United Nations

FCCC/ARR/2013/NOR

Framework Convention on Climate Change

Distr.: General
13 October 2014

English only

Report of the individual review of the annual submission of Norway submitted in 2013*

* In the symbol for this document, 2013 refers to the year in which the inventory was submitted, and not to the year of publication.

GE.14-18461 (E)

1418461

Contents

I. Introduction and summary

1. This report covers the review of the 2013 annual submission of Norway, coordinated by the UNFCCC secretariat, in accordance with decision 22/CMP.1. The review took place from 23 to 28 September 2013 in Bonn, Germany, and was conducted by the following team of nominated experts from the UNFCCC roster of experts: generalists – Mr. Paul Filliger (Switzerland) and Mr. Tomas Gustafsson (Sweden); energy – Ms. Kristien Aernouts (Belgium), Mr. Alexey Cherednichenko (Kazakhstan), Mr. Christo Christov (Bulgaria) and Ms. Lea Kai (Lebanon); industrial processes and solvent and other product use – Mr. David Kuntze (Germany) and Mr. Jacek Skoskiewicz (Poland); agriculture – Mr. Daniel Bretscher (Switzerland), Mr. Nguyen Mong Cuong (Viet Nam) and Mr. Tom Wirth (United States of America); land use, land-use change and forestry (LULUCF) – Mr. Agustin Inthamoussu (Uruguay) and Ms. Sekai Ngarize (United Kingdom of Great Britain and Northern Ireland); and waste – Ms. Juliana Bempah (Ghana) and Ms. Kaatje Jespers (Belgium). Ms. Bempah and Mr. Gustafsson were the lead reviewers. The review was coordinated by Mr. Tomoyuki Aizawa (UNFCCC secretariat).

2. In accordance with the "Guidelines for review under Article 8 of the Kyoto Protocol" (decision 22/CMP.1) (hereinafter referred to as the Article 8 review guidelines), 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. All encouragements and recommendations in this report are for the next annual submission after the review report has been published, unless otherwise specified. The expert review team (ERT) notes that the 2013 annual review report of Norway was published after the submission of the 2014 annual submission.

3. In 2011, the main greenhouse gas (GHG) in Norway was carbon dioxide (CO_2), accounting for 83.5 per cent of total GHG emissions[1] expressed in CO_2 equivalent (CO_2 eq), followed by methane (CH_4) (8.2 per cent) and nitrous oxide (N_2O) (5.9 per cent). Hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6) collectively accounted for 2.3 per cent of the overall GHG emissions in the country. The energy sector accounted for 74.5 per cent of total GHG emissions, followed by the industrial processes sector (14.3 per cent), the agriculture sector (8.5 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 53,446.37 Gg CO_2 eq and increased by 5.9 per cent between the base year[2] and 2011. The ERT concludes that the description in the national inventory report (NIR) of the trends for the different gases and sectors is reasonable.

4. Tables 1 and 2 show GHG emissions from sources included in Annex A to the Kyoto Protocol (hereinafter referred to as 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, elected activities under 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.

[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 sources included in Annex A to the Kyoto Protocol only.

5. Additional background data on recalculations by Norway in the 2013 annual submission, as well as information to be included in the compilation and accounting database, can be found in annex I to this report.

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[a] to 2011

			Gg CO_2 eq								*Change (%)*
		Greenhouse gas	*Base year[a]*	*1990*	*1995*	*2000*	*2008*	*2009*	*2010*	*2011*	*Base year–2011*
Annex A sources		CO_2	34 833.33	34 833.33	37 791.07	41 790.84	44 411.05	42 902.74	45 478.78	44 649.10	28.2
		CH_4	5 030.13	5 030.13	5 199.50	5 057.64	4 601.35	4 505.91	4 522.02	4 397.44	–12.6
		N_2O	5 018.81	5 018.81	4 623.62	4 682.56	3 891.06	3 277.66	3 138.65	3 163.18	–37.0
		HFCs	0.05	0.05	80.34	327.32	691.95	736.47	914.44	950.21	1 917 097.3
		PFCs	3 370.40	3 370.40	2 007.96	1 318.11	772.75	376.72	205.08	225.73	–93.3
		SF_6	2 199.78	2 199.78	607.79	934.42	65.40	61.46	75.38	60.72	–97.2
KP-LULUCF	Article 3.3[b]	CO_2					1 809.45	1 699.91	2 456.87	2 147.47	
		CH_4					0.02	0.00	0.01	0.00	
		N_2O					9.40	9.40	10.06	10.15	
	Article 3.4[c]	CO_2	NA				–28 431.15	–26 074.80	–28 234.32	–31 685.78	NA
		CH_4	NA				5.74	1.05	1.62	0.22	NA
		N_2O	NA				13.17	12.74	12.55	12.48	NA

Abbreviations: Annex A sources = sources included in Annex A of the Kyoto Protocol, 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, 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. For activities under Article 3, paragraph 3, of the Kyoto Protocol and forest management under Article 3, paragraph 4, of the Kyoto Protocol, only the inventory years of the commitment period must be reported.

[b] Activities under Article 3, paragraph 3, of the Kyoto Protocol, namely afforestation and reforestation, and deforestation.

[c] Elected activities under Article 3, paragraph 4, of the Kyoto Protocol, including forest management.

Table 2
Greenhouse gas emissions by sector and activity, base year[a] to 2011

		Gg CO_2 eq								*Change (%)*
	Sector	*Base year[a]*	*1990*	*1995*	*2000*	*2008*	*2009*	*2010*	*2011*	*Base year–2011*
Annex A	Energy	29 491.28	29 491.28	32 156.38	35 590.26	39 007.03	38 864.96	40 653.42	39 828.85	35.1
	Industrial processes	13 807.06	13 807.06	11 097.27	11 776.80	9 180.57	6 960.31	7 739.46	7 647.07	–44.6
	Solvent and other product use	191.18	191.18	186.74	181.74	170.30	150.59	170.88	180.55	–5.6
	Agriculture	5 102.75	5 102.75	5 105.75	5 068.88	4 844.96	4 633.49	4 542.58	4 568.66	–10.5
	Waste	1 860.23	1 860.23	1 764.14	1 493.21	1 230.70	1 251.60	1 228.01	1 221.25	–34.3
	LULUCF	NA	–15 347.62	–19 785.49	–14 995.68	–24 493.77	–22 218.96	–23 578.03	–27 572.93	NA
	Total (with LULUCF)	**NA**	**35 104.88**	**30 524.79**	**39 115.20**	**29 939.79**	**29 641.98**	**30 756.32**	**25 873.44**	**NA**
	Total (without LULUCF)	**50 452.50**	**50 452.50**	**50 310.28**	**54 110.89**	**54 433.56**	**51 860.95**	**54 334.35**	**53 446.37**	**5.9**
	Other[b]	NA	NA	NA	NA	NA	NA	NA	NA	NA
KP-LULUCF	Article 3.3[c] Afforestation and reforestation					–584.04	–714.29	–505.15	–655.43	
	Article 3.3[c] Deforestation					2 402.91	2 423.60	2 972.09	2 813.05	
	Total (3.3)					**1 818.87**	**1 709.31**	**2 466.94**	**2 157.62**	
	Article 3.4[d] Forest management					–28 412.25	–26 061.01	–28 220.15	–31 673.09	
	Article 3.4[d] Cropland management	NA				NA	NA	NA	NA	NA
	Article 3.4[d] Grazing land management	NA				NA	NA	NA	NA	NA
	Article 3.4[d] Revegetation	NA				NA	NA	NA	NA	NA
	Total (3.4)	**NA**				**–28 412.25**	**–26 061.01**	**–28 220.15**	**–31 673.09**	**NA**

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

[a] "Base year" for sources included in Annex A to the Kyoto Protocol refers to the base year under the Kyoto Protocol, which is 1990 for all gases. For activities under Article 3, paragraph 3, of the Kyoto Protocol and forest management under Article 3, paragraph 4, of the Kyoto Protocol, only the inventory years of the commitment period must be reported.

[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 national totals.

[c] Activities under Article 3, paragraph 3, of the Kyoto Protocol, namely afforestation and reforestation, and deforestation.

[d] Elected activities under Article 3, paragraph 4, of the Kyoto Protocol, including forest management.

II. Technical assessment of the annual submission

A. Overview

1. Annual submission and other sources of information

6. The 2013 annual inventory submission was submitted on 12 April 2013; it contains a complete set of common reporting format (CRF) tables for the period 1990–2011 and an NIR. Norway also submitted the 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 12 April 2013.

7. Norway officially submitted revised emission estimates on 11 November 2013 in response to the list of potential problems and further questions raised by the ERT. The values used in this report are those submitted by Norway on 11 November 2013.

8. The full list of materials used during the review is provided in annex II to this report.

2. Overall assessment of the inventory

9. Table 3 contains the ERT's overall assessment of the annual submission of Norway. For recommendations for improvements related to cross-cutting issues for specific categories, please see the paragraphs cross-referenced in the table.

Table 3
The expert review team's overall assessment of the annual submission

		General findings and recommendations
The expert review team's (ERT's) findings on completeness of the 2013 annual submission		
Annex A sources[a]	Complete	Mandatory: none
		Non-mandatory: Norway has reported the notation key "NE" for: potential HFC emissions from refrigeration and air-conditioning equipment; and other applications using ODS substitutes, which (2.F.6) have not been estimated at the subcategory level but have been included in the category total (consumption of halocarbons and SF_6); recovery of CO_2 from soda ash use
Land use, land-use change and forestry[a]	Not complete	Mandatory: none. Norway has reported the notation key "NE" for: the net carbon stock changes in organic soils for cropland, grassland and settlements converted to forest land; the net carbon stock changes in forest land, grassland, wetlands and settlements converted to cropland; and the net carbon stock changes in organic soils for forest land and wetlands converted to grassland
		Non-mandatory: Norway has reported the notation key "NE" for: the carbon stock changes in all pools except for soils from wetlands remaining wetlands (peat extraction) and from dead organic matter

		General findings and recommendations
		and soils for wetlands remaining wetlands (wooded mine); the carbon stock changes in living biomass for settlements remaining settlements; and non-CO_2 emissions from several pools from drainage of soils and wetlands
KP-LULUCF	Not complete	The Party did not demonstrate that organic soils under afforestation, reforestation and deforestation are not a source of emissions (see para. 15(a) below)
The ERT's findings on recalculations and time-series consistency in the 2013 annual submission	Generally consistent	In response to recommendations made in the previous review report, Norway undertook a large number of recalculations. A detailed summary of all recommendations is presented in chapter 9 of the NIR. The ERT recommends that Norway improve the descriptions of the reasons and justifications for the recalculations in the sectoral chapters (e.g. in the LULUCF sector) and also recommends that the Party improve the description of the newly introduced methods (e.g. in the agriculture sector). For these and additional category-specific recommendations, please see paragraph 52 below
The ERT's findings on verification and quality assurance/quality control procedures in the 2013 annual submission	Generally sufficient	The ERT recommends that the Party improve its quality control procedures when introducing new methods into the inventory preparation process. For example, the introduction of a new model to calculate CH_4 emissions from enteric fermentation (see para. 62 below) led to the inclusion of incorrect values in the CRF tables and the NIR. For additional category-specific recommendations, please see paragraphs 20, 25, 64, 70 and 79 below
The ERT's findings on the transparency of the 2013 annual submission	Generally sufficient, except for the agriculture and waste sectors	Transparency has been substantially improved since the previous annual submission. However, in the agriculture and waste sectors transparency is still insufficient and the ERT recommends that the Party improve the transparency of its reporting by including the information provided by Norway in response to the numerous questions raised before and during the current review. For additional category-specific recommendations, please see paragraphs 18, 19, 35, 36, 38, 39, 42, 45, 47, 51, 55, 56, 58, 59, 62, 66, 74, 82, 83, 87, 91 and 94 below

Abbreviations: Annex A sources = sources included in Annex A to the Kyoto Protocol, CRF = common reporting format, 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, NE = not estimated, NIR = national inventory report, ODS = ozone-depleting substances.

[a] The assessment of completeness by the ERT considers only the completeness of reporting of mandatory categories (i.e. categories for which methods and default emission factors are provided in 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*, or the IPCC *Good Practice Guidance for Land Use, Land-Use Change and Forestry*).

3. Description of the institutional arrangements for inventory preparation, including the legal and procedural arrangements for inventory planning, preparation and management

Inventory planning

10. The NIR described the national system for the preparation of the inventory. The Climate and Pollution Agency (KLIF), a directorate under the Norwegian Ministry of Environment, has overall responsibility for the national inventory. Other agencies 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. 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 the Kyoto Protocol.

11. 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. The recommendation made in the previous review report concerning the allocation of sufficient capacity and resources in the energy sector has been implemented and an effort has been made by the Party to resolve the problem related to large differences between the reference approach and the sectoral approach. In response to a question raised by the ERT during the review, Norway described in detail the status of the various projects for the improvement of the energy statistics and to reduce statistical differences in the energy balance. The projects are ongoing and some will not be finalized before 2015. The ERT welcomes the initiatives taken by the Party and strongly recommends that Norway describe in detail, in the NIR, the results of the projects and any further actions needed to reduce the differences between the reference and sectoral approaches.

Inventory preparation

12. Table 4 contains the ERT's assessment of Norway's inventory preparation process. For improvements related to specific categories, please see the paragraphs cross-referenced in the table.

Table 4
Assessment of inventory preparation by Norway

		General findings and recommendations
Key category analysis		
Was the key category analysis performed in accordance with the Intergovernmental Panel on Climate Change (IPCC) *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (hereinafter referred to as the IPCC good practice guidance) and the IPCC *Good Practice Guidance for Land Use, Land-Use Change and Forestry* (hereinafter referred to as the IPCC good practice guidance for LULUCF)?	Yes	
Approach followed?	Both tier 1 and tier 2	
Were additional key categories identified using a qualitative approach?	Yes	Carbon capture and storage (see para. 28 below)
Has the Party identified key categories for activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol following the guidance on establishing the relationship between the activities under the Kyoto Protocol and the associated key categories in the UNFCCC inventory?	Yes	In addition to forest management and deforestation, afforestation/reforestation is now identified as a key category (qualitative approach)
Does the Party use the key category analysis to prioritize inventory improvements?	Yes	
Are there any changes to the key category analysis in the latest submission?	Yes	Additional key categories are reported (see above)
Assessment of uncertainty analysis		
Approach followed?	Both tier 1 and tier 2	
Was the uncertainty analysis carried out in accordance with the IPCC good practice guidance and the IPCC good practice guidance for LULUCF?	Yes	
Quantitative uncertainty (including LULUCF)	Level = 34.7% Trend = 7.0%	
Quantitative uncertainty (excluding LULUCF)	Level = 3.8% Trend = 3.0%	

Abbreviation: LULUCF = land use, land-use change and forestry.

Inventory management

13. Norway has an archiving system, which includes the archiving of disaggregated emission factors (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 ERT noted that not all of the information relevant to the inventory calculations has been documented and archived (e.g. how the Party has derived the indirect emissions of non-methane volatile organic compounds or the EFs for CH_4 emissions from manure management). The ERT further noted that in response to questions raised by the ERT during previous reviews, Norway indicated that Norway was developing a physical and electronic library to archive the most important methodology reports. In response to questions raised by the ERT during the review regarding the status of this project, Norway stated that, unfortunately, there has been no further progress in this project, and at present it is uncertain when further progress can be expected. The ERT recommends that Norway develop this documentation project and reiterates the recommendation made in the previous review report that Norway ensure that all necessary information on country-specific methods, disaggregated EFs, parameters and AD is fully documented.

4. Follow-up to previous reviews

14. Most recommendations made in the previous review report have been addressed and documented in the NIR. Recommendations resolved are as follows: CO_2 emissions from the use of soda ash, CO_2 emissions from liming and N_2O emissions from cultivation of new cropland under deforestation have been reported; key categories under Article 3, paragraphs 3 and 4, of the Kyoto Protocol have been identified; a tier 1 uncertainty analysis has been performed for the latest year and the chosen uncertainties have been documented; QA/QC and verification approaches have been expanded; and a summary of how Norway has responded to the recommendations made in previous review reports has been inserted in the NIR in tabular format. Norway is commended for these substantial improvements.

15. Some recommendations made in previous review reports are pending, as follows:

(a) The reporting of some categories under the LULUCF sector and for KP-LULUCF (mandatory categories concerning deforestation) activities (see para. 78);

(b) The completion of the projects from the action plan to reduce the statistical differences in energy statistics, which are still ongoing and will last longer than expected (see para. 24 below);

(c) The further improvement of the description of the reasons and justifications for the recalculations, mainly in the agriculture and LULUCF sectors (see para. 58 below);

(d) The further enhancement of the implementation of the QA/QC procedures, particularly to improve QC when introducing new methods for calculating emissions (QC in the agriculture sector was insufficient) (see paras. 20, 25, 64 and 69 below);

(e) The improvement of the transparency of the Party's reporting, mainly in the agriculture and waste sectors (see paras. 59, 62, 66, 68, 69, 73, 74, 87, 88, 91 and 94 below);

(f) The further improvement of the documentation and archiving system by the development of a physical and electronic library (no further progress made in this project) (see para. 13 above).

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

16. During the review, the ERT identified a number of areas for improvement, including some related to specific categories. These are listed in the relevant chapters of this report and in table 8 below.

B. Energy

1. Sector overview

17. The energy sector is the main sector in the GHG inventory of Norway. In 2011, emissions from the energy sector amounted to 39,828.85 Gg CO_2 eq, or 74.5 per cent of total GHG emissions. Since 1990, emissions have increased by 35.1 per cent. The key drivers for the rise in emissions are: 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 growth in the economy and the population during the period 1990–2011; 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, 38.3 per cent of the emissions were from transport, followed by 36.3 per cent from energy industries, 8.4 per cent from manufacturing industries and construction and 8.2 per cent from other sectors. Fugitive emissions from fuels accounted for 8.2 per cent. The remaining 0.6 per cent were from other (fuel combustion).

18. The ERT noted that the methodological descriptions in the chapter for the energy sector, 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 categories energy industries and manufacturing industries and construction. The ERT further noted that the methodological descriptions regarding the emission calculations performed at the plant level included in the NIR as links to documents briefly describe the methodology. During the review, Norway provided additional information supporting the use of the country-specific methods for the emission calculations performed at the plant level in line with the Intergovernmental Panel on Climate Change (IPCC) *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (hereinafter referred to as the IPCC good practice guidance). The ERT reiterates the recommendation made in the previous review report that Norway improve the transparency of its reporting, as defined in the "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual inventories", by including supporting information, as provided during the review, on its use of the country-specific methods for the emission calculations performed at the plant level. In addition, the ERT recommends that the Party continue its work to improve the transparency of the NIR by including in the NIR tables that cross-reference the fuels and categories in the national energy balance with the fuel groups and categories in the CRF tables.

19. The ERT noted that the EFs for CO_2 emissions from fuel combustion are reported on the basis of weight (CO_2 t/t fuel) in the 2013 NIR, whereas another table in the NIR reports the net calorific value (NCV) of part of the fuels for which the EFs are given in the tables. The same approach is used to report the EFs for CH_4 (kg CH_4/t fuel) and N_2O (kg N_2O/t fuel), while the energy balance of the country is reported in energy units (PJ). During the review, Norway submitted tables with CO_2, CH_4 and N_2O EFs in t CO_2/GJ. The ERT recommends that the Party report the EFs in energy units (t/GJ fuel in NCV) and the NCVs of all the fuels for which EFs are reported.

20. Norway is commended for correcting the errors, revisions and reallocation of data identified in the previous review report. Nevertheless, there are a number of uncorrected errors from the previous annual submission and the ERT has identified new errors in the current annual submission. Therefore, the ERT recommends that Norway continue to strengthen its QC procedures with the aim of detecting errors prior to submitting the inventory. The ERT encourages Norway to consider implementing QA procedures for the energy sector, in line with its QA/QC plan.

21. Significant numbers of recalculations have been performed for almost all subcategories following the recommendations made in the previous review report, such as the reallocation of emissions and the correction of identified errors. Norway has provided sufficient references for the recalculations in the chapter for the energy sector in the NIR (sections 3.2.10.1 and 3.3.7). The ERT noted the inclusion of general information on the recommendations made in previous review reports, in the section on recalculations (section 9.4) in the NIR; however, it is too general to explain the significant numbers of recalculations in the energy sector. The ERT recommends that Norway track the recommendations made in 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

22. Table 5 provides a review of the information reported under the reference approach and the sectoral approach, as well as comparisons with other sources of international data. Issues identified in table 5 are more fully elaborated in paragraphs 23–27 below.

23. The difference in the CO_2 emission estimates between the reference approach and the sectoral approach varies between years, from –9.7 per cent in 1996 to 50.7 per cent in 2000. These large differences are also observed for other years and have been noted in previous review reports. The reference approach yields the higher estimate in a majority of the years. This issue is affecting all fuels and the trend in the difference in energy consumption is similar to that of the CO_2 emission estimates. In response to the recommendation made in the 2011 annual review report, Norway undertook a project and developed an action plan to investigate the differences between the sectoral and reference approaches. In sections 3.6.1 and 3.6.2 of the 2013 NIR, Norway reports the results of the implementation of the action plan to reconcile the differences between the two approaches and transparently explains the main reasons for the differences. The Party has reported the results of the project, including a number of improvements reported in two annexes to the NIR (annexes XI and XII). 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. As a result of the actions taken, the difference in CO_2 emissions between the sectoral and reference approaches was reduced for the years 2007–2011. However, the ERT notes that the difference remains large.

24. The ERT notes that the IPCC good practice guidance considers differences between the sectoral and reference approaches above 2 per cent to be significant but this is not applicable for Norway because the larger difference originates from the high level of oil and gas production and export. Only 5–6 per cent of production from primary fuels is consumed in the country. For this reason, the accuracy of the estimate of the difference between production and export is an order of magnitude lower than the accuracy of the production and export data. The ERT strongly recommends that Norway further improve the accuracy of the data collection procedures for oil and gas production, processing and export in order to further reduce the level of difference between the sectoral and reference approaches.

Table 5
Review of reference and sectoral approaches

		Paragraph cross-references
Difference between the reference approach and the sectoral approach	22.01 PJ, 4.08% 3 322.58 Gg CO_2 eq, 9.29%	23–25
Are differences between the reference approach and the sectoral approach adequately explained in the NIR and the CRF tables?	Yes	23, 25
Are differences with international statistics adequately explained?	Yes	
Is reporting of bunker fuels in accordance with the UNFCCC reporting guidelines?	Yes	26
Is reporting of feedstocks and non-energy use of fuels in accordance with the UNFCCC reporting guidelines?	Yes	27

Abbreviations: CRF = common reporting format, NIR = national inventory report, UNFCCC reporting guidelines = "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual inventories".

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

25. In response to the list of potential problems and further questions raised by the ERT during the review of the 2012 annual submission, Norway provided an action plan to: ensure sufficient capacity for data collection; collect sufficient AD; improve the quality of the AD; facilitate the QA/QC procedures in the energy sector; and ensure sufficient capacity to control the problem regarding the large differences between the reference and sectoral approaches. Norway is following the time schedule of the action plan and has reported as planned. However, the ERT considers that Norway has to provide more information in the NIR on the outcomes of the QC checks carried out for both the sectoral and the reference approaches and for all fuel groups (i.e. solid, liquid and gaseous). The ERT strongly recommends that Norway transparently and comprehensively report on the outcomes of these checks to ensure that the action plan developed in response to the potential problem identified in the 2012 annual submission is fully resolved. Norway informed that it has reported the results from the work described in the action plan in the 2014 annual submission.

International bunker fuels

26. Emissions from international aviation bunkers are calculated in accordance with a tier 2 approach from the core inventory of air emissions (CORINAIR). 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. No problems were identified.

Feedstocks and non-energy use of fuels

27. Norway reports CO_2 emissions from the non-energy use of coal, coke, petroleum coke, natural gas and liquefied petroleum gas (LPG) 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 in the NIR as to where the non-energy use of fuels occurs and where the associated emissions are reported under the industrial processes sector. The ERT reiterates the recommendation made in the previous review report that the Party complete CRF table 1.A(d). Further, the ERT strongly 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.

Country-specific issues

28. Norway identified carbon capture and storage (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. The ERT commends Norway for the transparent and comprehensive information provided on this country-specific activity.

3. Key categories

Stationary combustion: all fuels – CO_2, CH_4 and N_2O[3]

29. The ERT identified that the CO_2 implied emission factor (IEF) for liquid fuels for public electricity and heat production is 59.68 t/TJ in 2011 and is low compared with the IPCC default values for the most common liquid fuels (e.g. 74.07 t/TJ for gas oil) and the values used by other reporting Parties (ranging from 64.35 to 93.66 t/TJ); and the ERT noted that it has decreased from 70.04 t/TJ in 2010. The ERT considered that this was a potential underestimation of emissions, and included this issue in its list of potential problems and further questions.

30. In response to the list of potential problems and further questions raised by the ERT, Norway provided information clarifying the lower CO_2 IEF for liquid fuels. The energy liquid carriers used in this category were refinery gas and other liquid fuels, mainly fuel oils and LPG. The change in IEF from 70.0 to 59.7 t CO_2/TJ from 2010 to 2011 was due to the significant change in the fuel mix between those two years. The total consumption of liquid fuels increased by 22.8 per cent from 2010 to 2011 (i.e. from 3,842 to 4,718 TJ). In 2010, refinery gas constituted 10.6 per cent of total consumption of liquid fuels, increasing to 60.7 per cent in 2011. The EF for refinery gas (51.56–51.73 t/TJ) was verified in the European Union Emissions Trading System (EU ETS) and is around 20 per cent lower than the EFs for other liquid fuels. The ERT considers that this change in the energy mix explains the reduction in the IEF for liquid fuels used in this category. The ERT concluded that the Party justified the low value of the CO_2 IEF for liquid fuels in this category and supplied sufficient information on the fuel mix and corresponding CO_2 EFs. The ERT recommends that Norway include this information on the liquid fuel mix and its impact on the CO_2 IEF in the relevant categories in its NIR.

31. The ERT identified that the CO_2 IEF for liquid fuels for iron and steel for 2010 is 58.24 t/TJ and for 2011 is 56.62 t/TJ. The values for 2010 and 2011 are low compared with

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

the IPCC default values for the most common liquid fuels (e.g. 74.07 t/TJ for gas oil) and 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 ERT considered that this was a potential underestimation of emissions and included this issue in its list of potential problems and further questions.

32. The ERT identified that the CO_2 IEF for solid fuels for iron and steel for 2011 is 48.14 t CO_2/TJ. The value for 2011 has decreased from 105.94 t CO_2/TJ in 2010. In response to a question raised by the ERT during the review, Norway confirmed that there is an error in the inventory for this category in 2011. The ERT noted that the estimation is a potential underestimation of emissions for 2011 and included this issue in its list of potential problems and further questions.

33. In response to the list of potential problems and further questions raised by the ERT, Norway submitted revised estimates for CO_2 emissions from iron and steel for 2010–2011 and provided a description of the method used to calculate the emissions. Norway corrected: on-site consumption of CO-rich derived gas that had led to the double counting of emissions for 2010–2011 because the emissions were also included in the industrial processes sector; an error in input data for consumption of fuel oil for 2011; and fuel use in cases where the corresponding CO_2 emissions had been transferred to the industrial processes sector. Norway also changed the data source for consumption of CO-rich derived gas and the method for allocating total plant emissions to fuels. As a result, the CO_2 emissions from this category decreased by 68.99 Gg CO_2 eq, or 2.0 per cent, for 2010 and by 1.95 Gg CO_2 eq, or 0.1 per cent, for 2011, compared with the original submission. The ERT accepted the revised estimates and recommends that the Party continue to report in this way and provide explanations as to why the EFs are lower than the IPCC defaults in its NIR.

34. The ERT noted that the CO_2 IEFs for liquid fuels for chemicals for 2008–2011 (54.06–54.49 t CO_2/TJ) are lower than the IPCC default value range (60.98–99.83 t CO_2/TJ) and are among the lowest of the values reported by reporting Parties (ranging from 40.43 to 86.86 t CO_2/TJ) and have decreased gradually from 62.65 t CO_2/TJ in 1999 to 54.06–54.49 t CO_2/TJ in the period 2007–2011. The ERT noted that these estimations are a potential underestimation of emissions for 2008–2011 and included this issue in its list of potential problems and further questions raised by the ERT.

35. In response to the list of potential problems and further questions raised by the ERT, Norway provided information clarifying that the lower CO_2 IEF for liquid fuels is due to the energy mix. The ERT considers that this change in energy mix explains the reduction in the IEF for liquid fuels used in this category. The ERT concluded that Party has justified the low value of the CO_2 IEF for liquid fuels in this category and supplied sufficient information on the fuel mix and corresponding CO_2 EFs. The ERT recommends that Norway provide information on the liquid fuel mix combusted for chemicals and its impact on the CO_2 IEF in its NIR.

36. Following a recommendation made in the previous review report, Norway has divided the emissions from waste incineration for energy purposes into the fossil and biogenic fractions. The fossil fraction is reported under other fuels. The emissions from the biogenic fraction of the waste are 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 commends Norway for splitting the emissions from consumption of waste from waste incineration for energy into the fossil and biogenic fractions. Nevertheless, the ERT identified that medical waste incineration is not reported in the waste sector and there is no evidence that it was accounted for in the energy sector. In response to a question raised by the ERT during the review, the Party stated that there is no information available in the country for the quantity and characteristics of the

medical waste and that it is combusted for energy together with the other waste. The ERT recommends that Norway report the allocation of the medical waste and clarify the characteristics of the medical waste in the next NIR to ensure the completeness of its reporting.

Road transportation: liquid fuels – CO_2

37. The use of bioethanol and biodiesel was reported together with gasoline and diesel use in road transportation in the 2012 annual submission. Following the recommendation made in the previous annual review report, Norway reported consumption of and emissions from biofuels under biomass in the CRF tables, in accordance with the Revised 1996 IPCC Guidelines. The ERT commends Norway for splitting the consumption and reporting of biofuels from gasoline and diesel.

Oil and natural gas: liquid and gaseous fuels – CO_2 and CH_4

38. The reporting of fugitive emissions from oil and natural gas is not fully transparent. There is 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. In response to questions raised by the ERT during the review, the Party explained the methodology and reasons for the aggregated reporting of categories. Nevertheless, the ERT recommends that Norway report emissions from exploration separately from the other activities as it does not directly relate to the production activities and due to the potential significance of this subcategory in Norway. The ERT further recommends that Norway investigate ways to separately report emissions from the other subcategories and regardless of the ultimate allocation to the various subcategories, improve the description of the emission estimates in the NIR.

39. The national energy balance contains data on losses in addition to specific fuel consumption for flaring in oil and gas extraction. In response to questions raised by the ERT 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 flaring and the energy balance in the NIR.

4. Non-key categories

Road transportation: gaseous and liquid fuels – CH_4 and N_2O

40. Norway uses a bottom-up model to estimate the emissions of non-CO_2 gases from road transportation. The fuel consumption estimated using the bottom-up approach is not scaled to match the registered fuel sales, contrary to the IPCC good practice guidance. Norway does not perform the scaling of fuel in the bottom-up model. The Party does not report the difference between the fuel sales and the bottom-up fuel estimates, and the ERT notes that this does not allow it to evaluate the accuracy of the emissions. The ERT recommends that Norway either scale up the fuel estimated by the model or report the figures of fuel sold and fuel estimated.

C. Industrial processes and solvent and other product use

1. Sector overview

41. In 2011, emissions from the industrial processes sector amounted to 7,647.07 Gg CO_2 eq, or 14.3 per cent of total GHG emissions, and emissions from the solvent and other product use sector amounted to 180.55 Gg CO_2 eq, or 0.3 of total GHG emissions. Since 1990, emissions have decreased by 44.6 per cent in the industrial processes sector, and

decreased by 5.6 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 and the reduction in SF_6 used in aluminium and magnesium foundries. Within the industrial processes sector, 29.7 per cent of the emissions were from ferroalloys production, followed by 24.9 per cent from aluminium production, 11.8 per cent from refrigeration and air-conditioning equipment and 9.8 per cent from cement production. Ammonia production accounted for 4.2 per cent and titanium dioxide production accounted for 3.6 per cent. The remaining 16.0 per cent were distributed over other categories.

2. Key categories

Cement production – CO_2

42. The Party reported in its NIR (page 176) that cement is produced in two plants. The EFs used for cement production prior to the start of the EU ETS were 0.530 and 0.541 t CO_2/t clinker, while the IEFs for the years 1990–1997 (0.510–0.522) are significantly lower. Further, the ERT noted that between 2009 (0.5509 t/t) and 2010 (0.5259 t/t) the IEF decreased by 4.5 per cent. The ERT asked Norway to clarify this issue. In response to the question raised by the ERT during the review, Norway clarified that the description of the EFs in the NIR is not precise, and that the EFs after the start of the EU ETS vary more due to stricter requirements with regard to how the EFs are determined. The ERT strongly recommends that Norway, in its 2014 annual submission, provide correct and more detailed information on the method used to calculate the EF and the reason behind the fluctuation of the IEF in its NIR, as this issue may be a potential underestimation of emissions. Norway informed that more detailed information about the EF and the reason behind the fluctuation of the IEF has been included in the 2014 annual submission.

Lime production – CO_2

43. The ERT welcomes the newly introduced information on lime production (NIR, page 177). The NIR (section 4.2.2.2) states that all three plants calculate CO2 emissions based on the actual production volumes of lime, while in section 4.2.2.3 of the NIR it is mentioned that the AD are based on the input of limestone and dolomite. It is not clear to the ERT why Norway is not using lime production data to estimate CO2 emissions as suggested in the decision tree for lime production of the IPCC good practice guidance (figure 3.2). The ERT asked Norway to provide the rationale for using this methodology and information on the time series of limestone and dolomite consumption as well as plant-specific EFs. In response to the question raised by the ERT, Norway referred to the ERT of the 2011 NIR that acknowledged that Norway uses an approach that results in more accurate emission estimates (section 4.2.2.3 of the 2013 NIR) and that this was the rationale. The ERT recommends that Norway provide, in its NIR, a more transparent description of the methodology used. Norway informed that this has been improved in the 2014 annual submission.

Ammonia production – CO_2

44. The trend of CO_2 emissions from ammonia production reported by Norway in the NIR (page 185) shows a significant drop in 1999, which is a result of significantly lower ammonia production in that year (242.065 kt (1998), 148.233 kt (1999) and 406.293 kt (2000)). The ERT asked Norway to clarify the reason for the notable change in the production amount in 1999. In response to the question raised by the ERT during the review, Norway explained that the plant invested in upgraded production capacity and energy efficiency in the period 1999–2000. This explains the low AD (and therefore low emissions) in 1999 and the high AD (and therefore higher emissions) in 2000. The ERT recommends that Norway provide this information in its NIR. Norway informed that this information has been included in the 2014 annual submission.

45. Norway reported in its NIR that the EFs are calculated based on the composition of the gases consumed and that the composition is considered to be stable. Analysis of the IEF, however, shows variations in the trend: for example, the 1997 IEF is 1.80 t/t, while for 2007 the IEF is 1.36 t/t. No explanation for the trend was provided in the NIR. The ERT asked Norway to explain the trend. During the review, Norway provided information showing that the EFs for the gases are stable, but that the actual use of the different gases (AD) varies and that this explains why the IEF fluctuates. The ERT strongly recommends that Norway provide a transparent explanation of the fluctuation of the IEF in its NIR. Norway informed that these explanations have been included in the 2014 NIR.

46. Norway reported in its NIR (page 185), with respect to the feedstock use for ammonia production, that the mix of propane/butane is on average 60 per cent propane and 60 per cent butane." The ERT noted that the sum is 120 per cent. The ERT asked the Party for clarification and in response to the question raised by the ERT during the review, Norway clarified that this is an editorial error: the NIR should state that the mix is 60 per cent propane and 40 per cent butane. The ERT notes that the error does not affect the emissions estimates and recommends that the Party revise the description for that category in its NIR. Norway informed that this editorial issue was corrected in the 2014 NIR.

Aluminium production – PFCs

47. The PFC emissions from aluminium production significantly drop between 2002 and 2003 (from 1,437.56 to 909.07 Gg CO_2 eq) and between 2008 and 2009 (from 772.70 to 376.72 Gg CO_2 eq). This change is not caused by AD, which remain relatively stable. The ERT found that the IEFs for perfluoromethane (CF_4) and perfluoroethane (C_2F_6) were changed because the production technology was changed from Soederberg technology to pre-baked anodes in those years. Another factor for the drop in emissions was presented in table 4.17 of the NIR which shows a significant change in the IEF for Soederberg technology (for the years 2002–2003 the IEF changed from 3.096 to 1.77 and for the years 2008–2009 the IEF changed from 1.15 to 0.18 [Please insert the unit of measurement]). The ERT asked Norway to provide the reasons for such changes in the IEFs for Soederberg technology. In response to the question raised by the ERT during the review, the Party explained that the change in the IEF for Soederberg technology between 2002 and 2003 is due to the fact that one plant using this technology closed down. This plant produced 18.0 per cent of the aluminium produced in Norway with this technology in 2002 and had an EF in 2002 of 6.33 t/t. This EF was the highest among all the plants producing with Soederberg technology in 2002. The change in the IEF for Soederberg technology between 2008 and 2009 was due to the fact that another plant using this technology closed down in 2009. This plant produced 56.0 per cent of the aluminium produced in Norway with this technology in 2008. The plant had an EF of 1.94 in 2008, which was the highest among all the plants producing with Soederberg technology in 2008. The ERT recommends that Norway provide this information to justify the changes in the IEF in its NIR. Norway informed that the information to justify the changes in the IEF has been included in the 2014 NIR.

Consumption of halocarbons and SF_6 – HFCs

48. For domestic refrigeration, Norway reports AD (filled into new manufactured products) for HFC-125, HFC-134a and HFC-143a as 0.000001 t. This is low compared with the values reported by other Parties. The ERT asked Norway to explain the assumptions or data sources used for the low AD. In response to the question raised by the ERT during the review, the Party explained that there is no production of domestic refrigerators in Norway (Bjønness (2013)) and that the very low number of 0.000001 t is an artefact of the model, in order to avoid division by 0 in certain parts of it. The ERT recommends that Norway report these AD using the notation key "NO" (not occurring) if there is no production of domestic refrigeration, or clearly describe the assumptions used on introduction of this model in its NIR.

49. Regarding commercial refrigeration, Norway reported the notation key "NO" in CRF table 2(II).F for filling and disposal for HFC-134 and HFC-143. However, the ERT noticed that CRF table 2(II) shows bulk imports for HFC-134 (18.2 t in 2008, "NO" in 2009, 0.012 t in 2010 and 0.00368 t in 2011). In response to the question raised by the ERT during the review, the Party explained that according to its basic data, which are described in Bjønness (2013), only very little bulk imports of HFC-134 or HFC-143 have occurred after 2008. According to the model calculations, these amounts were filled into in-use products. The amount of imported goods in 2012 was 0.34 t in total. Due to simplicity, these amounts were not included in the model. The ERT strongly recommends that Norway, in its 2014 annual submission, either justify that "NO" is the appropriate notation key for HFC-134 or estimate HFC-134 emissions from filling after 2008 as this issue may be a potential underestimation of emissions.

3. Non-key categories

Limestone and dolomite use – CO_2

50. The NIR states that CO_2 emissions from a plant which produces calcium oxide (CaO) and magnesium oxide (MgO) from limestone and dolomite are reported under this category. The ERT noted that CaO is chemically the same as lime; thus, the ERT concludes that these emissions should be reported under lime production. In response to the question raised by the ERT during the review, Norway explained that the main product of that plant is MgO and thus the emissions are reported under this category. The ERT recommends that Norway report CO_2 emissions from lime production at the plant under the category lime production, in accordance with the IPCC good practice guidance. Norway informed that the emissions have remained in this category in the 2014 NIR and that the explanation of the main product of the plant being MgO has been included.

Soda ash production and use – CO_2

51. Norway reports in the NIR CO_2 emissions from the use of soda in other use of soda ash (CRF category 2.A.4), other (mineral production (glassworks: CRF category 2.A.7)) and nickel production (CRF category 2.C.5). Norway has used the default EF of 0.41492 t CO_2/t from the *2006 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the 2006 IPCC Guidelines) for the use of soda in other use of soda ash (CRF category 2.A.4) and other (mineral production (glassworks: CRF category 2.A.7)), while it has used the default EF of 0.415 t CO_2/t Na_2CO_3 from the Revised 1996 IPCC Guidelines for nickel production (CRF category 2.C.5). The ERT asked Norway to explain the reason for using the EF from the 2006 IPCC Guidelines instead of the EF from the Revised 1996 IPCC Guidelines. Norway explained that the EF of 0.41492 t/t was used by two installations in other (mineral production (glassworks: CRF category 2.A.7)) reporting under the EU ETS and for the use under the use of soda in other use of soda ash (CRF category 2.A.4), while the installation in nickel production (CRF category 2.C.5) that is not covered by the EU ETS was using the default EF from the Revised 1996 IPCC Guidelines. The ERT noted that this does not sufficiently explain the reason for using a lower EF as the Party has not provided a justification as to why the default EF from the 2006 IPCC Guidelines used in the use of soda in other use of soda ash (CRF category 2.A.4) and other (mineral production (glassworks: CRF category 2.A.7)) better reflects the national circumstances than the default value from the Revised 1996 IPCC Guidelines. The ERT strongly recommends that Norway, in its 2014 annual submission, provide a justification for its use of the lower EF in its NIR, as this issue may be a potential underestimation of emissions.

Other (mineral products) – CO_2

52. Regarding glass production, the NIR states (page 182) that the emissions from glassworks are calculated on the basis of EU ETS reports. However, the ERT noted that emissions are reported from 1990, while the EU ETS began operating in 2005. The ERT asked the Party to provide information on how it ensured time-series consistency for this category. In response to the question raised by the ERT during the review, the Party clarified that the use of EU ETS data does not represent a problem for time-series consistency because the Norwegian GHG inventory has, for a long time (since the early 1990s), included GHG emissions from industrial point sources (both emissions from processes and combustion). The ERT finds this clarification to be sufficient but recommends that Norway include the information in the NIR. Norway informed that this information has been included in an annex to the 2014 NIR.

Other (chemical industry) – CO_2, CH_4 and N_2O

53. With regard to ethylene production, Norway reported in CRF table 2(I).A-G that the AD for and emissions from ethylene production are reported as "NO", while the NIR (page 195) states that one of the plants in Norway is producing ethylene. In response to a question raised by the ERT during the review, Norway explained that the emissions are included in plastics under other (chemical industry). Norway stated that the notation key for ethylene production will be changed to "IE" in the next annual submission. The ERT recommends that Norway revise the notation key for ethylene production from "NO" to "IE". Norway informed that the notation key for ethylene production has been revised from "NO" to "IE" in the 2014 annual submission.

54. Regarding methanol production, the CO_2 IEF for methanol is 0.077 t/t and this is low compared with the value reported by other Parties. The ERT asked the Party to explain the origin of this CO_2 EF. In response to the question raised by the ERT during the review, the Party explained that the emissions included in the industrial processes sector are emissions from the combustion of natural gas in flaring. The emissions from fuel combustion are included under chemicals (fuel combustion). The plant concerned is part of the EU ETS and reports annually the EF used for calculating the CO_2 emissions from flaring. The ERT recommends that the Party update the CO_2 EF and provide a description of the calculations for this category. Norway informs that updated EFs and more information have been included in the 2014 NIR.

55. The IEF for methanol production shows significant fluctuations – for example, in 2000 the IEF is 0.168 t/t, while for 2001 the IEF is 0.073 t/t. The ERT asked Norway to explain the reason for those fluctuations. In response to the question raised by the ERT during the review, the Party explained that the emissions from flaring are reported under this category, and that these emissions have varied greatly (e.g. emissions from flaring were much higher in 2000 than in 1999 and 2001). Then, the IEFs based on production figures will also fluctuate naturally. The ERT recommends that Norway improve its description of the reasons for the IEF fluctuations in its NIR. Norway informed that the description of the reasons for the IEF fluctuations has been included in the 2014 NIR.

Other (metal production) – CO_2

56. The NIR (pages 213–214) describes the emissions from nickel production and manufacture of anodes. During the review, the ERT asked the Party to provide clarifications as to why those activities are reported together in the CRF tables. The Party answered that it intends to split these emissions in the CRF tables in the coming annual submission. Norway informs that this has been completed in the 2014 annual submission.

D. Agriculture

1. Sector overview

57. In 2011, emissions from the agriculture sector amounted to 4,568.66 Gg CO_2 eq, or 8.5 per cent of total GHG emissions. Since 1990, emissions have decreased by 10.5 per cent. The key driver for the fall in emissions is the reduction in the number of cattle livestock and reduced inputs of synthetic fertilizers to agricultural soils. Within the sector, 45.3 per cent of the emissions were from agricultural soils, followed by 44.3 per cent from enteric fermentation and 10.3 per cent from manure management. The remaining 0.1 per cent were from field burning of agricultural residues. Emissions from rice cultivation and from prescribed burning of savannas are reported as "NO".

58. Norway conducted many recalculations during the 2013 annual submission. Methodologies for estimating emissions from enteric fermentation and nitrogen excretion rates of livestock have been improved and very detailed country-specific models have been implemented. Livestock population statistics have been revised in order to fulfil the requirements of the new estimation methodology for enteric fermentation and nitrogen excretion. The ERT commends Norway for the sophisticated models. However, the ERT noted a lack of transparency in that some relevant calculation parameters were not provided in the NIR. The ERT recommends that Norway improve the structure of the documentation of the models and provide the most relevant calculation parameters in the NIR in order to increase the transparency of the inventory.

59. The ERT noted that the population numbers for cattle and sheep reported by Norway (755 and 1,531 thousand head, respectively) are lower than those reported to FAOSTAT (the database of the Food and Agriculture Organization of the United Nations) (862 and 2,300 thousand head, respectively). In the NIR, Norway indicated the use of a new system to regroup animal statistics in order to increase the accuracy of the emission estimates. For some animal categories not living for a whole year, the lifetime is taken into account to obtain a yearly average for the numbers of animals. In part, this revision contributed to the fact that the population numbers reported by Norway are lower than those reported to FAOSTAT. The ERT recommends that Norway improve the description of the method to show how the data used in the inventory are derived from the national statistics and a detailed explanation of how lifetime is taken into account to obtain a yearly average for the number of animals.

60. Norway states in the NIR that the registers cover 90–100 per cent of the livestock populations. Furthermore, in annex X to the NIR it is stated that approximately 90 per cent of the growing cattle are accounted for in the recording system. In response to a question raised by the ERT, Norway clarified that according to the Department of Primary Industry the statistics cover 100 per cent of the cattle population and over 99 per cent of all other animals. The ERT encourages Norway to prevent future misunderstandings concerning the coverage of the livestock statistics data by providing transparent explanations in its NIR.

61. Norway still uses two sets of livestock population data in its inventory. Revised animal statistics are used to estimate emissions from enteric fermentation and excretion of nitrogen for estimating N_2O emissions from manure management and agricultural soils. However, a different set of population data is used to calculate CH_4 emissions from manure management. The ERT considers that this reporting of livestock population statistics is not sufficiently transparent and that the description in the NIR should be improved. In response to a question raised by the ERT during the review, Norway stated that it will update the model for estimating CH_4 emissions from manure management in the 2014 annual submission, and that a single set of animal data will then be used in all calculations of agricultural emissions. The ERT welcomes this planned improvement and recommends that

Norway proceed in the implementation of the new model and that it use a single set of livestock population statistics for all emission categories.

2. Key categories

Enteric fermentation – CH_4

62. Norway implemented a detailed tier 2 method for estimating CH_4 emissions from cattle and sheep. The gross energy intake and methane conversion rate (Y_m) are estimated according to feed composition and animal performance (milk yield, carcass weight and age, in months, at slaughter). The ERT considers that the chosen approach is based on sound science and is in line with the Revised 1996 IPCC Guidelines and the IPCC good practice guidance. However, due to the detailed model, the ERT found that transparency should be increased by providing more data in the NIR. The ERT recommends that Norway report in the NIR information on: (i) the proportion of feed concentrate in the rations of mature dairy cows; (ii) the carcass weight and months at slaughter of young cattle; and (iii) all parameters required to estimate the gross energy intake of sheep and lambs in the NIR.

63. The ERT found that the gross energy intake for mature dairy cattle is more or less stable over the whole inventory period, while the milk yield as well as animal weight increase substantially (15.6 per cent and 16.6 per cent, respectively). This seems unrealistic as animals with a higher performance tend to have higher feed energy requirements. Furthermore, the ERT noted that the values provided for the gross energy intake and Y_m in CRF table 4.A are not consistent with the IEFs reported in the same table. In response to a question raised by the ERT during the review, Norway answered that incorrect numbers were reported for the gross energy intake for mature dairy cattle in the CRF tables and in NIR table AX-2. In the time series for mature dairy cattle, beef cows were included whereas in the emission calculations only dairy cattle were included.

64. The ERT was able to confirm that the EFs and consequently the emission estimates for enteric fermentation reported in the CRF tables are not affected by the error mentioned in paragraph 63 above. The ERT recommends that Norway improve its QA/QC activities to ensure that the reported values are consistent within and between different CRF tables as well as consistent with the values reported in the NIR. The ERT further recommends that Norway report the correct values for the gross energy intake and Y_m for all animals concerned in CRF table 4.A.

65. Norway has reported Y_m and consequently EFs for enteric fermentation that are considerably higher than the default values and uncertainty ranges provided in the IPCC good practice guidance (table 4.8, page 4.26). During the review, Norway provided revised estimates for Y_m after correction of the errors mentioned in paragraph 63 above. However, the revised estimates are still among the highest of all reporting Parties and the ERT still considers that they might be overestimated. The ERT encourages Norway to conduct further quality checks and, if appropriate, to revise the methodology used to estimate Y_m.

66. In annex X to the NIR (page 20), Norway states that Y_m for sheep more than one year is 6.5 per cent and for sheep less than one year is 4.5 per cent based on the IPCC good practice guidance. Accordingly, the reported mean Y_m for the year 2011 in CRF table 4.A is 5.3 per cent. However, the default values in the IPCC good practice guidance (table 4.9, page 4.27) are 7 per cent for mature sheep and 5–6 per cent for lambs less than one year, depending on feed digestibility. In response to a question raised by the ERT during the review, Norway explained that Norwegian mature sheep and sheep less than one year have a relatively long indoor forage period when they also receive some concentrates. The ERT noted that the explanation provided is reasonable. The ERT recommends that Norway improve the documentation in the NIR of Y_m for sheep and provide an adequate rationale for the low value.

Manure management – CH_4

67. Norway uses a country-specific approach to estimate volatile solid (VS) excretion from livestock. During the review, the ERT estimated VS excretion using a tier 1 approach and equation 15 from page 4.23 of the Revised 1996 IPCC Guidelines with default values for feed digestibility (60.0 per cent) and ash content (8.0 per cent). Additionally, gross energy values reported by Norway have been used as input data. Values of VS excretion for dairy cattle and sheep estimated by the ERT are higher than those reported by Norway in CRF table 4.B(a), even when accounting for a high feed energy digestibility of 70.0 per cent. Furthermore, the ERT noted that VS excretion of mature dairy cattle as reported by Norway is constant over the inventory time period while an increase would be expected due to higher performance and a subsequent higher gross energy intake in later years.

68. The ERT is of the view that the discrepancies in VS excretion mentioned in paragraph 67 above are rather due to an overestimation of gross energy intake and that CH_4 emissions from manure management are not underestimated. In response to a question raised by the ERT during the review, Norway stated that it is aware of this inconsistency and that it is planning an update of the factors used for the calculation of CH_4 emissions from manure management in the 2014 annual submission. The ERT welcomes this planned improvement and encourages Norway to employ further quality checks and to consider the consistency between gross energy intake and VS excretion. Furthermore, the ERT recommends that Norway report values for feed energy digestibility in the NIR.

69. Norway used a single methane conversion factor (MCF) for all animal types, irrespective of the manure management system used. The previous ERT found that this could lead to a potential overestimation of CH_4 emissions from manure management. In response to a question raised by the current ERT during the review, Norway informed the ERT that it would update the parameters used for estimating CH_4 emissions from manure management, including the MCFs, in the 2014 annual submission. The ERT welcomes this planned improvement and recommends that Norway provide MCFs for each animal waste management system. Furthermore, the ERT reiterates the recommendation made in the previous review report that Norway document in the NIR the method used to derive the new parameters and archive the source of the parameters.

Manure management – N_2O

70. In CRF table 4.B(b), total nitrogen excretion can be calculated by multiplying the animal population numbers with specific nitrogen excretion rates or by adding up the nitrogen managed in the individual animal waste management systems. The ERT found that for goats there is a difference between these two numbers. In response to a question raised by the ERT during the review, Norway explained that the number for dairy goats has been reported instead of the weighted mean nitrogen excretion rate. The ERT recommends that Norway report the correct nitrogen excretion rates for all animals in CRF table 4.B(b). Additionally, the ERT recommends that Norway implement further QC checks in order to ensure consistency in its reporting of nitrogen excretion from livestock.

71. Norway uses a country-specific model to calculate ammonia (NH_3) emissions and subsequently N_2O emissions from animal manure management and agricultural soils. From the description in the NIR the ERT could not assess exactly at which stage of the nitrogen flow cascade the NH_3 volatilized is subtracted. This problem was already noted during the previous annual review in 2012. In response to a question raised by the ERT during the review, Norway explained that, in its NH_3 model, part of the volatilization is expected to take place already, during storage of the manure. Norway further explained that this is the reason why this part of the nitrogen is subtracted before the calculation of the N_2O emissions from manure management.

72. The ERT considers that the estimation of N_2O emissions from manure management described in paragraph 71 above is not in accordance with the IPCC good practice guidance and leads to an underestimation of emissions. The ERT therefore included this issue in its list of potential problems and further questions.

73. In response to the list of potential problems and further questions raised by the ERT, the Party submitted revised estimates of N_2O emissions from manure management, which were estimated based on the amount of nitrogen excreted by the animal population before subtracting the nitrogen volatilized as NH_3. Additionally, while reviewing the calculations for leaching and runoff, Norway found another error related to the potential problem raised by the ERT. Following the IPCC good practice guidance and in line with the new estimates calculated for emissions of N_2O from manure management, the input of nitrogen from animal manure that forms N_2O from leaching and runoff has now been estimated based on the total amount of nitrogen excreted by the animal population and with no subtraction of the NH_3 volatilized from manure storage. This means that nitrogen excreted on pasture is now also included in the calculation of N_2O emissions from leaching and runoff. The ERT confirmed that the calculation was conducted in accordance with the IPCC good practice guidance; therefore, the ERT accepted the revised estimates. The changes in the calculations have increased the N_2O emissions from manure management in 2011 by 12.2 Gg CO_2 eq, or by 8.2 per cent, and N_2O emissions from leaching and runoff by 72.0 Gg CO_2 eq, or by 46.4 per cent, in 2011. In order to facilitate the future assessment of the N_2O emission estimates, the ERT recommends that Norway provide an improved description of the nitrogen flow model. Special attention should be given to the volatilization of NH_3 and nitrogen oxide (NO_x) and to nitrogen lost due to leaching and runoff.

Agricultural soils – N_2O

74. Norway uses a detailed country-specific model to account for the volatilization of nitrogen. The ERT noted that Norway does not mention volatilization of NO_x in the documentation of the estimation method used for N_2O emissions from agricultural soils. However, the IPCC good practice guidance states that both the fraction of synthetic nitrogen fertilizer that volatilizes as NH_3 and NO_x ($Frac_{GASF}$) and the fraction of animal manure that volatilizes as NH_3 and NO_x ($Frac_{GASM}$) should include NO_x. The ERT reiterates the recommendation made in the previous review report that Norway increase the transparency of the model for NH_3 volatilization. Furthermore, the ERT encourages Norway to account for NO_x volatilization under direct soil emissions and indirect soil emissions. The EFs for NO_x could be taken from the EMEP/CORINAIR *Emission Inventory Guidebooks*.

75. The ERT found that $Frac_{GASF}$ as reported in CRF table 4.D is lower than the default value in table 4.19 of the Revised 1996 IPCC Guidelines and among the lowest of all reporting Parties. Furthermore, in NIR table 6.14 Norway provides EFs for NH_3 for different fertilizers that are in the range expected by the ERT (15 per cent for urea, 5 per cent for ammonium sulphate and ammonium nitrate and 1 per cent or less for other synthetic fertilizers). The ERT recommends that Norway revise the values of $Frac_{GASF}$ reported in CRF table 4.D and report this parameter consistently in the NIR and the CRF tables.

E. Land use, land-use change and forestry

1. Sector overview

76. In 2011, net removals from the LULUCF sector amounted to 27,572.93 Gg CO_2 eq. Since 1990, net removals have increased by 79.7 per cent. The key driver for the rise in net removals is the steadily increasing growth in living biomass due to the forest management

policy over the past 60–70 years, which includes an intensive planting of trees in new areas and replanting of trees after harvesting on existing forest land. Within the sector, forest land resulted in the largest net removals of 32,367.09 Gg CO_2 eq in 2011, followed by small net removals of 83.23 Gg CO_2 eq from wetlands due to biomass sequestration in trees. Settlements are now the largest net emission source from the LULUCF sector, accounting for 2,704.28 Gg CO_2 eq, followed by cropland, with emissions of 1,933.87 Gg CO_2 eq. Grassland accounted for 175.52 Gg CO_2 eq net emissions and other land for 46.95 Gg CO_2 eq.

77. 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.

78. The ERT welcomes Norway's efforts to provide a consistent time series of land-use changes and an appropriate land-use matrix with corresponding land-use classes, and for implementing the recommendation made in the previous review report to include the land-use data sets for the mountainous areas and for Finmark County in the NFI. The ERT notes that the land-use change area above the coniferous limit, and in Finmark County, have been recalculated in the 2013 annual submission, due to the inclusion of information from the NFI, maps, and old and new aerial photography that have been used to improve the estimates back to 1990. The inclusion of all areas for land use is in line with the requirements of the IPCC *Good Practice Guidance for Land Use, Land-Use Change and Forestry* (hereinafter referred to as the IPCC good practice guidance for LULUCF) and the ERT welcomes this improvement.

79. The ERT notes that there are some discrepancies in the calculation of areas reported under the Convention. The sum of land uses reported under the Convention in the CRF tables submitted in 2013 is 32,378.54 kha. There are differences between the total land area under the Convention and the Kyoto Protocol, of 1.62 kha. In response to questions raised by the ERT during the review, the Party provided an explanation that there was a mistake in the land uses reported in the CRF tables under the Convention, in that the area of wetlands for peat extraction (338 ha) was not subtracted from the total wetlands area, and that this will be corrected in the 2014 annual submission. Norway informed that this has been corrected in the 2014 annual submission.

80. The Party states in the NIR: "other land represents 45.4 per cent of the total land area of Norway". During the review, the ERT asked Norway about its efforts to implement recommendations made in the previous review reports, namely that the Party disaggregate the category and reclassify the areas that have the potential to become forests. In response to the question raised by the ERT during the review, Norway explained that an analysis had been made to distinguish other land into subcategories that may or may not have the potential to become forest. Norway defines the potential to become forest as areas: that are located below the alpine forest limit; and that have soil cover. Preliminary results show that less than 19.0 per cent of other land has the potential to become forest and the Party stated that a table with results will be presented in the NIR in 2014. The ERT welcomes this effort and recommends that the Party report on any progress made and/or on the revised land-use classification.

2. Key categories

Forest land remaining forest land – CO_2

81. The ERT noted that the carbon stock changes in mineral soils and dead organic matter were estimated using the dynamic soil Yasso07 model. 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 previously applied the tier 1 IPCC default factor for boreal forests of 0.16 Mg C/ha/year from the IPCC good practice guidance for LULUCF. In the previous review report, the ERT recommended that the Party consider updating the EF to one that more accurately represents the Nordic conditions. The ERT notes that Norway informs that a tier 2 method was used in the 2013 annual submission with an EF for drained organic forest soils (1.9 Mg C/ha/year), which was derived from a Swedish study. With regard to undisturbed organic forest soils, the ERT encouraged Norway to justify that these soils are in balance, for example by providing references to published research. Norway informed that such references have been included in the 2014 annual submission. In response to a question raised by the ERT during the review regarding updating the EF, Norway explained that there is ongoing work to test and validate the Yasso07 model. The ERT recommends that Norway include information on and results of the ongoing work in its NIR. The ERT considers that this could be a potential underestimation of emissions. Norway informed that information has been provided in the 2014NIR regarding the validation work of the Yasso07 model.

Land converted to cropland – N_2O

82. The Party has reported N_2O emissions from disturbance associated with land-use conversion from wetlands to cropland from 1990 and 2000 as "NO", while those values were reported with figures in the previous annual submission. In response to the question raised by the ERT during the review, the Party explained that the revision of the NFI database resulted in no areas of wetlands converted to cropland from 1990 and 2000. Therefore, the notation key "NO" was applied. The ERT expects the conversion of wetlands to cropland to result in an increase in N_2O emissions associated with the conversion. The ERT recommends that Norway increase the transparency of its reporting by providing more information when reporting categories as "NO".

83. Similarly, for other land converted to cropland, N_2O emissions from disturbance associated with land-use conversion to cropland from 1990 and 2011 have been reported as "NO", while those values were reported with figures in the previous submission. The ERT recommends that Norway increase the transparency of its reporting by providing more information when reporting categories as "NO".

Grassland remaining grassland – CO_2

84. The ERT noted that there is a distinction between the definitions of cropland and grassland with respect to organic soils. Norway has provided the definitions of grassland and cropland in the NIR (page 284), emphasizing that the national area estimate of organic soils is based on soil samples on cultivated/ploughed fields according to the cropland and grassland definitions, which place all organic soils under cropland even if grass is grown. The ERT welcomes this improvement. However, the ERT noted that the net carbon stock changes in organic soils for the whole time series have been reported as "NO", while those values were reported with figures in the previous annual submission. The ERT considers this an inconsistency and recommends that the Party provide the estimates. Norway informed that estimates have been provided in the 2014 NIR.

3. Non-key categories

Liming – CO_2

85. The ERT welcomes the efforts made by Norway in reporting the emissions separately from limestone and dolomite used for agricultural lime application (cropland and/or grassland) following the recommendation made in the previous review report. The ERT noted that Norway applies the default EF from the 2006 IPCC Guidelines without justifying why the default EF better fits the national circumstances. The ERT recommends

that Norway provide justification to explain why the default EF from the 2006 IPCC Guidelines better fits the national circumstances.

F. Waste

1. Sector overview

86. In 2011, emissions from the waste sector amounted to 1,221.25 Gg CO_2 eq, or 2.3 per cent of total GHG emissions. Since 1990, emissions have decreased by 34.3 per cent. The key driver for the fall in emissions is from the category solid waste disposal on land due to the decrease in the landfilling of organic waste in Norway. This is because from 1 July 2009, legislation was passed banning the deposition of biodegradable waste in landfills and this has further reduced the CH_4 emissions emanating from landfills. Many permits were given for the disposal of biodegradable waste for one extra year, some extended to 2010 and a few to 2011. The transitional period ended on 31 December 2012. Within the sector, 87.8 per cent of the emissions were from solid waste disposal on land, followed by 12.2 per cent from wastewater handling. The remaining 0.01 per cent were from waste incineration.

2. Key categories

Solid waste disposal on land – CH_4

87. The ERT noted that the choice of AD and methodologies are not clearly described in the NIR. For instance, the different waste compositions of waste sent to landfill were not provided in the NIR. The ERT reiterates the recommendations made in the previous review report that Norway enhance the transparency of its reporting by providing the AD in a tabular format in the NIR and all assumptions used when converting the data from the waste statistics to those used in the emission model. Norway informed that these data have been included in the 2014 NIR.

88. The ERT noted that the amount of "other material" is estimated based on an assumption; however, information on the assumption is not provided. In response to a question raised by the ERT during the review, Norway responded that the reference for the assumption will be provided in the next annual submission. The ERT recommends that Norway provide the reference for the assumption on the amount of "other material" used for the estimation of emissions in its NIR.

89. The ERT noted that the new half-life and degradable organic carbon (DOC) values used by the Party for the estimation of emissions in the 2013 annual submission were not referenced and details of how they were used were also not provided in the NIR. The ERT recommends that Norway use the new DOC values and provide references for the different parameter values used for the half-life and DOC, including any supporting documentation, to enhance transparency. Norway informed using the IPCC default values for DOC and half-life values, and that this information has been included in the 2014 NIR.

Wastewater handling – N_2O

90. The ERT noted that protein consumption (kg/person/day) was reported as "NA" (not applicable) in CRF table 6.B, although there are data available for the entire time series and these are provided in table 8.4 of the NIR. In response to a question raised by the ERT during the review, the Party responded that data are available and will be included in the CRF table for the next annual submission. The ERT recommends that Norway estimate the emissions using the protein consumption values in table 8.4 of the NIR. Norway informed that the data on protein consumption have been included in the CRF tables in the 2014 annual submission.

3. Non-key categories

Wastewater handling – CH_4

91. In the NIR, it is indicated that emissions from the industries with their own wastewater treatment plants are small and that these plants are mainly aerobic. However, the ERT noted that this information is not sufficiently transparent for it to be reviewed. In response to a question raised by the ERT during the review, Norway confirmed that this issue was raised during the 2012 review and that it is in the process of investigating emissions from wastewater from chemical industries. However, there was insufficient time to include further information in the 2013 annual submission. The ERT noted that Norway has made investigations on emissions from industrial wastewater and recommends that Norway provide more information in the NIR on the level of AD available for industrial wastewater treatment plants, especially for oil refinery, pulp and paper, pharmaceutical and chemical companies.

92. The ERT noted that the two pulp and paper industries in Norway treat wastewater anaerobically and that these plants recover CH_4 for energy production, but the amount of gas from one of the plants is not included in the energy statistics, hence the combustion-related emissions are not included in the emission inventory. The ERT strongly recommends that Norway include estimates of emissions from all pulp and paper industries. Norway informed that Norway has made investigations and the emissions from the pulp and paper industries have been included in the 2014 annual submission.

93. The ERT noted that the NIR states that CH_4 recovery is occurring while it is reported as "NO" in CRF table 6.B. The ERT recommends that the Party correct this inconsistency. Norway informed the correction of the notation key in the CRF table has been done in the 2014 annual submission.

Waste incineration – CH_4 and N_2O

94. The ERT noted during the review that the Party did not provide details of the AD and methodologies used in estimating CH_4 and N_2O emissions from biogenic sources and cremation. The ERT recommends that the Party provide detailed information on the AD and methodologies used in estimating CH_4 and N_2O emissions from biogenic sources and cremation.

Other (waste) – CH_4

95. The ERT noted from the previous review report that 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 therefore reiterates the encouragement made in the previous review report that Norway explore the possibility of estimating and reporting emissions from waste composting. Norway informed that the emissions from composting will be included in the 2015 annual submission in line with the 2006 IPCC Guidelines.

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

96. Table 6 provides an overview of the information reported and parameters selected by Norway under Article 3, paragraphs 3 and 4, of the Kyoto Protocol.

Table 6
Supplementary information reported under Article 3, paragraphs 3 and 4, of the Kyoto Protocol

		Findings and recommendations
Has the Party reported information in accordance with the requirements in paragraphs 5–9 of the annex to decision 15/CMP.1?	Not sufficient	97, 99
Identify any elected activities under Article 3, paragraph 4, of the Kyoto Protocol	Forest management	
Identify the period of accounting	Commitment period accounting	
Assessment of the Party's ability to identify areas of land and areas of land-use change	Sufficient	

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

Afforestation and reforestation – CO_2

97. The ERT notes that the carbon stock changes in organic soils under afforestation are reported as "NO", while paragraph 6(e) of the annex to decision 15/CMP.1 and paragraph 21 of the annex to decision 16/CMP.1 require that the Party report all carbon pools including soil organic carbon. The ERT concludes that the Party's reporting is not in line with the requirements under decisions 15/CMP.1 and 16/CMP.1. During the review, the ERT asked the Party to provide information about the NFI database, a map showing the overlap of the category afforestation and reforestation (units of land harvested since the beginning of the commitment period) with a soil map (mineral/organic) for Norway to demonstrate that the category is not a source of emissions. The Party responded that: "the assessment of whether a soil is organic or not is made in the field by the NFI staff. The definition of organic soil is an organic layer deeper than 40 cm. The plots under afforestation and reforestation – units of land harvested since the beginning of the commitment period – were not classified as organic soils." For units of land harvested since the beginning of the commitment period, Norway highlighted that the NFI database contains information that the area in this category (1.89 kha) is mineral soil and the area of organic soil is therefore estimated as zero, and the notation key "NO" is reported because zero is not a valid value in the CRF Reporter software. The ERT reiterates the recommendation made in the previous review report that Norway continue to develop a methodology for estimating and reporting all carbon pools, including soil organic carbon, in order to fulfil the requirements under decisions 15/CMP.1 and 16/CMP.1. Norway informed that this recommendation has been done in the 2014 annual submission.

98. The ERT noted that Norway applies a broad definition of directly human-induced afforestation and reforestation activities. In previous reviews, 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, consistent with the requirements of paragraph 8(a) of the annex to decision 15/CMP.1. The ERT welcomes Norway's consideration of its interpretation of human-induced afforestation and reforestation, to justify that the land-use changes from unmanaged land are human-induced, in the 2013 annual submission.

Deforestation – CO_2

99. The ERT noted that the carbon stock changes in organic soils under deforestation are reported as "NE", while paragraph 6(e) of the annex to decision 15/CMP.1 and paragraph 21 of the annex to decision 16/CMP.1 require that the Party report all carbon pools including soil organic carbon. The ERT concludes that this is not in line with the requirements under decisions 15/CMP.1 and 16/CMP.1. During the review, the ERT asked the Party to provide information that demonstrates that the category is not a source of emissions. Norway responded that it is not able to demonstrate that the category is not a source, and provided a table with an explanation that the area of organic soils under deforestation is mostly forest land converted to settlement, except for 0.9 kha in 2011 of forest converted to wetlands. The Party further explained that it has applied the EF for cropland from the 2006 IPCC Guidelines because settlements are likely to be deeply drained. This results in a conservative estimate. Norway indicated that it applied the same EF for the area of forest land converted to wetlands assuming it is drained. The default EF for cropland in the boreal cool temperate climate of 5 Mg C/ha was applied. The ERT strongly recommends that the Party include the estimates of emissions from organic soils. Norway informed that this recommendation has been done in the 2014 annual submission.

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

Forest management – CO_2

100. The ERT notes that it is not clear from the 2013 NIR whether the previous recommendation 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 therefore reiterates the recommendation made in the previous review report 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. Norway informed that this recommendation has been done in the 2014 annual submission.

101. The ERT has previously noted that Norway did not report the information related to paragraph 9(c) of the annex to decision 15/CMP.1, which is "information that activities under Article 3, paragraph 4, are not accounted for under Article 3, paragraph 3". The ERT noted that the information provided in the 2013 annual submission (section 11.5.3) stating how afforestation and deforestation activities (Article 3, paragraph 3) are distinguished from forest management activities (Article 3, paragraph 4) and acknowledges that the methodologies applied by Norway and use of NFI data for area estimation is sufficient information to demonstrate that no forest management activities are accounted for under afforestation and reforestation or deforestation.

2. Information on Kyoto Protocol units

Standard electronic format and reports from the national registry

102. Norway has reported information on its accounting of Kyoto Protocol units in the required SEF tables, as required by decisions 15/CMP.1 and 14/CMP.1. The ERT took note

of the findings and recommendations included in the standard independent assessment report (SIAR) on the SEF tables and the SEF comparison report.[4] The SIAR was forwarded to the ERT prior to the review, pursuant to decision 16/CP.10. The ERT reiterates the recommendations contained in the SIAR.

103. 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 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 referred to 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.

104. The Party provided access to information from its national registry that substantiated or clarified the information reported in its annual submission.

Calculation of the commitment period reserve

105. Norway has reported its commitment period reserve in its 2013 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

106. Norway reported that there are changes in its national system since the previous annual submission. The Party described the changes in its NIR: enhanced routines are implemented for QC of the CRF data to ensure the correctness of the data and the consistency between the data provided in the NIR and in the CRF tables; a LULUCF-specific plan for QA/QC was developed internally at NFLI. The ERT concluded that the Party's national system continues to be in accordance with the requirements of national systems set out in decision 19/CMP.1.

4. Changes to the national registry

107. Norway reported that there are changes in its national registry since the previous annual submission. The Party described in detail the changes in its NIR: the changes are triggered by the centralization of the EU ETS operations into a single European Union registry operated by the European Commission called the Consolidated System of EU registries (CSEUR) (see page 425 of the NIR). CSEUR is a consolidated platform which implements the national registries in a consolidated manner and was developed together with the new EU registry. The national registry of Norway switched to the new system on 20 June 2012. During the process, all relevant transactions and holdings data were migrated to the CSEUR platform. In the SIAR, the following comments and recommendations are listed:

(a) The SIAR assessor notes that Norway is not fully reporting the changes in the national registry related to the change of test results and change of database structure. The assessor recommends that Norway provide this information related to the most current

[4] The SEF comparison report is prepared by the international transaction log (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.

implemented version of the consolidated registry software. The assessor further notes that Norway provided this information in response to the SIAR findings. However, additional analysis of the documentation provided reveals that an incomplete test was performed and that an insufficient database structure was provided;

(b) The assessor strongly recommends that the Party test each release thoroughly against the data exchange standard (DES) as part of each major release cycle and provide the results of such tests in its NIR.

108. The ERT concluded that, taking into account the confirmed changes in the national registry, Norway's national registry continues to perform the functions set out in the annex to decision 13/CMP.1 and the annex to decision 5/CMP.1 and continues to adhere to the technical standards for data exchange between registry systems in accordance with relevant decisions of the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol (CMP). The ERT recommends that Norway include all other additional information in response to the SIAR findings in its NIR in accordance with decision 15/CMP.1, annex, chapter I.G.

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

109. Norway reported that there are changes in its reporting of the minimization of adverse impacts in accordance with Article 3, paragraph 14, of the Kyoto Protocol since the previous annual submission. The Party described the changes in the NIR. The ERT concluded that, taking into account the confirmed changes in the reporting, the information provided is complete and transparent.

110. The described changes concern: an increase in the CO_2 tax for offshore petroleum activities; tests of carbon capture technologies; changes in cooperation with less developed countries; and new bilateral partnerships with three African countries.

III. Conclusions and recommendations

A. Conclusions

111. Table 7 summarizes the ERT's conclusions on the 2013 annual submission of Norway, in accordance with the Article 8 review guidelines.

Table 7
Expert review team's conclusions on the 2013 annual submission of Norway

		Paragraph cross-references
The ERT concludes that the inventory submission of Norway is complete (categories, gases, years and geographical boundaries and contains both an NIR and CRF tables for 1990–2011)		
Annex A sources[a]	Complete	
LULUCF[a]	Not complete	
KP-LULUCF	Not complete	15(a)
The ERT concludes that the inventory submission of Norway has been prepared and reported in accordance with the UNFCCC reporting	Yes	

		Paragraph cross-references
guidelines		
The submission of information required under Article 7, paragraph 1, of the Kyoto Protocol has been prepared and reported in accordance with decision 15/CMP.1	No	15(a)
The Party's inventory is in accordance with the *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*	Yes	18, 19, 50, 72, 89
Norway has reported information on Article 3, paragraphs 3 and 4, of the Kyoto Protocol	Yes	
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	Yes	
The national system continues to perform its required functions as set out in the annex to decision 19/CMP.1	Yes	
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	Yes	107
Did Norway provide information in the NIR on changes in its reporting of the minimization of adverse impacts in accordance with Article 3, paragraph 14, of the Kyoto Protocol?	Yes	

Abbreviations: Annex A sources = sources included in Annex A to the Kyoto Protocol, CMP = Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol, CRF = common reporting format, ERT = expert review team, 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, NIR = national inventory report, UNFCCC reporting guidelines = "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual inventories".

[a] The assessment of completeness by the ERT considers only the completeness of reporting of mandatory categories (i.e. categories for which methods and default emission factors are provided in 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*, or the IPCC *Good Practice Guidance for Land Use, Land-Use Change and Forestry*).

B. Recommendations

112. The ERT identified the issues for improvement listed in table 8 below. All recommendations are for the next annual submission, unless otherwise specified.

Table 8
Recommendations identified by the expert review team

Sector	*Category*	*Recommendation*	*Paragraph cross-references*
Cross-cutting		Improve the descriptions of the reasons and justifications for the recalculations in the sectoral chapters (e.g. in the LULUCF sector)	Table 3
		Improve the description of the newly introduced methods (e.g. in the agriculture sector)	Table 3
		Improve the quality control procedures when introducing new methods into the inventory preparation process	Table 3
		Describe in detail, in the NIR, the results of the projects for the improvement of the energy statistics and to reduce statistical differences in the energy balance, and any further actions needed to reduce the differences between the reference and sectoral approaches	11
		Develop the documentation project to establish a physical and electronic library to archive the most important methodology reports	13
		Ensure that all necessary information on country-specific methods, disaggregated EFs, parameters and AD is fully documented	13
Energy	Sector overview	Improve the transparency of its reporting, as defined in the UNFCCC reporting guidelines, by including supporting information, as provided during the review, to its use of the country-specific methods for emission calculations performed at the plant level	18
		Continue its work to improve the transparency of the NIR by including in the NIR tables that cross-reference the fuels and categories in the national energy balance with the fuel groups and categories in the CRF tables	18
		Report the EFs in energy units (t/GJ fuel in NCV) and the NCVs of all the fuels for which EFs are reported	19
		Continue to strengthen the QC procedures with the aim of detecting errors prior to submitting the inventory	20
		Track the recommendations made in previous review reports and address their status of implementation, either in the section on recalculations or in the section on planned inventory improvements	21
	Reference and sectoral approaches	Further improve the accuracy of the data collection procedures for oil and gas production, processing and export in order to further reduce the level of difference between the sectoral and reference approaches	24
		Transparently and comprehensively report on the outcomes of the QC checks carried out for both the reference and sectoral approaches to ensure that the action plan developed in response to the potential problem identified in the 2012 annual submission is fully resolved	25
	Feedstocks	Complete CRF table 1.A(d)	27

Sector	*Category*	*Recommendation*	*Paragraph cross-references*
	and Non-energy use of fuels	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	27
	Stationary combustion:	Include the information on the liquid fuel mix and its impact on the CO_2 IEF in the relevant categories in the NIR	30
	all fuels – CO_2, CH_4 and N_2O	Continue to report in the way described in paragraph 33 of this report and provide explanations as to why the EFs are lower than the IPCC defaults in the NIR	33
		Provide information on the liquid fuel mix combusted for chemicals and its impact on the CO_2 IEF in the NIR	35
		Report the allocation of the medical waste and clarify the characteristics of the medical waste in the next NIR to ensure completeness of the reporting	36
		Report emissions from exploration separately from the other activities as it does not directly relate to the production activities and due to the potential significance of this subcategory in Norway	38
		Investigate ways to separately report emissions from the other subcategories and regardless of the ultimate allocation to the various subcategories, improve the description of the emission estimates in the NIR	38
		Include the information on how the energy balance contains data on losses in addition to specific fuel consumption for flaring in oil and gas extraction in the description of the flaring and the energy balance in the NIR	39
	Road transportation: gaseous and liquid fuels – CH_4 and N_2O	Scale up the fuel estimated by the model or report the figures of fuel sold and fuel estimated	40
Industrial processes and solvent and other product use	Cement production – CO_2	Provide correct and more detailed information on the method used to calculate the EF and the reason behind the fluctuation of the IEF in the NIR as this issue may be a potential underestimation of emissions, in its 2014 annual submission	42
	Lime production – CO_2	Provide, in its NIR, a more transparent description of the methodology used	43
	Ammonia	Provide the information on AD for 1999 and 2000 in the NIR	44
	production – CO_2	Provide a transparent explanation of the fluctuation of the IEF in the NIR	45
		Revise the description for the category in the NIR	46

Sector	*Category*	*Recommendation*	*Paragraph cross-references*
	Aluminium production – PFCs	Provide the information to justify the changes in the IEF in the NIR	47
	Consumption of halocarbons and SF_6 – HFCs	Report the AD for this category using the notation key "NO" if there is no production of domestic refrigeration, or clearly describe the assumptions on introduction of this model in the NIR	48
		Justify that "NO" is the appropriate notation key for HFC-134 or estimate HFC-134 emissions from filling after 2008, in its 2014 annual submission	49
	Limestone and dolomite use – CO_2	Report CO_2 emissions from lime production at the plant under the category lime production, in accordance with the IPCC *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories*	50
	Soda ash production and use – CO_2	Provide a justification for the use of the lower EF in the NIR, as this issue may be a potential underestimation of emissions, in its 2014 annual submission	51
	Other (mineral products) – CO_2	Include the information on the time-series consistency of the AD for this category in the NIR	52
	Other (chemical industry) – CO_2, CH_4 and N_2O	Revise the notation key for ethylene production from "NO" to "IE"	53
		Update the CO_2 EF and provide a description of the calculations for this category	54
		Improve the description of the reasons for the IEF fluctuations in the NIR	55
Agriculture	Sector overview	Improve the structure of the documentation of the models and provide the most relevant calculation parameters in the NIR in order to increase the transparency of the inventory	58
		Improve the description of the method to show how the data used in the inventory are derived from national statistics and a detailed explanation of how lifetime is taken into account to obtain a yearly average for the number of animals	59
		Proceed in the implementation of the new model and use a single set of livestock population statistics for all emission categories	61
	Enteric fermentation – CH_4	Report in the NIR information on: (i) the proportion of feed concentrate in the rations of mature dairy cows; (ii) the carcass weight and months at slaughter of young cattle; and (iii) all parameters required to estimate the gross energy intake of sheep and lambs in the NIR	62
		Improve the QA/QC activities to ensure that the reported values are consistent within and between different CRF tables as well as consistent with the values reported in the NIR	64

Sector	*Category*	*Recommendation*	*Paragraph cross-references*
		Report the correct values for gross energy intake and Y_m for all animals concerned in CRF table 4.A	64
		Improve the documentation in the NIR of Y_m for sheep and provide an adequate rationale for the low value	66
	Manure management – CH_4	Report values for feed energy digestibility in the NIR	68
		Provide MCFs for each animal waste management system	69
		Document in the NIR the method used to derive the new parameters and archive the source of the parameters	69
	Manure management – N_2O	Report the correct nitrogen excretion rates for all animals in CRF table 4.B(b)	70
		Implement further QC checks in order to ensure consistency in the reporting of nitrogen excretion from livestock	70
		Provide an improved description of the nitrogen flow model. Special attention should be given to the volatilization of ammonia (NH_3) and nitrogen oxide (NO_x) and to nitrogen lost due to leaching and runoff	73
	Agricultural	Increase the transparency of the model for NH_3 volatilization	74
	soils – N_2O	Revise the values of $Frac_{GASF}$ reported in CRF table 4.D and report this parameter consistently in the NIR and the CRF tables	75
LULUCF	Sector overview	Report on any progress made and/or on the revised land-use classification	80
	Forest land remaining	Consider updating the EF to one that more accurately represents the Nordic conditions	81
	forestland – CO_2	Include information on and results of the ongoing work to improve the validation of the Yasso07 model in the NIR	81
	Land converted to cropland – N_2O	Increase the transparency of the reporting by providing more information when reporting categories as "NO" for land-use conversion from wetlands to cropland	82
		Increase the transparency of the reporting by providing more information when reporting categories as "NO" for other land converted to cropland	83
	Grassland remaining grassland – CO_2	Provide the estimates for this category	84
	Liming – CO_2	Provide justification to explain why the default EF from the *2006 IPCC Guidelines for National Greenhouse Gas Inventories* better fits the national circumstances	85
Waste	Solid waste disposal on land – CH_4	Enhance the transparency of the reporting by providing the AD in a tabular format in the NIR and all assumptions used when converting the data from the waste statistics to those used in the emission model	87

Sector	*Category*	*Recommendation*	*Paragraph cross-references*
		Provide the reference for the assumption on the amount of "other material" used for the estimation of emissions in the NIR	88
		Use the new DOC values and provide references for the different parameter values used for the half-life and DOC, including any supporting documentation, to enhance transparency	89
	Wastewater handling – N_2O	Estimate the emissions using the protein consumption values in table 8.4 of the NIR	90
	Wastewater handling – CH_4	Provide more information in the NIR on the level of AD available for industrial wastewater treatment plants, especially oil refinery, pulp and paper, pharmaceutical and chemical companies	91
		Include estimates of emissions from all pulp and paper industries	92
		Correct the inconsistency in the reporting of CH_4 recovery between the NIR and the CRF tables	93
	Waste incineration – CH_4 and N_2O	Provide detailed information on the AD and methodologies used in estimating CH_4 and N_2O emissions from biogenic sources and cremation	94
KP-LULUCF	Afforestation and reforestation – CO_2	Continue to develop a methodology for estimating and reporting all carbon pools, including soil organic carbon, in order to fulfil the requirements under decisions 15/CMP.1 and 16/CMP.1	97
	Deforestation – CO_2	Include the estimates of emissions from organic soils	99
	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	100
National registry		Provide the information related to the most current implemented version of the consolidated registry software	107
		Test each release thoroughly against the data exchange standard as part of each major release cycle and provide the results of such tests in the NIR	107
		Include all other additional information in response to the SIAR findings in the NIR in accordance with decision 15/CMP.1, annex, chapter I.G	108

IV. Questions of implementation

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

Annex I

Background data on recalculations and information to be included in the compilation and accounting database

Table 9
Recalculations in the 2013 annual submission for the base year and the most recent year

Greenhouse gas source and sink categories	*1990*	*2010*	*1990*	*2010*	*Reason for the recalculation*
	Value of recalculation (Gg CO_2 eq)		*Per cent change*		
1. Energy	–75.72	–72.93	–0.3	0.2	Error correction, changed AD
A. Fuel combustion (sectoral approach)	–75.72	–189.00	–0.3	–0.5	
1. Energy industries		–23.53		–0.2	
2. Manufacturing industries and construction	–70.65	–145.44	–1.9	–4.0	
3. Transport	1.17	–35.99	0.01	–0.2	
4. Other sectors	–6.23	14.33	–0.1	0.4	
5. Other	0.001	1.64	0.0001	0.6	
B. Fugitive emissions from fuels		116.07		3.6	
1. Solid fuels					
2. Oil and natural gas		116.07		3.7	
2. Industrial processes	103.65	260.78	0.83	3.5	Methodological change, changed AD
A. Mineral products	18.59	2.00	2.6	0.2	
B. Chemical industry	71.20	12.99	2.2	1.1	
C. Metal production	7.6		0.1		
D. Other production		25.24		13.9	
E. Production of halocarbons and SF_6					
F. Consumption of halocarbons and SF_6	0.03	168.27	0.1	20.5	
G. Other	6.2	52.24	NA	NA	
3. Solvent and other product use	0.00002	1.28	0.00001	0.8	Improved AD
4. Agriculture	579.96	266.00	12.8	6.2	Changed AD and EFs, methodological change
A. Enteric fermentation	325.34	176.22	16.3	9.3	
B. Manure management	29.54	32.98	6.8	7.4	
C. Rice cultivation					
D. Agricultural soils	230.50	59.85	11.2	3.1	
E. Prescribed burning of savannas					
F. Field burning of agricultural residues	–5.414	–3.06	–17.2	–50.3	

Greenhouse gas source and sink categories	*1990*	*2010*	*1990*	*2010*	*Reason for the recalculation*
	Value of recalculation (Gg CO_2 eq)		*Per cent change*		
G. Other					
5. Land use, land-use change and forestry	–6 671.32	9 366.40	76.9	–28.4	Changed AD and EFs, methodological change
A. Forest land	–6 842.56	7 195.61	60.6	–20.1	
B. Cropland	1 883.62	1 920.49	409.7	2 843.5	
C. Grassland	–1 904.38	–1 579.92	–101.0	–94.0	
D. Wetlands	–61.83	–84.89	–1 804.9	–2 478.1	
E. Settlements	252.02	1 866.88	98.5	161.7	
F. Other land	1.81	48.22	NA	NA	
G. Other					
6. Waste	40.54	–19.64	2.2	–1.6	Methodological change, changed AD and EFs
A. Solid waste disposal on land	40.54	0.88	2.4	0.1	
B. Wastewater handling	–0.00002	–20.53	–0.00001	–12.3	
C. Waste incineration		0.00003		0.02	
D. Other					
7. Other	**NA**	**NA**	**NA**	**NA**	
Total CO_2 equivalent without LULUCF	**648.44**	**435.49**	**1.3**	**0.8**	
Total CO_2 equivalent with LULUCF	**–6 022.88**	**9 801.89**	**–14.6**	**46.8**	

Abbreviations: AD = activity data, EF = emission factor, LULUCF = land use, land-use change and forestry, NA = not applicable.

Table 10
Information to be included in the compilation and accounting database in t CO_2 eq for 2011, 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 2011				
CO_2	44 651 055	44 649 103		44 649 103
CH_4	4 397 436			4 397 436
N_2O	3 079 056	3 163 181		3 163 181
HFCs	950 212			950 212
PFCs	225 726			225 726
SF_6	60 716			60 716
Total Annex A sources	**53 364 200**	**53 446 374**		**53 446 374**
Activities under Article 3, paragraph 3, for 2011				
3.3 Afforestation and reforestation on non-harvested land for 2011	–606 664			–606 664
3.3 Afforestation and reforestation on harvested land for 2011	–48 769			–48 769
3.3 Deforestation for 2011	2 813 054			2 813 054
Activities under Article 3, paragraph 4, for 2011[c]				
3.4 Forest management for 2011	–31 673 087			–31 673 087
3.4 Cropland management for 2011				
3.4 Cropland management for the base year				
3.4 Grazing land management for 2011				
3.4 Grazing land management for the base year				
3.4 Revegetation for 2011				
3.4 Revegetation in the base year				

Abbreviation: Annex A sources = sources included in Annex A to the Kyoto Protocol.
[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 11
Information to be included in the compilation and accounting database in t CO_2 eq for 2010

	As reported	*Revised estimates*	*Adjustment*[a]	*Final*[b]
Annex A emissions for 2010				
CO_2	45 547 769	45 478 777		45 478 777
CH_4	4 522 016			4 522 016
N_2O	3 052 566	3 138 653		3 138 653
HFCs	914 444			914 444
PFCs	205 076			205 076
SF_6	75 382			75 382
Total Annex A sources	**54 317 252**	**54 334 348**		**54 334 348**
Activities under Article 3, paragraph 3, for 2010				
3.3 Afforestation and reforestation on non-harvested land for 2010	–678 666			–678 666
3.3 Afforestation and reforestation on harvested land for 2010	173 515			173 515
3.3 Deforestation for 2010	2 972 090			2 972 090
Activities under Article 3, paragraph 4, for 2010[c]				
3.4 Forest management for 2010	–28 220 154			–28 220 154
3.4 Cropland management for 2010				
3.4 Cropland management for the base year				
3.4 Grazing land management for 2010				
3.4 Grazing land management for the base year				
3.4 Revegetation for 2010				
3.4 Revegetation in the base year				

Abbreviation: Annex A sources = sources included in Annex A to the Kyoto Protocol.
[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 12
Information to be included in the compilation and accounting database in t CO_2 eq for 2009

	As reported	*Revised estimates*	*Adjustment*[a]	*Final*[b]
Annex A emissions for 2009				
CO_2	42 902 744			42 902 744
CH_4	4 505 906			4 505 906
N_2O	3 189 959	3 277 656		3 277 656
HFCs	736 469			736 469
PFCs	376 717			376 717
SF_6	61 455			61 455
Total Annex A sources	**51 773 251**	**51 860 948**		**51 860 948**
Activities under Article 3, paragraph 3, for 2009				
3.3 Afforestation and reforestation on non-harvested land for 2009	–696 261			–696 261
3.3 Afforestation and reforestation on harvested land for 2009	–18 028			–18 028
3.3 Deforestation for 2009	2 423 599			2 423 599
Activities under Article 3, paragraph 4, for 2009[c]				
3.4 Forest management for 2009	–26 061 015			–26 061 015
3.4 Cropland management for 2009				
3.4 Cropland management for the base year				
3.4 Grazing land management for 2009				
3.4 Grazing land management for the base year				
3.4 Revegetation for 2009				
3.4 Revegetation in the base year				

Abbreviation: Annex A sources = sources included in Annex A to the Kyoto Protocol.
[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 13
Information to be included in the compilation and accounting database in t CO_2 eq for 2008

	As reported	*Revised estimates*	*Adjustment*[a]	*Final*[b]
Annex A emissions for 2008				
CO_2	44 411 050			44 411 050
CH_4	4 601 353			4 601 353
N_2O	3 801 283	3 891 064		3 891 064
HFCs	691 954			691 954
PFCs	772 747			772 747
SF_6	65 395			65 395
Total Annex A sources	**54 343 783**	**54 433 563**		**54 433 563**
Activities under Article 3, paragraph 3, for 2008				
3.3 Afforestation and reforestation on non-harvested land for 2008	–566 007			–566 007
3.3 Afforestation and reforestation on harvested land for 2008	–18 028			–18 028
3.3 Deforestation for 2008	2 402 908			2 402 908
Activities under Article 3, paragraph 4, for 2008[c]				
3.4 Forest management for 2008	–28 412 245			–28 412 245
3.4 Cropland management for 2008				
3.4 Cropland management for the base year				
3.4 Grazing land management for 2008				
3.4 Grazing land management for the base year				
3.4 Revegetation for 2008				
3.4 Revegetation in the base year				

Abbreviation: Annex A sources = sources included in Annex A to the Kyoto Protocol.
[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.

Annex II

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 2013. Available at <http://unfccc.int/resource/docs/2013/asr/nor.pdf>.

Synthesis and assessment report on the greenhouse gas inventories submitted in 2013. Available at <http://unfccc.int/resource/webdocs/sai/2013.pdf>.

FCCC/ARR/2012/NOR. Report of the individual review of the annual submission of Norway submitted in 2012. Available at <http://unfccc.int/resource/docs/2013/arr/nor.pdf>.

Standard independent assessment report, parts 1 and 2. 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 Mr. Simen Ramberg Helgesen and Mr. Hans Kolshus (Climate and Pollution Agency), including additional material on the methodologies and assumptions used. The following documents[1] were also provided by Norway:

Kathrine Loe Bjønness. 2013. *Emissions of HFCs and PFCs from product use in Norway. Documentation of methodologies*. Oslo–Kongsvinger: Statistisk sentralbyrå • Statistics Norway

[1] Reproduced as received from the Party.

Annex III

Acronyms and abbreviations

AD	activity data
C	carbon
CaO	calcium oxide
CCS	carbon capture and storage
CF_4	perfluoromethane
C_2F_6	perfluoroethane
CH_4	methane
CMP	Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol
CO	carbon monoxide
CO_2	carbon dioxide
CO_2 eq	carbon dioxide equivalent
CORINAIR	core inventory of air emissions
CRF	common reporting format
CSEUR	Consolidated System of EU registries
DES	data exchange standard
DOC	degradable organic carbon
DOM	dead organic matter
EF	emission factor
ERT	expert review team
EU ETS	European Union Emissions Trading System
FAOSTAT	database of the Food and Agriculture Organization of the United Nations
$Frac_{GASF}$	fraction of synthetic nitrogen fertilizer that volatilizes as NH_3 and NO_x
$Frac_{GASM}$	fraction of animal manure that volatilizes as NH_3 and NO_x
Gg	gigagram (1 Gg = 10^9 g)
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
GJ	gigajoule (1 GJ = 10^9 joule)
ha	hectare (1ha = 100a = 10,000m^2)
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)
KLIF	Climate and Pollution Agency
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
LPG	liquefied petroleum gas
LULUCF	land use, land-use change and forestry
MCF	methane conversion factor
Mg	megagram (1 Mg = 1 tonne)
MgO	magnesium oxide
N_2O	nitrous oxide
NA	not applicable
Na_2CO_3	soda ash (sodium carbonate)
NCV	net calorific value
NE	not estimated
NFI	National Forest Inventory

NFLI	Norwegian Forest and Landscape Institute
NH_3	ammonia
NIR	national inventory report
NO	not occurring
NO_x	nitrogen oxide
ODS	ozone-depleting substances
PFCs	perfluorocarbons
PJ	petajoule (1 PJ = 10^{15} joule)
QA/QC	quality assurance/quality control
SEF	standard electronic format
SF_6	sulphur hexafluoride
SIAR	standard independent assessment report
SN	Statistics Norway
TJ	terajoule (1 TJ = 10^{12} joule)
UNFCCC	United Nations Framework Convention on Climate Change
VS	volatile solid
Y_m	methane conversion rate