes sector may not cover all uses.

176. The submission of information required under Article 7, paragraph 1, of the Kyoto Protocol has generally been prepared and reported in accordance with decision 15/CMP.1. Norway did not report all of the activities/pools/parameters that should be included in the reporting under Article 3, paragraphs 3 and 4, of the Kyoto Protocol (see para. 160 above).

177. Norway's inventory is generally in line with the Revised 1996 IPCC Guidelines, the IPCC good practice guidance and the IPCC good practice guidance for LULUCF. The ERT identified that some categories in the agriculture sector (see paras. 91 and 101 above) were not estimated completely in line with the IPCC good practice guidance.

178. The Party has made recalculations for the inventory between the 2011 and 2012 submissions in response to the 2011 annual review report, following changes in AD and in

order to rectify identified errors. The impact of these recalculations on the national totals is an increase in emissions of 0.35 per cent for 2009. The recalculations took place in all sectors.

179. Norway has reported estimates for activities under Article 3, paragraph 3, of the Kyoto Protocol (afforestation, reforestation and deforestation) as well as estimates for forest management activities under Article 3, paragraph 4, of the Kyoto Protocol for the years 2008–2010. The reporting has generally been prepared in line with the IPCC good practice guidance for LULUCF. The ERT identified areas where further improvements are needed, for example in relation to completeness (see para. 160 above) and a potential revision of the areas included under afforestation and reforestation, pending the provision of documentation to justify that the activities are directly human-induced (see para. 162 above). Norway has elected to account for the KP-LULUCF activities at the end of the commitment period.

180. The Party has made recalculations for the KP-LULUCF activities between the 2011 and 2012 submissions following updated AD provided by the NFI. The impact of these recalculations on each KP-LULUCF activity for 2009 is a decrease in net removals from afforestation and reforestation of 1.1 per cent, a decrease in net emissions from deforestation of 52.4 per cent and an increase in net removals from forest management of 7.5 per cent.

181. Norway has reported information on its accounting of Kyoto Protocol units in accordance with decision 15/CMP.1, annex, chapter I.E, and used the required reporting format tables as specified by decision 14/CMP.1.

182. The national system continues to perform its required functions as set out in the annex to decision 19/CMP.1. However, the ERT noted that, previously, insufficient resources had been allocated to the implementation of the QA measures in the energy sector to resolve the issues relating to the large differences between the sectoral and reference approaches. In response to questions raised by the ERT in the previous review report, Norway implemented a project to resolve this issue. The ERT welcomed the results of the project; however, the ERT noted that the project has not yet resolved the issue.

183. 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.

184. Norway has reported information under decision 15/CMP.1, annex, chapter I.H, "Minimization of adverse impacts in accordance with Article 3, paragraph 14" as part of its 2012 annual submission. The information is complete and transparent, but did not address the changes since the previous annual submission.

B. Recommendations

185. The ERT identifies issues for improvement as listed in table 6 below.

Table 6
Recommendations identified by the expert review team

Sector	*Category*	*Recommendation*	*Paragraph reference*
Cross-cutting	Completeness	Provide estimates for all mandatory categories (specifically in relation to the industrial processes and LULUCF sectors)	10 and 176
	National system	Implement the action plan to reduce the large differences between the reference approach and the sectoral approach, and describe the results of the above-mentioned plan and any further action needed	17, 54–58 and 182
	Key category analysis	Clearly indicate which activities are identified as key categories under Article 3, paragraphs 3 and 4, of the Kyoto Protocol and provide the rationale for including them as key categories	23
	Uncertainty analysis	Provide the results of the uncertainty analysis for the latest inventory year in all future submissions	24
		Provide the rationale for the low uncertainty estimates for the AD used to estimate the CO_2 emissions from the energy sector	25
	Recalculations	Describe the reasons and provide justification for all recalculations	29
	QA/QC and verification	Enhance the implementation of the QA/QC plan, ensure that all experts understand the plan and its aims and document the measures implemented on an annual basis and the results of the measures	31
		Ensure that additional checks are conducted by the experts when finalizing the CRF tables in order to ensure the correctness of the data and the consistency between the data provided in the NIR and in the CRF tables	32
		Provide updated information on verification measures in the NIR	33
	QA/QC, verification and transparency	Include a summary of the QA/QC measures applied to the plant-specific data in the NIR	34
	Transparency	Prioritize the improvement of the transparency of the NIR, taking into account the detailed comments under the cross-cutting and sectoral sections of the review report (strong recommendation)	39
	Archiving and documentation	Document and archive all necessary information on country-specific methods, disaggregated EFs, parameters and AD	40
Energy	Transparency	Improve the transparency of the NIR by including more detailed information on the AD	47
		Provide information on the methodologies used by the companies to estimate emissions and documentation to justify that those methods are in line with the IPCC good practice guidance	47
	QC	Continue to strengthen the QC procedures with the aim of detecting the errors prior to submitting the inventory	49

Sector	*Category*	*Recommendation*	*Paragraph reference*
		Provide information on the QC procedures in place for plant-specific data and report the results of the QC measures	50
		Compare the plant-specific AD collected under the EU ETS with data from other sources (e.g. statistical data and the national energy balance)	51
	Time-series consistency	Include a discussion in the NIR on time-series consistency	52
	Planned improvements	Track the recommendations made in the previous review reports	53
	Reference and sectoral approaches	Transparently and comprehensively report on the outcomes of the action plan in response to the potential problems identified by the ERT	58
	Feedstocks and non-energy use of fuels	Provide balances showing that all non-energy use of fuels is accounted for in the industrial processes sector and complete CRF table 1.A(d)	60
		Prepare carbon balances for the categories under non-energy use of fuels in the NIR	61
	Indirect CO_2 emissions from NMVOCs	Provide a reference in the NIR and include a discussion on the applicability of the same conversion factor for all sources of NMVOCs	63
	Stationary combustion – CO_2, CH_4 and N_2O	Split the consumption of waste and emissions from waste incineration into the fossil and biogenic fractions and report them under biomass and other fuels, respectively, in the CRF tables	64
	Public electricity and heat production – CO_2	Correct the errors made when calculating the CO_2 IEF for gaseous fuels	65
		Revise the CO_2 EFs for other fuels used in the calculation of the emission estimates for this category	66
	Iron and steel production – CO_2	Amend the incorrect allocation of emissions between fuel types which led to the low-value CO_2 IEF for liquid fuels	67
	Chemicals – CO_2	Provide information on the method used to calculate the CO_2 IEFs for gaseous fuels	68
	Other manufacturing industries – CO_2	Correct the incorrect allocation of fuels, primarily relating to emissions from cement production, which led to unusual values of the CO_2 IEFs and inter-annual fluctuations in liquid, solid and gaseous fuels	69
	Residential – CO_2, CH_4 and N_2O	Report the consumption of and emissions from paraffin wax use together	70
	Road transportation – CO_2, CH_4 and N_2O	Report the consumption of and emissions from biofuels separately under biomass in the CRF tables. Include information on the amount of bioethanol and biodiesel used and the applied EFs in the NIR	71
	Fugitive emissions from oil and gas – CO_2 and CH_4	Improve the description provided in the NIR, including the rationale for reporting under the current categories instead of using the more detailed disaggregation according to the CRF categories	72

Sector	*Category*	*Recommendation*	*Paragraph reference*
		Include information on losses in the description of the energy balance in the NIR	73
	Road transportation – CH_4 and N_2O	Include information on the N_2O IEF in the discussion on time-series consistency within the road transportation category in the NIR	75
	Other – CO_2	Correct the error in the reporting of CO_2 emissions from biomass	76
Industrial processes and solvent and other product use	Transparency	Improve the descriptions of the methods used to calculate the emission estimates in order to allow the ERT to review the consistency of the methods used by the Party with the IPCC default methodologies. Include more information about the AD and EFs and a discussion on the inter-annual fluctuations in the IEFs, at least for the key categories	81
	QA/QC and verification	Improve the sector-specific QC procedures, in order to avoid editing errors in the NIR	82
	Iron and steel production – CO_2	Include a section in the NIR on the rationale for the choice of the AD, together with the descriptions of the carbon inputs and outputs, in order to enhance transparency	84
	Ferroalloys production – CO_2	Provide information on, as well as justification for, the significant inter-annual fluctuations in the AD, IEFs and emission estimates	85
	Limestone and dolomite use – CO_2	Provide a balance of the limestone and dolomite use, including details of the various uses and information on where the corresponding CO_2 emissions are reported in the NIR and in the CRF tables	86
	Soda ash production and use – CO_2	Further investigate the remaining uses of soda ash and report them in the 2013 annual submission. Provide information on imports and on the different uses of soda ash in the NIR, as well as on the categories under which the emissions from soda ash use are reported	87
	Methanol production – CH_4 and NMVOCs	Include an explanation for the use of a constant value in the calculation of the emission estimates, which differ from the plant-specific measurements and investigate, in cooperation with the plants, the inter-annual fluctuations in the measurements so as to allow them to be used in future inventory submissions	88
Agriculture	Enteric fermentation – CH_4	Provide a table in the NIR containing disaggregated data on population numbers, GE and Y_m for respective animals at the subcategory level	92 and 94
		Report the number of cattle under the appropriate subcategories	91 and 95
		Review the use of the notation keys	96
		Document in the NIR any changes made to the inventory for the agriculture sector compared with the previous annual submission	97
	Manure management – CH_4	Estimate emissions from dairy cattle and beef cattle separately	91 and 98
		Document the method used to derive the new parameters in	99

Sector	*Category*	*Recommendation*	*Paragraph reference*
		the NIR and archive the source of the parameters	
		Provide the definitions for the respective subcategories for each animal type and describe how the AD are obtained for the respective animals	100
	Manure management – N_2O	Reallocate the adjusted ammonia–nitrogen to the appropriate subcategories	91 and 101
		Document the method used to derive the new parameters in the NIR and archive the source of the parameters	102
	Agricultural soils – N_2O	Address the transparency issue related to the ammonia model by providing the information suggested by the ERT	92 and 103
		Periodically verify the estimated areas of organic soils	106
	Field burning of agricultural residues – CH_4 and N_2O	Revise the estimates and update the NIR accordingly	108
LULUCF	General	Provide a consistent time-series of land-use changes as soon as the relevant data become available	111
		Improve the description of the recalculations in the NIR and describe them at the level of aggregation where they appear	115
		Strengthen the QA/QC procedures for the LULUCF sector in order to avoid minor errors and inconsistencies from occurring in future annual submissions	117
		Provide estimates for the mandatory categories currently reported using the notation key "NE" and provide estimates for forest land and grassland converted to other land-use categories in CRF table 5 under "information items"	118
	Forest land remaining forest land – CO_2	Further explore different methods to estimate the annual values based on consecutive NFI data sets	120
		Consider updating the EF for drained organic forest soils to one that more accurately represents the Nordic conditions	121
	Land converted to forest land – CO_2	Report the estimates for mineral and organic soils separately	122
	Grassland remaining grassland – CO_2 and cropland remaining cropland – CO_2	Provide updated information on cropland and grassland	126
	Other land – CO_2	Make further efforts to utilize the new NFI data, provide estimates for all land-use conversions from and to other land and include the carbon stock changes for all relevant categories, where appropriate	127
	Liming – CO_2	Report emissions from liming for limestone and dolomite separately in the next annual submission	128

Sector	*Category*	*Recommendation*	*Paragraph reference*
	Biomass burning – CH_4 and N_2O	Derive separate values for the biomass volume for productive and unproductive forest, in order to increase the accuracy of the estimated emissions	130
Waste	Transparency	Improve the transparency of the NIR by including information on the AD, calculation parameters and country-specific methodologies used	133
	QA/QC procedures	Make further efforts to enhance the QC procedures for the waste sector, including by analysing the reasons why it is not possible to detect the errors through the application of the current QC procedures	134
	Planned improvements	Track the recommendations made in the previous review reports and address their status of implementation	135
	Solid waste disposal on land – CH_4	Correct the references in the NIR and provide justification for the use of the default values from the 2006 IPCC Guidelines and the rationale for not using the results of the country-specific studies	136
		Include the AD in a tabular format and describe the assumptions used when converting the data from the waste statistics	137
		Include information on the CH_4 recovery from landfills and the method used to estimate the CH_4 content in the landfill gas, including the frequency of data collection	138
		Provide information on the landfill gas recovered, the CH_4 content of landfill gas, the amount flared and the amount used for energy production	139
		Include the reference for the country-specific degradable organic carbon content for the waste fraction “other” and documentation on the assumptions used	140
		Include a table with information on the end-uses of sewage sludge	141
		Include a description of the data used in the emission calculations and describe any differences between the waste statistics and the inventory data	142
	Wastewater handling – N_2O	Include the relevant AD and provide additional information (e.g. references and assumptions) on the country-specific EF used to estimate emissions from the biological treatment of wastewater	143
		Include the updated values for the protein consumption	144
	Wastewater handling – CH_4	Provide information on the industries with separate wastewater treatment facilities, report on the recovery of CH_4 from wastewater handling in CRF table 6.B and include information on how the recovered biogas has been considered in the energy sector	145
		Provide a time series for the AD and MCF values used	146
		Include a description of the method used to derive the MCF value, at least for the latest reported year	147
	Waste incineration – CO_2, CH_4 and	Improve the description of the incinerated amount of waste and include data for the complete time series	149

Sector	*Category*	*Recommendation*	*Paragraph reference*
	N_2O		
KP-LULUCF	General	Include information related to the uncertainty estimates for areas subject to afforestation, reforestation and deforestation	153
		Use updated land-use information to report activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol	154
		Provide additional information on how the land-use changes accounted for under the KP-LULUCF activities relate to the land-use changes reported under the Convention	155
		Provide information on how the Yasso and Yasso07 models estimate the emissions/removals for the aggregate of soil organic matter and dead organic matter	156
		Provide all of the information related to the requirements set out in paragraphs 5 to 9 of the annex to decision 15/CMP.1	157
		Improve the analysis and description of the key categories in the NIR and in table NIR-3	158
		Improve the QA/QC procedures in order to avoid inconsistencies in the use of the notation keys	159
		Include the emissions that are currently not reported under the relevant activities	160
	Afforestation and reforestation – CO_2	Reconsider the interpretation of human-induced afforestation and reforestation	162
	Forest management – CO_2	Explore different methods of estimating the annual values (including interpolation and extrapolation techniques) and make efforts to reduce the influence of random variation in the annual estimates for living biomass and land use	164
Article 3, paragraph 14, of the Kyoto Protocol		Report on any changes in the information provided under Article 3, paragraph 14, of the Kyoto Protocol	172

Abbreviations: AD = activity data, CRF = common reporting format, EFs = emission factors, ERT = expert review team, EU ETS = European Union emissions trading scheme, GE = gross energy intake, IEFs = implied emission factors, IPCC = Intergovernmental Panel on Climate Change, KP-LULUCF = land use, land-use change and forestry emissions and removals from activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, LULUCF = land use, land-use change and forestry, MCF = methane conversion factor, NIR = national inventory report, NMVOCs = non-methane volatile organic compounds, QA/QC = quality assurance/quality control, Ym = CH4 conversion rate.

IV. Questions of implementation

186. 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. *2006 IPCC Guidelines for National Greenhouse Gas Inventories*. Available at <http://www.ipcc-nggip.iges.or.jp/public/2006gl/index.html>.

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 2012. Available at <http://unfccc.int/resource/docs/2012/asr/nor.pdf>.

Synthesis and assessment report on the greenhouse gas inventories submitted in 2012. Available at <http://unfccc.int/resource/webdocs/sai/2012.pdf>.

FCCC/ARR/2011/NOR. Report of the individual review of the annual submission of Norway submitted in 2011. Available at <http://unfccc.int/resource/docs/2011/arr/nor.pdf>.

UNFCCC. *Standard Independent Assessment Report*, parts I and II. Available at <http://unfccc.int/kyoto_protocol/registry_systems/independent_assessment_reports/items/4061.php>.

B. Additional information provided by the Party

Responses to questions during the review were received from Ms. Britta Hoem (Climate and Pollution Agency), including additional material on the methodologies and assumptions used. The following documents[1] were also provided by Norway:

Marken, J., Hoem, B., 2011, *Models for Calculating Methane Emission from Manure Management in Norway*, Universtetet for Miljø- og Biovitenskap.

Rypdal, K. & Zhang, L-C. 2000. *Uncertainties in the Norwegian greenhouse gas emission inventory*. Oslo. Statistics Norway (Report 2000/3).

Rypdal, K., Bloch, V.V.H., Flugsrud, K., Gobakken, T., Hoem, B., Tomter, S.M. and Aalde, H. 2005. *Emissions and removals of greenhouse gases from land use, land-use change and forestry in Norway.* Oslo. CICERO and Norwegian Institute of Land Inventory A/S (NIJOS report 11/2005).

Sandmo, T. *The Norwegian emission inventory 2011 - Documentation of methodologies for estimating emissions of greenhouse gases and long-range transboundary air pollutants.* Oslo. Statistics Norway (Documents 21/2011).

[1] Reproduced as received from the Party.

Annex II

Acronyms and abbreviations

AD	activity data
BOD_5	biological oxygen demand
CCS	carbon capture and storage
CH_4	methane
C	carbon
CMP	Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol
CO_2	carbon dioxide
CO_2 eq	carbon dioxide equivalent
CRF	common reporting format
DOC	degradable organic carbon
DOM	dead organic matter
EF	emission factor
ERT	expert review team
EU ETS	European Union emissions trading scheme
$Frac_{GASM}$	fraction of livestock N excretion that volatizes as NH_3 and NO_x
$Frac_{LEACH}$	fraction of N input to soils that is lost through leaching and run-off
GE	gross energy intake
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
IEF	implied emission factor
IPCC	Intergovernmental Panel on Climate Change
ITL	international transaction log
kg	kilogram (1 kg = 1,000 grams)
KP-LULUCF	emissions and removals from activities under Article 3, paragraph 3 and 4, of the Kyoto Protocol
LULUCF	land use, land-use change and forestry
m^3	cubic metre
MCF	methane conversion factors
Mg	megagram (1 Mg = 1 tonne)
N	nitrogen
N_2O	nitrous oxide
NA	not applicable
NE	not estimated
NFI	national forestry inventory
NH_3	ammonia
NIR	national inventory report
NMVOCs	non-methane volatile organic compound
NO	not occurring
PFCs	perfluorocarbons
QA/QC	quality assurance/quality control
SEF	standard electronic format
SF_6	sulphur hexafluoride
SIAR	standard independent assessment report
TJ	terajoule (1 TJ = 10^{12} joule)
UNFCCC	United Nations Framework Convention on Climate Change
Y_m	CH_4 conversion rate