Advance Version

COMPLIANCE COMMITTEE **CC/ERT/ARR/2013/8**
8 April 2013

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

Note by the secretariat

The report of the individual review of the annual submission of Sweden submitted in 2012 was published on 5 April 2013. For purposes of rule 10, paragraph 2, of the rules of procedure of the Compliance Committee (annex to decision 4/CMP.2, as amended by decision 4/CMP.4), the report is considered received by the secretariat on the same date. This report, FCCC/ARR/2012/SWE, contained in the annex to this note, is being forwarded to the Compliance Committee in accordance with section VI, paragraph 3, of the annex to decision 27/CMP.1.

United Nations FCCC/ARR/2012/SWE

Framework Convention on Climate Change

Distr.: General
5 April 2013

English only

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

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

Contents

I. Introduction and summary

1. This report covers the centralized review of the 2012 annual submission of Sweden, coordinated by the UNFCCC secretariat, in accordance with decision 22/CMP.1. The review took place from 24 to 29 September 2012 in Bonn, Germany, and was conducted by the following team of nominated experts from the UNFCCC roster of experts: generalists – Mr. Takeshi Enoki (Japan) and Mr. Dennis Rudov (Belarus); energy – Mr. Christo Christov (Bulgaria), Mr. Sangay Dorji (Bhutan), Mr. Constantin Harjeu (Romania) and Mr. Lawrence Kotoe (Ghana); industrial processes – Ms. Marisol Bacong (Philippines) and Ms. Youngsook Lyu (Republic of Korea); agriculture – Ms. Agita Gancone (Latvia) and Mr. Jacques Kouazounde (Benin); land use, land-use change and forestry (LULUCF) – Ms. Andrea Brandon (New Zealand) and Ms. Naoko Tsukada (Japan); and waste – Mr. Pavel Gavrilita (Republic of Moldova) and Mr. Kai Skoglund (Finland). Ms. Bacong and Mr. Enoki were the lead reviewers. The review was coordinated by Ms. Sevdalina Todorova and Ms. Astrid Olsson (UNFCCC secretariat).

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

3. In 2010, the main greenhouse gas (GHG) in Sweden was carbon dioxide (CO_2), accounting for 79.8 per cent of total GHG emissions[1] expressed in carbon dioxide equivalent (CO_2 eq), followed by nitrous oxide (N_2O) (10.7 per cent) and methane (CH_4) (7.9 per cent). Hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6) collectively accounted for 1.6 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 agriculture sector (11.9 per cent), the industrial processes sector (10.3 per cent), the waste sector (2.8 per cent) and the solvent and other product use sector (0.5 per cent). Total GHG emissions amounted to 66,271.36 Gg CO_2 eq and decreased by 9.1 per cent between the base year[2] and 2010.

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

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

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

[2] "Base year" refers to the base year under the Kyoto Protocol, which is 1990 for CO_2, CH_4 and N_2O, and 1995 for HFCs, PFCs and SF_6. The base year emissions include emissions from Annex A sources only.

Table 1

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

			Gg CO_2 eq								*Change*
		Greenhouse gas	*Base year[a]*	*1990*	*1995*	*2000*	*2005*	*2008*	*2009*	*2010*	*Base year–2010 (%)*
Annex A sources		CO_2	56 890.29	56 890.29	58 854.44	54 132.67	53 282.09	50 138.63	46 663.62	52 883.68	–7.0
		CH_4	7 049.88	7 049.88	6 952.49	6 364.75	5 887.17	5 375.23	5 278.25	5 254.56	–25.5
		N_2O	8 376.32	8 376.32	8 072.38	7 595.96	7 062.43	6 948.16	6 783.67	7 052.14	–15.8
		HFCs	132.12	4.15	132.12	567.89	789.53	866.58	868.51	849.43	542.9
		PFCs	343.43	376.82	343.43	240.52	257.15	225.05	35.33	158.21	–53.9
		SF_6	126.68	107.49	126.68	93.59	142.48	83.87	80.53	73.34	–42.1
KP-LULUCF	Article 3.3[b]	CO_2						2 415.33	2 232.27	1 964.55	
		CH_4						NO	NO	NO	
		N_2O						5.97	5.11	5.22	
	Article 3.4[c]	CO_2	NA					–39 910.40	–38 659.85	–36 993.67	NA
		CH_4	NA					13.16	2.53	0.65	NA
		N_2O	NA					50.34	45.88	65.83	NA

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

[a] "Base year" for Annex A sources refers to the base year under the Kyoto Protocol, which is 1990 for CO_2, CH_4 and N_2O, and 1995 for HFCs, PFCs and SF_6. The "base year" for activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol is 1990.

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

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

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

			Gg CO_2 eq								*Change Base year–2010 (%)*
		Sector	*Base year[a]*	*1990*	*1995*	*2000*	*2005*	*2008*	*2009*	*2010*	
Annex A		Energy	53 606.37	53 606.37	55 441.87	50 556.63	49 565.43	46 391.86	44 640.20	49 358.89	–7.9
		Industrial processes	6 443.55	6 329.78	6 644.15	6 811.84	7 003.55	6 832.62	5 010.33	6 840.59	6.2
		Solvent and other product use	332.49	332.49	308.55	277.54	302.79	311.05	311.11	311.11	–6.4
		Agriculture	9 115.03	9 115.03	8 853.49	8 433.69	8 078.92	8 040.53	7 808.30	7 912.34	–13.2
		Waste	3 421.27	3 421.27	3 233.47	2 915.69	2 470.14	2 061.45	1 939.97	1 848.43	–46.0
		LULUCF	NA	41 259.47	35 468.86	38 911.20	30 889.85	36 777.98	35 747.88	34 055.34	NA
		Total (with LULUCF)	**NA**	**31 545.48**	**39 012.67**	**30 084.18**	**36 530.99**	**26 859.55**	**23 962.03**	**32 216.03**	**NA**
		Total (without LULUCF)	**72 918.72**	**72 804.95**	**74 481.54**	**68 995.38**	**67 420.84**	**63 637.52**	**59 709.91**	**66 271.36**	**–9.1**
		Other[b]	NO	NO	NO	NO	NO	NO	NO	NO	NO
KP-LULUCF	Article 3.3[c]	Afforestation and reforestation						–826.14	–817.58	–796.01	
		Deforestation						3 247.44	3 054.95	2 765.78	
		Total (3.3)						**2 421.30**	**2 237.38**	**1 969.78**	
	Article 3.4[d]	Forest management						39 846.91	38 611.44	36 927.19	
		Cropland management	NA					NA	NA	NA	NA
		Grazing land management	NA					NA	NA	NA	NA
		Revegetation	NA					NA	NA	NA	NA
		Total (3.4)	**NA**					**39 846.91**	**38 611.44**	**36 927.19**	**NA**

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

[a] "Base year" for Annex A sources refers to the base year under the Kyoto Protocol, which is 1990 for CO_2, CH_4 and N_2O, and 1995 for HFCs, PFCs and SF_6.

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

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

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

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

	As reported	*Revised estimates*	*Adjustment*[a]	*Final*[b]
Commitment period reserve	331 161 849	331 356 813		331 356 813
Annex A emissions for current inventory year				
CO_2	52 883 685			52 883 685
CH_4	5 254 559			5 254 559
N_2O	7 013 146	7 052 139		7 052 139
HFCs	849 428			849 428
PFCs	158 212			158 212
SF_6	73 339			73 339
Total Annex A sources	**66 232 370**	**66 271 363**		**66 271 363**
Activities under Article 3, paragraph 3, for current inventory year				
3.3 Afforestation and reforestation on non-harvested land for current year of commitment period as reported	–796 009			–796 009
3.3 Afforestation and reforestation on harvested land for current year of commitment period as reported	NO			NO
3.3 Deforestation for current year of commitment period as reported	2 765 784			2 765 784
Activities under Article 3, paragraph 4, for current inventory year[c]				
3.4 Forest management for current year of commitment period	–36 927 189			–36 927 189
3.4 Cropland management for current year of commitment period				
3.4 Cropland management for base year				
3.4 Grazing land management for current year of commitment period				
3.4 Grazing land management for base year				
3.4 Revegetation for current year of commitment period				
3.4 Revegetation in base year				

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

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

	As reported	*Revised estimates*	*Adjustment*[a]	*Final*[b]
Annex A emissions for 2009				
CO_2	46 663 621			46 663 621
CH_4	5 278 252			5 278 252
N_2O	6 744 937	6 783 672		6 783 672
HFCs	868 508			868 508
PFCs	35 330			35 330
SF_6	80 529			80 529
Total Annex A sources	**59 671 176**	**59 709 911**		**59 709 911**
Activities under Article 3, paragraph 3, for 2009				
3.3 Afforestation and reforestation on non-harvested land for 2009 as reported	–817 576			–817 576
3.3 Afforestation and reforestation on harvested land for 2009 as reported	NO			NO
3.3 Deforestation for 2009 as reported	3 054 955			3 054 955
Activities under Article 3, paragraph 4, for 2009[c]				
3.4 Forest management for 2009	–38 611 435			–38 611 435
3.4 Cropland management for 2009				
3.4 Cropland management for base year				
3.4 Grazing land management for 2009				
3.4 Grazing land management for base year				
3.4 Revegetation for 2009				
3.4 Revegetation in base year				

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

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

	As reported	*Revised estimates*	*Adjustment*[a]	*Final*[b]
Annex A emissions for 2008				
CO_2	50 138 634			50 138 634
CH_4	5 375 234			5 375 234
N_2O	6 909 843	6 948 156		6 948 156
HFCs	866 580			866 580
PFCs	225 048			225 048
SF_6	83 869			83 869
Total Annex A sources	**63 599 208**	**63 637 521**		**63 637 521**
Activities under Article 3, paragraph 3, for 2008				
3.3 Afforestation and reforestation on non-harvested land for 2008 as reported	–826 140			–826 140
3.3 Afforestation and reforestation on harvested land for 2008 as reported	NO			NO
3.3 Deforestation for 2008 as reported	3 247 435			3 247 435
Activities under Article 3, paragraph 4, for 2008[c]				
3.4 Forest management for 2008	–39 846 907			–39 846 907
3.4 Cropland management for 2008				
3.4 Cropland management for base year				
3.4 Grazing land management for 2008				
3.4 Grazing land management for base year				
3.4 Revegetation for 2008				
3.4 Revegetation in base year				

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

II. Technical assessment of the annual submission

A. Overview

1. Annual submission and other sources of information

6. The 2012 annual inventory submission was submitted on 26 March 2012; it contains a complete set of common reporting format (CRF) tables for the period 1990–2010 and a national inventory report (NIR). Sweden also submitted information required under Article 7, paragraph 1, of the Kyoto Protocol, including information on: activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, accounting of Kyoto Protocol units, changes in the national system and in the national registry, and the minimization of adverse impacts in accordance with Article 3, paragraph 14, of the Kyoto Protocol. The standard electronic format (SEF) tables were submitted on 26 March 2012. The annual submission was submitted in accordance with decision 15/CMP.1.

7. Sweden officially submitted revised emission estimates on 4 October 2012 in response to questions raised by the expert review team (ERT) during the review. The values used in this report are based on the values contained in the revised emission estimates submitted on 4 October 2012.

8. Where necessary, the ERT also used the previous year's submission during the review. In addition, the ERT used the standard independent assessment report (SIAR), parts I and II, to review information on the accounting of Kyoto Protocol units (including the SEF tables and their comparison report) and on the national registry.[3]

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

Completeness of inventory

10. The inventory covers all mandatory[4] source and sink categories for the period 1990-2010 and is complete in terms of gases, years and geographical coverage. However, as indicated in the NIR, Sweden is still working to ensure the complete reporting of some minor categories, such as biofuels in military transportation, and some emissions for several categories in the industrial processes sector (see para. 56 below). The ERT noted that the Party has reported CO_2 emissions from oil transport as not estimated ("NE") and encourages Sweden to make efforts to include estimates for these emissions in its next annual submission (see para. 37 below). Sweden does not report the optional categories

[3] The SIAR, parts I and II, is prepared by an independent assessor in line with decision 16/CP.10 (paras. 5(a), 6(c) and 6(k)), under the auspices of the international transaction log administrator (ITL) using procedures agreed in the Registry System Administrators Forum. Part I is a completeness check of the submitted information relating to the accounting of Kyoto Protocol units (including the SEF tables and their comparison report) and to national registries. Part II contains a substantive assessment of the submitted information and identifies any potential problem regarding information on the accounting of Kyoto Protocol units and the national registry.

[4] Mandatory source and sink categories under the Kyoto Protocol are all source and sink categories for which the Intergovernmental Panel on Climate Change (IPCC) *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories* and the IPCC *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* provide methodologies and/or emission factors to estimate GHG emissions.

under the LULUCF sector. The ERT encourages the Party to continue its efforts to improve the completeness of its inventory.

11. Sweden has provided a complete set of CRF tables and has used the notation keys appropriately throughout the tables. The ERT noted only minor differences between the annotated outline of the NIR and the Party's NIR, namely in relation to missing information on KP-LULUCF activities in the chapter on recalculations and inventory improvements (see para. 117 below).

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

Overview

12. The ERT concluded that the national system continues to perform its required functions.

13. Sweden reported in the NIR that no changes have been made to the national system since the previous annual submission.

Inventory planning

14. The NIR describes the national system and the institutional arrangements for the preparation of the inventory, including the legal and procedural arrangements for inventory planning, preparation and management. The Swedish Ministry of the Environment is the designated single national entity with overall responsibility for the national inventory. The Swedish Environmental Protection Agency (SEPA) is responsible for: coordinating the preparation of the inventory; performing the final quality assurance/quality control (QA/QC) checks; submitting the inventory to the European Union and to the UNFCCC; and publishing the national inventory.

15. Most of the data and documentation contained in the Party's inventory were produced by the Swedish Environmental Emissions Data (SMED) consortium, consisting of the Swedish Meteorological and Hydrological Institute, Statistics Sweden, the Swedish University of Agricultural Sciences and the Swedish Environmental Research Institute. Sufficient capacity and resources for the preparation of the inventory and the implementation of inventory improvements are ensured through a nine-year contract between SEPA and SMED.

16. Other agencies and organizations are involved in the preparation of the inventory: the Swedish Energy Agency, the Swedish Transport Administration, the National Maritime Administration and the Swedish Armed Forces provide data on the energy sector; the Swedish Chemicals Agency provides data and conducts peer reviews for the industrial processes and solvent and other product use sectors; the Swedish Board of Agriculture provides data and peer reviews for the agriculture sector; the Swedish Association of Waste Management provides data on the waste sector; and the Swedish University of Agricultural Sciences provides data on the LULUCF sector and on KP-LULUCF activities, while the National Board of Forestry is responsible for conducting a peer review.

17. Sweden has a QA/QC system in place as part of its national system. The Party's QA/QC plan has been elaborated and implemented. In its 2012 annual submission, Sweden moved the description of its QA/QC procedures from the annex to the NIR to the chapter on inventory planning, preparation and management. The ERT welcomes this change.

Inventory preparation

Key categories

18. Sweden has reported tier 1 and tier 2 key category analyses, both level and trend assessment, as part of its 2012 annual submission. The tier 1 key category analysis performed by the Party and that performed by the secretariat[5] produced different results owing to the different level of disaggregation used by Sweden. The Party has included the LULUCF sector in its key category analysis, which was 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). However, the ERT noted that Sweden has not disaggregated the categories by fuel in the energy sector, as identified by the ERT in the previous annual review report, and the categories under the LULUCF sector have been aggregated by land-use and by GHG. The ERT encourages Sweden to perform the key category analysis following the level of aggregation suggested by the IPCC good practice guidance for LULUCF (table 5.4.1).

19. The results of the tier 1 and tier 2 key category analyses are presented in CRF table 7 as well as in the NIR and in annex 1 to the NIR. Sweden uses the results of the tier 2 key category analysis to prioritize the development and improvement of the inventory. In its NIR, Sweden reported that tier 2 QA procedures are applied to the key categories, resulting in a list of suggested inventory improvements. In response to a question raised by the ERT during the review, the Party provided the ERT with documentation showing the suggested inventory improvements (see para. 27 below).

20. Sweden has identified key categories for activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, for the years 2008–2010 and has reported them in table NIR-3. The Party has reported a qualitative key category analysis, which identified all CO_2 emissions and removals from the KP-LULUCF activities as key. However, this approach is not entirely consistent with the approach suggested by the IPCC good practice guidance for LULUCF, in view of the fact that the level of aggregation used by the Party for the LULUCF sector hinders a clear understanding of the relationship between the LULUCF sector and the KP-LULUCF activities (see table 5.4.4 of the IPCC good practice guidance). The ERT recommends that Sweden improve its reporting of the key category analyses in its next annual submission.

Uncertainties

21. Sweden has performed a tier 1 uncertainty analysis, both including and excluding LULUCF, in line with the IPCC good practice guidance. The overall uncertainty of the national GHG emissions is 4.1 per cent excluding LULUCF and 25.2 per cent including LULUCF, which are 2.2 per cent and 36.3 per cent lower, respectively, than the uncertainties reported in the previous annual submission. This decrease is explained by the use of new assumptions regarding the correlations between the uncertainties for some

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

emission factors (EFs), mainly in the energy and agriculture sectors and in the chemical industry category. Also, during the review, Sweden clarified that the system for calculating the uncertainties had been revised, which had also led to a change in the uncertainty values. The ERT encourages the Party to provide a more detailed explanation in the NIR for such significant changes in the overall uncertainty values between annual submissions. For the trend analysis, the uncertainty is 2.1 per cent excluding LULUCF and 7.0 per cent including LULUCF.

22. In the previous review report, the ERT noted that the approach used by Sweden to estimate uncertainties does not consider the correlation between gases. In annex 7 to the 2012 NIR, Sweden has reported that uncertainties related to activity data (AD) have been corrected to take into account the correlation structure of the AD, particularly with regard to fuel use. The ERT welcomes this improvement and encourages Sweden to continue its work to improve its uncertainty estimates. The ERT reiterates the encouragement from the previous review report that the Party implement a tier 2 uncertainty analysis in its next annual submission.

23. The ERT concluded that the NIR does not clearly explain how the recalculations performed by the Party affect the uncertainty values. However, the ERT concluded from the information provided in the sector-specific chapters of the NIR that the recalculations do have an effect on the uncertainties; for example, the CO_2 EFs used for the category public electricity and heat production were updated according to the most recently available data (para 3.2.6.5 of the NIR), leading to a decrease in the uncertainty of the EF from 7 to 5.8 per cent compared with that reported in the 2011 annual submission. The ERT reiterates the recommendation made in the previous review report that Sweden provide more detailed information in the NIR regarding which specific inventory improvements lead to reduced uncertainty.

24. During the previous review, the ERT noted that the uncertainty of some AD was reported as "0" in table A.7.2 in annex 7 to the NIR, with no explanations provided. In the 2012 annual submission, some of the AD uncertainties that were previously reported as "0" have been reported using estimated values, such as the uncertainties for CH_4 and N_2O emissions from road transportation, CO_2 emissions from other mineral use, CO_2 emissions from ferroalloys and aluminium production and CO_2 and CH_4 emissions from waste incineration. The ERT welcomes this improvement. However, the Party did not provide explanations for the changed uncertainty values in the NIR. Some AD uncertainty values were still reported by Sweden as "0" (e.g. CH_4 emissions from oil and natural gas activities, CH_4, CO_2 and N_2O emissions from other chemical industry and SF_6 emissions from magnesium foundries). In response to a question raised by the ERT during the review, Sweden provided explanations for the use of "0" values and for the changes made to some of the uncertainty values since the previous annual submission. Particularly, the Party commented that AD uncertainties for directly measured emissions, such as CH_4 from oil and natural gas activities, are allocated to either the AD or EF depending on the likelihood of correlation over time; and that for CH_4 and N_2O emissions from road transportation the estimation method has changed. The ERT recommends that the Party improve the transparency of its reporting by including explanations for any remaining "0" values, as well as for any changes in the uncertainty values across annual submissions and any plans for reducing the uncertainty of its estimates, in its next NIR.

Recalculations and time-series consistency

25. Recalculations have been performed and reported in accordance with the IPCC good practice guidance. The ERT noted that the recalculations reported by the Party for the years 1990–2009 have been undertaken to take into account: the reallocation of emissions from the combustion of natural gas in gasworks from other (energy) to public electricity and heat

production in the energy sector; a revised calculation methodology in the energy and LULUCF sectors; revised EFs in the energy and agriculture sectors; new AD in the energy, industrial processes and agriculture sectors; and revised AD for all sectors. The recalculations were consistently applied over the whole time series. The major changes, and the magnitude of the impact, include: an increase in estimated total GHG emissions in the base year of 0.4 per cent without LULUCF and of 13.4 per cent with LULUCF. For 2009, the recalculations resulted in a decrease in total estimated GHG emissions of 0.6 per cent excluding LULUCF, but led to an increase of 20.0 per cent including LULUCF. This major change was due to the recalculation of CO_2 removals in the category forest land, leading to a reduction in estimated net removals of 13.3 per cent since the previous annual submission (see para. 85 below). The rationale for these recalculations is provided in the sectoral chapters and in chapter 10 of the NIR, as well as in CRF table 8(b). However, more detailed information is required for several categories in the LULUCF sector and for some KP-LULUCF activities (see paras. 86 and 111 below).

Verification and quality assurance/quality control approaches

26. In the NIR, Sweden reported that it has in place a QA/QC plan, in accordance with decision 19/CMP.1. The Party has performed tier 1 QC checks for all categories and tier 2 QC checks for certain categories in the energy and industrial processes sectors. The ERT reiterates the encouragement from the previous review report that Sweden expand its tier 2 QC activities to cover the agriculture, LULUCF and waste sectors. All of the QC procedures performed are documented by SMED in QC checklists for each CRF code or group of codes, which are reviewed after the completion of the draft NIR. Internal checks of data inputted into the CRF Reporter software are also performed.

27. The Party's QA/QC system includes national peer reviews for the key categories performed by sectoral authorities, as defined in Ordinance 2005:626, and coordinated by SEPA. During such reviews, the methodologies and EFs used are checked, the AD and emission estimates are compared with other national statistics, and areas for further inventory improvements are defined. The results of the national peer reviews are documented in review reports. In response to a question raised by the ERT during the review, Sweden provided the ERT with a list of recommendations from such a report (in Swedish), containing recommendations from the peer review, the priority level of the recommendation, the response of SMED to the recommendation, as well as the responsible person, date and status of the issue. The ERT welcomes the documentation provided by the Party during the review and reiterates the encouragement from the previous review report that Sweden include the results of national peer reviews in the sections on sector-specific QA/QC activities in the NIR of its next annual submission.

28. Chapter 10 of the NIR contains the list of inventory improvements carried out in response to the review process since the 2006 annual submission, as well as a list of recommendations not yet implemented, with corresponding explanations. The ERT welcomes the transparency of the information provided by the Party, which demonstrates that the efficient implementation of the national QA/QC system is ensured.

Transparency

29. Sweden's inventory is generally transparent with regard to the methodologies, EFs and AD used. The ERT noted the improvement in the transparency of the Party's reporting in relation to the QA/QC system (see para. 17 above) and at the sectoral level (see para. 31 below). However, the ERT identified several issues related to the transparency of the Party's reporting, in relation to which further improvement is required; these are listed in the relevant sectoral chapters of this report (see paras. 41, 59, 67, 73, 76, 78, 79, 88 and 99 below). The ERT recommends that Sweden improve the transparency of its reporting by following the recommendations contained in this review report.

Inventory management

30. Sweden has a centralized archiving system, which includes the archiving of disaggregated EFs and AD, and documentation on how these factors and data have been generated and aggregated for the preparation of the inventory. The archived information also includes internal documentation on QA/QC procedures, external and internal reviews, and documentation on annual key categories and key category identification and planned inventory improvements. The Technical Production System (TPS) for storing and handling emission data has been in place since 2007. It allows different users to access and use all data available for the preparation of the inventory, including AD, EFs and CRF tables, while ensuring the security of these data. In addition to TPS, documentation, data and the calculations for each annual submission are stored on the servers at each organization involved in the preparation of the inventory, and, for collective use and archiving, that information is stored in two 'cloud' storages – one for SEPA, SMED and other agencies, and the other for SMED only.

3. Follow-up to previous reviews

31. The ERT noted that, in line with the Swedish inventory cycle, the GHG inventory is compiled by 15 October, thereby allowing only minor recommendations made in the previous review report to be implemented in the current annual submission, while more significant changes are performed in time for the following year's annual submission. Taking this into account, the ERT noted that the following recommendations made in the previous review report have been implemented in the 2012 annual submission:

(a) An improved description of the national system regarding QA/QC procedures and the inventory cycle;

(b) The provision of uncertainty estimates for several categories which were previously reported as "0";

(c) An improvement in the transparency of the Party's reporting in relation to the energy sector (the allocation of emissions from venting), the industrial processes sector (the provision of an explanation for the CO_2 EF from cement production, and the carbon mass balance of integrated iron and steel plants in Sweden) and the LULUCF sector (the provision of additional information on the drivers of the emission/removal trends and their impact on the annual carbon stock change);

(d) An improvement in the completeness of the inventory through the provision of estimates for CO_2 emissions from natural gas transmission and CH_4 emissions from natural gas transmission and distribution in the energy sector;

(e) An improvement in the accuracy of the reporting on the LULUCF sector by changing the methodology used in order to avoid large inter-annual fluctuations in the carbon stock change.

32. However, a number of cross-sectoral recommendations made in the previous review report have not yet been implemented, such as: the expansion of the tier 2 QC checks to cover the agriculture, LULUCF and waste sectors; and the improvement of the explanation of the specific inventory improvements that lead to improved uncertainty estimates and how these improved uncertainty estimates are considered in the uncertainty analysis (see paras. 23 and 26 above). The recommendations made in the previous review report addressing sector-specific issues are reiterated in the relevant sector chapters of this report.

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

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

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

B. Energy

1. Sector overview

35. The energy sector is the main sector in the GHG inventory of Sweden. In 2010, emissions from the energy sector amounted to 49,358.89 Gg CO_2 eq, or 74.5 per cent of total GHG emissions. Since 1990, emissions have decreased by 7.9 per cent. The key driver for the fall in emissions is the decrease in emissions from the residential and commercial sector associated with the stagnation of emissions from transport. Within the sector, around 42.0 per cent of the emissions were from transport, followed by 26.5 per cent from energy industries, 20.5 per cent from manufacturing industries, 8.6 per cent from other sectors (residential and commercial) and 2.0 per cent from fugitive emissions. The remaining 0.4 per cent were from other (fuel combustion).

36. The Party has made recalculations for the energy sector between the 2011 and 2012 annual submissions following changes in AD, EFs and methodologies (e.g. the implementation of a new methodology for off-road and working machinery). The recalculations are transparently documented in the CRF tables and in the NIR. The impact of these recalculations on the energy sector is an increase in the estimate of emissions for 2009 of 0.1 per cent. The main recalculations for 2009 took place in the following categories:

(a) Energy industries: an increase in the estimate of emissions of 1.3 per cent (121.57 Gg CO_2 eq) owing to the use of a revised CO_2 EF for derived steelwork gases in public electricity and heat production and the reallocation of natural gas combustion in gasworks from other (stationary combustion) to public electricity and heat production;

(b) Manufacturing industries and construction: a decrease in the estimate of emissions of 1.2 per cent (104.65 Gg CO_2 eq) owing to the use of a revised EF for in-house produced gas used in the chemical industry;

(c) Transport: a negligible change in the estimate of emissions for 2009, but a more substantive increase in the estimates of emissions for previous years of the time series, owing to the correction of erroneous data and the implementation of a new methodology for working machinery and off-road vehicles, a change in the model used for estimating emissions from road vehicles from ARTEMIS to HBEFA 3.1 and the use of new EFs.

37. The energy sector is generally complete in term of gases, years and geographical coverage. The estimates of CH_4 and N_2O emissions from the combustion of ethanol in road transportation and of CH_4 emissions from natural gas transmission and distribution, which were omitted from the initial 2011 annual submission, have been included in the 2012 annual submission. As noted in the NIR, the emissions that are not yet reported in the inventory are CH_4 and N_2O emissions from liquid biofuels used in military transportation and fuels generated in-house. The ERT encourages Sweden to continue its efforts to ensure the completeness of its inventory for the energy sector. In addition, the ERT noted that the Party has reported CO_2 emissions from oil transport as "NE". The ERT encourages the Party to include estimates for these emissions in its next annual submission, for example calculated using country-specific data and default EFs from table 2.16 of the IPCC good practice guidance.

38. The inventory reporting follows the "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC

reporting guidelines on annual inventories" (hereinafter referred to as the UNFCCC reporting guidelines). The inventory for the energy sector is transparent, and the assumptions and methodologies used, the collection of AD and the selection of EFs are clearly explained and well documented in the NIR. The ERT noted that the NIR refers to national studies carried out in relation to the energy sector inventory (e.g. a study on bunker fuels, a study performed by Statistics Sweden in 2009, including the detailed comparison between the quarterly fuel statistics, the annual industrial energy survey and the national energy balance), without providing detailed information on their findings and results. The ERT encourages Sweden to provide, in its next annual submission, more detailed information on the conclusions of the national studies conducted in relation to the energy sector.

39. The ERT acknowledges the implementation of a number of recommendations made in the previous review report, namely: the revision of the CO_2 EFs for coke oven gas, blast furnace gas and steel converter gas, taking into account the energy gases sold to two public electricity and heat production plants; and the inclusion of estimates for CO_2 emissions from natural gas transmission and CH_4 emissions from natural gas transmission and distribution. Further, Sweden has provided additional information to confirm the accuracy of the CO_2 EFs used for gaseous fuels for the period 1990–2000 and has explained how the CO_2 EFs for the period 2001–2007 were calculated prior to the use of data from the European Union emissions trading scheme (EU ETS) for the years 2008–2010. The ERT commends the Party for these improvements.

2. Reference and sectoral approaches

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

40. Estimates of CO_2 emissions from fuel combustion have been calculated using the reference approach and the sectoral approach. For 2010, the CO_2 emissions estimated using the sectoral approach were 1.65 per cent higher than the emissions estimated using the reference approach. The ERT noted that the documentation box of CRF table 1.A(c) still contains the incorrect reference to section 3.3.6 of the NIR regarding the explanation of the differences between the two approaches. The ERT therefore reiterates the recommendation made in previous review reports that Sweden correct this reference in the next annual submission. The ERT also noted that the difference between the two approaches fluctuates from –8.2 to +1.6 per cent across the inventory years, and therefore suggests that the Party include a brief explanation for the causes of the differences in the documentation box of CRF table 1.A(c) in the next annual submission. Although the NIR contains some information on the two approaches, the explanation of the reasons for the deviations in the estimates calculated using the two approaches is not sufficiently clear. A study which aims to minimize the difference between the approaches, or to at least identify more detailed explanations for the difference, will be carried out in 2012 and the results will be implemented in the next annual submission. The ERT commends Sweden for undertaking the study and encourages the Party to report on its progress and results and incorporate its conclusions in the next annual submission.

41. The ERT noted that, for the reference approach reported in CRF table 1.A(b), the fuels are reported in energy units and an oxidation factor of 1.0 is used by the Party to convert net carbon emissions to CO_2 emissions. In response to a question raised by the ERT during the review, Sweden explained that the oxidation is accounted for in the EFs used in the reference approach. The ERT strongly recommends that the Party follow the IPCC default reporting method for the reference approach, so that all fuels are reported in natural units and the real carbon content of fuels and default oxidation factors are used, in order to further improve the transparency of the Party's reporting.

42. For 2010, there is a difference of 4 per cent in the apparent fuel consumption between the reference approach and the data from the International Energy Agency (IEA). The total apparent consumption according to the IEA data is higher, owing mainly to differences in the liquid fuel trade, coking coal imports and jet kerosene stock change. The growth rate of the total apparent consumption for the period 1990–2010 is 8 per cent according to the CRF tables and 0 per cent according to the IEA data. The ERT recommends that Sweden more clearly explain the differences between the two data sets once the results from the national study have been obtained (see para. 40 above).

International bunker fuels

43. The use of international bunker fuels in Sweden is substantially greater than the fuel used for domestic navigation and aviation. Data on international bunker fuels used for navigation are provided in the fuel supply and delivery statistics, while the use of international bunker fuels for aviation is calculated using both data on fuel supply and delivery from Statistics Sweden and information from the Swedish Transport Agency. The ERT noted that there are differences between the data on bunker fuels reported in the CRF tables and the IEA data, particularly for jet kerosene (e.g. by up to 40 per cent for aviation bunker fuels for the period 1992–2001). The Party explained in the NIR that, according to a study performed in 2010, the differences between the IEA data and the data reported in the CRF tables could be a result of the revision policies of different reporting obligations. In response to a question raised by the ERT during the review, the Party explained that the amount of jet kerosene reported in the CRF tables is based on national energy statistics and the split between domestic and international consumption is based on information from the Swedish Transport Agency. In addition, the NIR provides information on the action taken in 2010 and 2011 to ensure the accuracy of the reporting of international bunker fuels and the split between international and domestic fuel consumption. The ERT commends Sweden for the efforts undertaken.

44. The gas/diesel oil consumption for navigation reported to IEA (148,444 TJ) for 2010 is higher than the consumption reported in the CRF tables (124,842 TJ) (a difference of 19.2 per cent). Sweden explained that, in the CRF tables, the category "gas/diesel oil" is split into diesel and domestic heating oil using a different net calorific value (NCV), while IEA applies the same NCV for the whole category. The ERT considered the response satisfactory.

45. Further, the ERT noted discrepancies between CRF tables 1.C and 1.A(b) for gas/diesel oil (international marine bunkers) and residual fuel oil (international marine bunkers) for all years of the time series, with the discrepancies being particularly significant for residual fuel oil for the years 2001 and 2007. The ERT reiterates the recommendation made in previous review reports that Sweden correct these discrepancies or explain them in its next annual submission.

Feedstocks and non-energy use of fuels

46. AD on feedstocks and non-energy use of fuels are collected from the quarterly fuel statistics, which provide information on whether fuels are used as raw materials or for energy purposes. However, the ERT noted that a fraction of 1.0 for carbon stored in feedstocks and non-energy use of fuels is used by Sweden for all fuels. The ERT strongly recommends that the Party justify the fraction used for carbon stored or reassess the fraction of carbon stored on the basis of the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the Revised 1996 IPCC Guidelines) and the IPCC good practice guidance and recalculate the sectoral approach emission estimates for the next annual submission, if necessary.

3. Key categories[6]

Stationary combustion: solid fuels – N_2O

47. The ERT noted significant variations in the N_2O implied emission factors (IEFs) used for solid fuels. The IEFs (ranging from 8.41 to 15.97 kg/TJ) for public electricity and heat production are the highest reported by all Parties for all years of the time series (ranging from 0.05 to 15.97 kg/TJ). The IEF shows a decreasing trend between 1990 (15.97 kg/TJ) and 2010 (9.61 kg/TJ). There is a 49.8 per cent decrease between the value in 1990 and 2009 and a 7.3 per cent increase in 2010 compared with the 2009 value (8.96 kg/TJ). In addition, the 2010 value of the N_2O IEF (4.25 kg/TJ) for chemicals is 74.7 per cent below the 1990 value (16.80 kg/TJ) and the inter-annual fluctuations range between –34.3 and +48.1 per cent. During the review, Sweden explained that the inter-annual variations were due to changes in the fuel mix. The decreasing use of coal since 1990, with a considerably higher EF than other solid fuels (e.g. peat, steelwork gases, etc.), has resulted in a much lower IEF for solid fuels in recent years. The ERT recommends that the Party include this explanation in its next annual submission. The ERT reiterates the recommendation made in the previous review report that Sweden review the N_2O EFs used for public electricity and heat production and provide further justification for the country-specific EFs used in its next annual submission.

48. Sweden uses a constant N_2O IEF (20.0 kg/TJ) for food processing, beverages and tobacco, which is the second highest reported by Parties (0.8 to 962.80 kg/TJ). The ERT encourages the Party to review and report on the source of the EF used in its next annual submission.

Road transportation: all fuels – CO_2, CH_4 and N_2O[7]

49. Road transportation is the single largest key category for Sweden (excluding LULUCF). The estimates are calculated using a combination of a tier 1 approach with a country-specific EF for CO_2 emissions and using a model-based approach for CH_4 and N_2O emissions. The ERT noted the improvements made in the road transportation category as a result of the shift from the ARTEMIS model to the HBEFA (version 3.1) model and the explanations provided for the differences in the models. The ERT acknowledges the efforts made by Sweden to ensure the completeness of the emission estimates by reporting emissions not included in the model, namely CH_4 and N_2O emissions from ethanol used by passenger cars and heavy-duty vehicles, which were also reported in the 2011 annual submission, and CH_4 and N_2O emissions from natural gas and biogas, which were reported in the 2012 annual submission for the first time. The ERT commends the Party for these improvements.

50. The trend in the CH_4 IEF (103.71–316.68 t/TJ) for gaseous fuels shows large inter-annual fluctuations in recent years as follows: 2006/2007 (–26.3 per cent), 2007/2008 (+12.3 per cent), 2008/2009 (+64.2 per cent) and 2009/2010 (–20.3 per cent). In response to a question raised by the ERT during the review, Sweden explained that country-specific EFs for CH_4 emissions from passenger cars and heavy-duty vehicles are used. The EF differs noticeably between the two vehicle categories as the consumption of natural gas differs between years and vehicles and the IEF is the average for all vehicle categories. The ERT recommends that Sweden describe the changes in natural gas consumption by vehicle type across the entire time series in its next annual submission.

[6] The key category analysis applied by Sweden disaggregates the energy sector by category and by gas, without specifying the types of fuel used (see para. 18 above).

[7] Not all emissions related to all gases and fuels under this category are key categories. However, since the calculation procedures for issues related to this category are discussed as a whole, the individual gases and fuels are not assessed in separate sections.

4. Non-key categories

Stationary combustion: other fuels – CO_2

51. The ERT noted that the 2010 value of the CO_2 IEF (27.81 t/TJ) for public electricity and heat production is the lowest reported by all Parties (within the range of 27.81 to 142.29 t/TJ). Sweden explained that the large share of emissions reported under "other fuels" in public electricity and heat production is from the combustion of municipal waste. The CO_2 EFs (32.7 kg/GJ for the period 1990–1995 and 25 kg/GJ for 1996 onwards) account for the fossil-fuel share of the CO_2 emitted. The ERT recommends that Sweden provide more detailed information on the fossil-fuel shares and the EF used by year, and justify the change in the value of the EF in 1996 in the next annual submission.

Stationary combustion: biomass – CH_4

52. The CH_4 IEF was constant throughout the period 1990–2005 (30 kg/TJ) but decreased to 18.18 kg/TJ in 2007. The 2010 value (19.47 kg/TJ) is 35.1 per cent lower than the 1990 value. Sweden explained that, in the early years of the time series, wood was the only biogenic fuel used in the chemical industry. Since 2006, the amounts of landfill gas and tall oil used have increased considerably, and these fuels have much lower EFs than wood, which affects the overall IEF for CH_4 emissions from biomass. The ERT recommends that Sweden include this explanation, together with information on the fuel mix in a tabular format, in the NIR of its next annual submission.

C. Industrial processes and solvent and other product use

1. Sector overview

53. In 2010, emissions from the industrial processes sector amounted to 6,840.59 Gg CO_2 eq, or 10.3 per cent of total GHG emissions, and emissions from the solvent and other product use sector amounted to 311.11 Gg CO_2 eq, or 0.5 per cent of total GHG emissions. Since 1990, emissions have increased by 6.2 per cent in the industrial processes sector and decreased by 6.4 per cent in the solvent and other product use sector. The key drivers for the rise in emissions in the industrial processes sector are the increase in HFC emissions from consumption of halocarbons and SF_6 and the slight increase in CO_2 emissions from cement production. The increase in HFC emissions is balanced by the decreasing trend in emissions from chemical industry. In 2009, there was a sharp decrease in emissions from iron and steel production of 38.9 per cent due to the global economic recession. In 2010, the emissions from iron and steel production rose to pre-2009 levels. Within the industrial processes sector, 48.6 per cent of the emissions were from metal production, followed by 30.4 per cent from mineral products, 13.0 per cent from consumption of halocarbons and SF_6 and 6.7 per cent from chemical industry. Other production accounted for 1.3 per cent. There were no emissions from production of halocarbons and other industries in Sweden.

54. The Party has made recalculations for the industrial processes sector between the 2011 and 2012 annual submissions in response to the 2011 annual review report, following changes in AD and EFs and in order to rectify identified errors. The impact of these recalculations on the industrial processes sector is an increase in the estimate of emissions for 2009 of 0.07 per cent. The main recalculations for 2009 took place in the following categories:

(a) Consumption of halocarbons and SF_6: a decrease in the estimate of emissions of 6.6 per cent (65.04 Gg CO_2 eq), owing mainly to the use of updated data (e.g. on the bulk import and export of HFCs for refrigeration and air conditioning);

(b) Chemical industry: an increase in the estimate of emissions of 11.3 per cent (42.55 Gg CO_2 eq) owing to the improved completeness of data (i.e. the inclusion of CO_2 emissions from two facilities producing inorganic chemicals and CH_4 emissions from one facility producing PVC) and the use of revised national statistics regarding the import and export of carbide production;

(c) Metal production: an increase in the estimate of CO_2 emissions from iron and steel by 1.4 Gg owing to the use of updated AD and the inclusion of CO_2 emissions from the use of organic binders and bentonite.

55. The Party has made recalculations for the solvent and other product use sector between the 2011 and 2012 annual submissions following changes in AD (the updating of the data from the Product Register of the Swedish Chemicals Agency) and in order to rectify identified errors. The impact of these recalculations on the solvent and other product use sector is an increase in the estimate of emissions for 2009 of 0.05 per cent.

56. Sweden has reported all mandatory categories for all years of the time series (1990–2010). The following emissions were reported as "NE": CO_2 emissions from non-iron ore mining and dressing; CH_4 emissions from base chemicals for the plastic industry (other (chemical industry)); CH_4 emissions from the pharmaceutical industry (other (chemical industry)); CH_4 emissions from aluminium production; CH_4 emissions from other non-ferrous metals; and CO_2 emissions from food and drink. With regard to consumption of halocarbons and SF_6, some of the information on the estimation of the potential emissions was also reported as "NE". In response to questions raised by the ERT during the review week, Sweden explained that the above-mentioned categories were reported as "NE" owing to a lack of information from individual plants and owing to the unavailability of IPCC default methods. The ERT encourages the Party to continue its efforts to improve the completeness of its inventory.

57. The NIR provides a transparent description of the methods used and of how time-series consistency is ensured. Differences in the methods used across the time series are described and compared with the methods contained in the *2006 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the 2006 IPCC Guidelines) and the IPCC good practice guidance. Emission data were reported to be more consistent from 2005 to 2010 as a result of the use of plant-specific data (from facilities' environmental reports and through contacts with the companies), particularly in relation to cement production, limestone and dolomite use, nitric acid production, carbide production, iron and steel production and aluminium production.

58. The uncertainties for the sector are low (±2 per cent for the AD and ±5 per cent for the EFs), calculated using plant-reported data and EU ETS reports, with the required verification performed by accredited bodies. The NIR reports that additional activities were conducted to ensure that the AD, EFs and emission data directly reported by the plants were of high quality by: comparing the methods used with the methods contained in the IPCC good practice guidance; comparing the EFs with IPCC default values and with the values used by other reporting Parties; comparing plant-specific reported data, including EU ETS data, with data from Statistics Sweden and industry associations; and/or verifying data through direct contact with the plant operators. However, high uncertainties were reported for SF_6 emissions from magnesium foundries (±40 per cent) and for the EFs for mobile air conditioners (up to ±40 per cent) and other refrigeration (±50 per cent). The ERT recommends that Sweden provide information on planned improvements for the categories with high uncertainties in the next annual submission.

59. The ERT noted that most of the recommendations made in the previous review report have been addressed. Thus, the 2012 annual submission contains additional relevant information on how the CO_2 EF for cement production is obtained as well as a carbon mass

balance for the integrated iron and steel plants in Sweden. The ERT commends the Party for improving the transparency of the reporting on the sector. However, there are some pending recommendations from the previous review report, mainly in relation to the reallocation of certain emissions, such as the reallocation of gases from coke ovens, blast furnaces and steel plants collected in gas holders to iron and steel production, or the reallocation of CO_2 emissions from the use of limestone and dolomite in primary and secondary production of steel, other metal production, production of clay-based products and glass production under limestone and dolomite use (see para. 68 below). The ERT encourages the Party to continue to transparently report the allocation of the emissions and make efforts to allocate the emissions in line with the IPCC good practice guidance.

2. Key categories

Cement production – CO_2

60. Sweden applied a tier 2 method using clinker production, the cement kiln dust factor, the calcium oxide (CaO) content of the clinker and emissions from the organic carbon content of the raw meal to calculate the CO_2 emission estimates for cement production. This is in line with the IPCC good practice guidance. The emissions reported cover the three cement facilities in Sweden.

61. Sweden reported CO_2 emission estimates for the organic carbon content of the raw meal for the period 1990–2010. For the period 2005–2010, the CO_2 emissions from the raw meal were estimated using information from the facilities for 2004 and added to the estimated CO_2 emissions from clinker production. In response to questions raised by the ERT during the review, Sweden clarified that, for the period 2005–2010, the EU ETS data already included CO_2 emissions from the organic carbon content of the raw meal, and that the reported emissions are therefore overestimated. The Party indicated that it plans to remove the reported CO_2 emissions from the organic carbon content of the raw meal in its next annual submission. The ERT recommends that Sweden reconsider the estimates of emissions from cement production for the entire time series in its next annual submission.

Lime production – CO_2

62. Sweden reported that the CO_2 emission estimates are calculated based on lime production by type of lime and using the EF and data on the purity of lime from the 2006 IPCC Guidelines. The AD were obtained from the sugar industry, the Swedish Lime Association and the Swedish Lime Industry. The Party reported that more than 99 per cent of the lime used in the sugar and in the pulp and paper industries is quicklime, with a 95 to 97 per cent CaO content. For other lime production, the Party reported that the data on the production of quicklime, hydraulic lime and dolomitic lime were obtained from the Swedish Lime Association. In response to questions raised by the ERT during the review, Sweden indicated that about 90 to 96 per cent of the lime produced in conventional lime mills is quicklime and 4 to 10 per cent is dolomitic lime. The ERT recommends that Sweden improve the transparency of the next NIR by providing information on the ratio of limestone to dolomite used in other lime production and by clarifying the use of hydraulic lime.

Aluminium production – PFCs

63. Sweden has reported PFC emissions from one aluminium production facility consisting of pre-baked cells and Söderberg anodes. The NIR indicates that the AD used to calculate the PFC emission estimates and anode effects were provided by the facility for the entire time series (1990–2010). The PFC emissions were calculated using a tier 2 method and an IPCC default EF, in line with the IPCC good practice guidance.

64. The NIR reports a downward trend in PFC emissions from 1990 to 2010, with large inter-annual fluctuations in the IEF reported from 2008 to 2010 due to the conversion of all Söderberg ovens to pre-baked cells in 2008, thereby leading to a decrease in PFC emissions in 2009. In response to questions raised by the ERT during the review, Sweden explained that the increase in PFC emissions in 2010 was due to a high power input to the anodes as a result of the cold winter and power outages. The ERT recommends that the Party include an explanation of the causes of the increase in PFC emissions from 2009 to 2010 and any other relevant information on the IEF trend in the next annual submission.

Consumption of halocarbons and SF_6 – HFCs

65. To estimate HFC emissions from refrigeration and air-conditioning equipment, Sweden uses a combination of a tier 2/country-specific methodology and EFs based on information provided by equipment producers, national statistics, industry experts and IPCC default values. Both actual and potential emissions were estimated per chemical. HFC emissions from stationary air-conditioning, mobile air-conditioning, refrigeration and freezing equipment, and heat pumps are included in this category. Since data were derived from source-independent national statistics, the emissions from industrial refrigeration and stationary air-conditioning in CRF table 2(II).F were reported as included elsewhere ("IE") and are included under commercial refrigeration. The ERT encourages Sweden to estimate the emissions from industrial refrigeration and stationary air-conditioning and report them separately from those from commercial refrigeration.

66. Sweden reported high uncertainties for the EFs used for mobile air-conditioning and for other refrigeration. A comparison of the Party's EFs with IPCC default values for mobile air-conditioning in cars shows that Sweden reported a higher EF for refrigerants remaining at decommissioning owing to the continuous maintenance and refilling of the equipment. The Party has not indicated any planned category-specific improvements in the NIR. The ERT encourages Sweden to provide plans for the improvement of the country-specific EFs and the reduction of their uncertainty in the next annual submission.

67. In the NIR, the Party reported that it has not been possible thus far to establish the amount of solvent used following efforts to gather national information on this category. Consequently, Sweden reported emissions from solvents as not occurring ("NO") in section 4.7.5 of the NIR and in the CRF tables. The ERT noted that emissions from solvents are still reported as "NE" in table 4.39 of the NIR. The ERT reiterates the recommendations made in the previous review report that Sweden continue its efforts to estimate these emissions, explain any recalculations and improve the consistency between the NIR and the CRF tables.

3. Non-key categories

Limestone and dolomite use – CO_2

68. The ERT noted that Sweden has chosen not to report CO_2 emissions from the use of limestone and dolomite in primary and secondary production of steel, other metal production, production of clay-based products and glass production under this category. The Party has recognized in the NIR and noted from the recommendations made in previous review reports that this type of reporting is not in line with the Revised 1996 IPCC Guidelines. However, the Party reiterated that CO_2 emissions from these sources are at a low level and that it is not considered to be good practice to spend resources on obtaining the underlying data in order to separate these emissions. The ERT recommends that Sweden continue to provide information on the allocation of the emissions and any planned changes in the allocation of the emissions from the use of limestone and dolomite in

primary and secondary production of steel, other metal production, production of clay-based products and glass production.

D. Agriculture

1. Sector overview

69. In 2010, emissions from the agriculture sector amounted to 7,912.34 Gg CO_2 eq, or 11.9 per cent of total GHG emissions. Since 1990, emissions have decreased by 13.2 per cent. The key drivers for the fall in emissions are the decreases in the number of livestock and the application of nitrogen (N) fertilizer. Within the sector, 56.2 per cent of the emissions were from agricultural soils, followed by 34.3 per cent from enteric fermentation and 9.5 per cent from manure management.

70. The Party has made recalculations for the agriculture sector between the 2011 and 2012 annual submissions in response to the 2010 annual review report, partly in response to the 2011 annual review report and following changes in AD and EFs. The impact of these recalculations on the agriculture sector is a decrease in the estimate of emissions for 2009 of 4.7 per cent. The main recalculations for 2009 took place in the following categories:

(a) Manure management: a decrease in the estimate of emissions of 17.5 per cent (258.29 Gg CO_2 eq), owing mainly to a revised methane conversion factor (MCF) for liquid manure for cattle and swine;

(b) Agricultural soils: a decrease in the estimate of emissions of 5.5 per cent (252.64 Gg CO_2 eq), owing mainly to revised values of the fraction of livestock N excretion that volatilizes as ammonia (NH_3) and nitrogen oxide ($Frac_{GASM}$) and changes to the area of agricultural land including organic soils;

(c) Enteric fermentation: an increase in the estimate of emissions of 1.0 per cent (27.16 Gg CO_2 eq), owing mainly to the update of the number of horses and slaughter chickens for the whole time series.

71. The recalculations have been performed for the entire time series and are well documented in the NIR and in CRF table 8(b).

72. The sector is complete in terms of categories, gases, geographical coverage and years. Emissions from rice cultivation, prescribed burning of savannahs and field burning of agricultural residues were reported as "NO".

73. The reporting of the sector is generally transparent. However, the ERT noted that the recommendations made in the previous review report that Sweden improve the transparency of the NIR by including further background information on the calculation of the average milk yield, the N flow model (STANK) and the CH_4 IEF trends for manure management have not been addressed in the 2012 annual submission. The ERT encourages Sweden to implement those recommendations in order to increase the transparency of its reporting in the next annual submission. Further, the ERT recommends that Sweden justify the use of country-specific values (e.g. the MCF for liquid manure), including the provision of additional information in the NIR in order to ensure the transparency of the reporting for the manure management categories, and include an analysis of the CH_4 IEF used for the more significant subcategories in the NIR. The uncertainties are well documented for each subcategory in the NIR.

74. The sector-specific QA/QC procedures are described for each subcategory. Sweden pointed out that the AD are checked for consistency and that external national experts annually review the emission estimates and methods used. However, the ERT recommends

that the Party improve its QC procedures to ensure the consistency of the information provided in the NIR and in the CRF tables (see para. 81 below).

75. Most of the recommendations made in previous review reports (and some of the recommendations made in the 2011 annual review report (e.g. the update of the notation keys used in the additional information box of CRF table 4.A) have been addressed in the 2012 annual submission. Pending recommendations are reiterated in the category-specific sections below.

2. Key categories

Enteric fermentation – CH_4

76. Sweden applied a country-specific methodology using metabolizable energy to estimate CH_4 emissions from cattle. As pointed out in the previous review report, for transparency purposes, the values of the average gross energy intake and average CH_4 conversion rate should be included in the NIR for the entire time series. The ERT reiterates the recommendation made in the previous review report that Sweden include this information in its next annual submission.

77. Sweden uses a tier 1 method from the IPCC good practice guidance with default EFs for sheep, goats, horses and swine to estimate emissions for this category. The AD are provided by the Swedish Board of Agriculture and Statistics Sweden. The ERT concludes that this approach is in accordance with the IPCC good practice guidance.

78. The ERT noted that the CH_4 IEFs (ranging from 118.27 to 132.38 kg/head/year) for dairy cattle are among the highest reported by Parties (ranging from 0.09 to 138.81 kg/head/year). In response to a question raised by the ERT during the review, Sweden explained that this is due to the higher than average milk yield. The data for milk production are produced by the Swedish Dairy Association and are considered to be of good quality. The ERT encourages Sweden to further improve the transparency of its reporting by including the CH_4 EFs for dairy cattle for the entire time series in the NIR of its next annual submission.

Manure management – CH_4 and N_2O

79. Sweden estimates CH_4 and N_2O emissions from manure management using EFs from the IPCC good practice guidance in combination with country-specific AD. In the previous review report the ERT pointed out that Sweden's definitions of animal waste management systems used for both the CH_4 and the N_2O emission estimates are not in line with the IPCC good practice guidance, because they do not include the fraction of N excreted on pasture. In response to a question raised by the ERT during the review, the Party explained that the definition used for pasture, range and paddock manure is in line with the IPCC good practice guidance. However, Sweden noted that the equation in paragraph 6.3.2.2 of the NIR may be confusing and confirmed that it would be explained in more detail in the next annual submission. The ERT recommends that the Party include information on the definition of animal waste management systems in the relevant chapter of the NIR, in order to ensure the transparency of its reporting.

80. The 2010 value of the CH_4 IEF (1.40 kg/head/year) for swine is among the lowest reported by Parties (ranging from 0.58 to 39.46 kg/head/year) and below the IPCC default range (between 3 and 20 kg/head/year). The Party explained that the reason for the lower value is the lower annual mean temperature in Sweden, which results in a lower value for the MCF compared with those of other countries. In response to a question raised by the ERT during the review, Sweden provided additional information on the country-specific MCF value of 3.5 per cent for liquid manure. The ERT recommends that the Party include,

in the NIR of its next annual submission, more detailed information to justify the country-specific MCF value used.

81. In response to a question raised by the ERT during the review as to why the reported CH_4 IEF for swine differs between CRF table 4.B(a) and NIR table 6.16 and why there is no information on the CH_4 EF (0.19 kg/head/year) for reindeer in NIR table 6.16, Sweden responded that the relevant table in the NIR (page 245) has not been correctly updated in the 2012 annual submission with the new country-specific CH_4 EF for swine and the EF used for reindeer. The ERT recommends that Sweden implement enhanced QC procedures to avoid inconsistencies between the CRF tables and the NIR in its next annual submission.

Direct soil emissions – N_2O

82. During the previous review Sweden indicated its plans to improve transparency by reporting the N fraction of legumes ($Frac_{NCRBF}$) and other crops ($Frac_{NCRO}$) separately in the additional information box of CRF table 4.D. The ERT commends Sweden for improving transparency by providing such information in CRF table 4.D in the 2012 annual submission.

Pasture, range and paddock manure – N_2O

83. Sweden uses a default EF of 0.02 kg N_2O-N/kg N excreted from the IPCC good practice guidance to estimate N_2O emissions from pasture, range and paddock manure. However, in its emission calculations, the Party continues to subtract the fraction of N lost as NH_3 ($Frac_{GASM}$) from the total amount of N excreted on pastures, which is not in line with the definition of the IPCC default EF (N_2O-N/kg N excreted) and equation 4.18 of the IPCC good practice guidance, since the default EF already considers NH_3 losses. To avoid a potential underestimation of N_2O emissions from pasture, range and paddock, the ERT recommended that Sweden apply the default EF and equation 4.18, in line with the IPCC good practice guidance. In response to the list of potential problems and further questions raised by the ERT during the review, the Party provided revised N_2O emission estimates for the whole time series. The recalculations resulted in an increase in the estimate of N_2O emissions from pasture, range and paddock manure for 2010 of 9.9 per cent, from 1.31 Gg to 1.44 Gg. The ERT concluded that the potential problem had been resolved by the Party. The ERT noted that the revision has been applied to the entire time series on the basis of the AD in CRF table 4.B(b). However, the AD for N excretion on pasture, range and paddock in CRF table 4.D were not consistently changed (e.g. for 2010, 41,699,874.45 kg N/year is reported in CRF table 4.D instead of 45,702,068.07 kg N/year). The ERT recommends that Sweden ensure the consistency of the information between CRF tables 4.B(b) and 4.D in the next annual submission.

E. Land use, land-use change and forestry

1. Sector overview

84. In 2010, net removals from the LULUCF sector amounted to 34,055.34 Gg CO_2 eq. Since 1990, net removals have decreased by 17.5 per cent. The key drivers for the fall in removals are the increase in felling and the impact of the severe storms that occurred in 2005 and 2007. Within the sector, forest land is a major category, accounting for a net sink of 38,085.35 Gg CO_2 eq in 2010, followed by grassland, which accounted for a net sink of 765.35 Gg CO_2 eq in 2010. Net emissions of 2,865.13 Gg CO_2 eq were from settlements, followed by 1,876.44 Gg CO_2 eq from cropland and 43.79 Gg CO_2 eq from wetlands.

85. Sweden has made recalculations for the LULUCF sector between the 2011 and 2012 annual submissions following changes in the area reported for each category using data derived from the updated Swedish National Forest Inventory (NFI), owing to the revision

of the sample data used for the calculation of carbon stock changes in living biomass, dead organic matter (DOM) and soil organic carbon in mineral soils (derived from updated sampling data from the Swedish Forest Soil Inventory) and in order to correct identified errors. The impact of these recalculations on the LULUCF sector is a decrease in the estimate of removals for 2009 of 14.1 per cent. The main recalculations for 2009 took place in the following categories:

(a) Forest land remaining forest land (CO_2): a decrease in the estimate of removals of 13.3 per cent (6,095.68 Gg) owing to the change in the reported area and the revision of the sample data for living biomass, DOM and soil organic carbon;

(b) Grassland remaining grassland (CO_2): an increase in the estimate of removals of 21.1 per cent owing to the change in the reported area and the revision of the sample data for DOM and soil carbon in mineral soils.

86. Information on the recalculations is provided in CRF table 8(b) and in the NIR (section 7.6). However, the NIR does not provide information at the category-specific level. The ERT recommends that Sweden include detailed information on the recalculations in its next annual submission, including the rationale for and the impact of the recalculations at a category- and pool-specific level. Further, the ERT encourages the Party to restructure the sectoral layout of the NIR to include category-specific sections on uncertainties and time-series consistency, QA/QC and verification procedures and planned inventory improvements, in line with the annotated outline of the NIR.

87. The reporting of the LULUCF sector is generally complete. The Party has reported the carbon stock changes in all carbon pools and all other emissions for the mandatory categories considered to be managed. With regard to land converted to wetlands and other land, the relevant areas are reported, but the pools are reported as not applicable ("NA"). Sweden explained that these lands are considered to be unmanaged, except for 10 kha used for peat extraction. The ERT encourages the Party to improve the completeness of its inventory by including the missing optional categories (e.g. non-CO_2 emissions from drainage of soils and wetlands) and reiterates the encouragement from the previous review report that Sweden disaggregate the emissions currently reported as "IE" and report them in the appropriate categories in its next annual submission (e.g. non-CO_2 emissions from biomass burning on land converted to forest land).

88. Since the 2010 annual submission, Sweden has reported emissions/removals from harvested wood products (HWPs) on an informal basis in the NIR, using the production approach described in the 2006 IPCC Guidelines. For the 2012 annual submission, a tier 3 model was used to estimate the emissions and removals, applying different life-cycle lengths per product category and different inflows of new paper products. Using this approach, the emissions/removals from HWPs in 2010 are calculated as approximately 4,000 Gg CO_2 (reported only in the NIR). The ERT welcomes the provision of this informal information, which serves to advance the reader's knowledge on the influence of HWPs on the reporting and accounting of LULUCF, and encourages Sweden to further develop the estimation process and improve the transparency of its reporting by including information on the uncertainty of the estimates.

89. The main land-use categories are generally reported using tier 2 and tier 3 methods (e.g. the stock change method), while non-CO_2 gases are mostly reported using tier 1 methods. The methods used to estimate carbon stock changes, and the EFs, parameters and AD used, are mostly country-specific, based on the well-developed NFI and the Swedish Forest Soil Inventory. The ERT commends Sweden for using country-specific data and higher-tier methods in line with the IPCC good practice guidance for LULUCF, and reiterates the encouragement from the previous review report that Sweden further improve the methods used to estimate non-CO_2 gases.

90. Sweden has performed an uncertainty assessment for all reported categories, except for the category other land. The uncertainties mainly arise from random errors in sampling data in the carbon stock change estimates. The uncertainty for living biomass in all reported land-use categories was estimated to 24 per cent, while the uncertainty for DOM was estimated to 50 per cent and soil organic carbon to 35 per cent. Sweden also provided uncertainty estimates for non-CO_2 categories (e.g. 100 per cent uncertainty for N_2O emissions from disturbance associated with land-use conversion to cropland, 75 per cent uncertainty for N_2O and CH_4 emissions from biomass burning and 50 per cent uncertainty for N_2O emissions from direct N fertilization). These percentages are the same as those reported in the previous annual submission. The ERT recommends that the Party update the uncertainty values when the input parameters used for the estimates are changed.

91. For the 2012 annual submission, Sweden has improved the calculation method used to estimate emissions and removals from the LULUCF sector following the recommendations made in the previous review report, thereby avoiding the large inter-annual fluctuations in the carbon stock change observed in the previous annual submission. Up until the 2011 annual submission, the estimates for this sector fluctuated considerably and the emission/removal trend changed significantly as a result of recalculations. Sweden explains in its NIR that the fluctuations in the level and the trend for the sector were mainly caused by random sampling variations. For the 2012 annual submission, the Party has applied an extrapolation approach based on five-year rolling averages to estimate the annual update of the data. The new approach improves the time-series consistency of the Party's reporting. The estimation method used by Sweden is provided in the NIR. The ERT welcomes this improvement in time-series consistency.

2. Key categories

Forest land remaining forest land – CO_2

92. Country-specific methodologies and AD are used for the estimates from forest land remaining forest land, in line with the tier 2 and tier 3 methods contained in the IPCC good practice guidance for LULUCF. Sweden has improved the calculation method used for forest land remaining forest land (see para. 91 above). As a result, the carbon stock change over the time series remains almost constant, and the significant increment for 2009 observed in the previous annual submission was averaged out. The ERT recognizes that this methodological change has led to an improvement in time-series consistency and in the transparency of the Party's reporting.

93. In the previous review report, the ERT recommended that Sweden provide additional information on the drivers of the emission/removal trends and their impact on the annual carbon stock change. In response to a question raised by the ERT during the review, Sweden provided additional information to illustrate the long-term increasing trend in the carbon stock reported in the NIR, as well as the growth rate and the harvest volume during the period 1926–2008. This information enabled the ERT to confirm that the emission/removal trends reported in the 2012 annual submission and the annual harvest volume generally correspond. The ERT welcomes this additional information and reiterates the recommendation made in the previous review report that Sweden include, in the next annual submission, further information on and an analysis of the drivers behind the emission/removal trends.

Land converted to forest land – CO_2

94. Country-specific methodologies have been used for land converted to forest land, in line with the tier 2 and tier 3 methods from the IPCC good practice guidance for LULUCF. The net overall CO_2 emission/removal trend is highly variable, with inter-annual changes within the range of –180.9 to +1,003.2 per cent. In response to a question raised by the ERT

during the review, Sweden explained that the high inter-annual variations in this category are caused by the 20-year transition period used, which means that land areas are both added to and subtracted from the total land area of the category. Net removals decrease when an area with large net removals is transferred from land converted to forest land to forest land remaining forest land after the 20-year transition period. This category also consists of five subcategories with a highly variable carbon stock per area, which, in combination with the transfer of land areas between categories, may result in large inter-annual fluctuations. The ERT noted Sweden's explanations and encourages the Party to include additional information in the next annual submission to explain the trend and the way in which the areas for the five subcategories are estimated using the new approach (using an extrapolation approach based on five-year rolling averages), while ensuring consistency with the areas reported under forest land remaining forest land.

Cropland remaining cropland – CO_2

95. Emissions from cropland remaining cropland fluctuate significantly and generally show a decreasing trend, which is mainly driven by emissions from organic soils. The carbon stock change in organic soils is estimated using a tier 2 approach with country-specific EFs derived from eight sampling data sets. The overall decrease in the emission trend is explained by the decrease in the total area of cropland. However, the Party has not provided information to explain the inter-annual fluctuations. The ERT recommends that Sweden provide information on the drivers of the inter-annual fluctuations in the next annual submission.

3. Non-key categories

Biomass burning – CO_2, CH_4 and N_2O

96. Emission estimates are provided only for forest land remaining forest land and grassland remaining grassland. For the remaining categories, the notation keys "IE", "NA" and "NO" are used. The inconsistent use of notation keys was observed by the ERT between the LULUCF reporting and the KP-LULUCF reporting. In CRF table 5(V), CO_2 emissions from biomass burning on land converted to forest land are reported as "IE", but, in CRF table 5(KP-II)5, emissions from biomass burning on afforested and reforested land are reported as "NO". In response to a question raised by the ERT during the review, Sweden informed the ERT that no biomass burning has so far been detected on land converted to forest land, and that it will therefore correct the notation key used in CRF table 5(V) to "NO" in its next annual submission in order to maintain the consistency and transparency of the reporting. The ERT recommends that Sweden ensure the consistent reporting of emissions from biomass burning between the LULUCF sector and the KP-LULUCF activities.

F. Waste

1. Sector overview

97. In 2010, emissions from the waste sector amounted 1,848.43 Gg CO_2 eq, or 2.8 per cent of total GHG emissions. Since 1990, emissions have decreased by 46.0 per cent. The key driver for the fall in emissions is the implementation of policies, measures and economic instruments which have resulted in the improvement of waste management practices and techniques in Sweden (e.g. the reduction of organic waste deposited and the increased collection of CH_4 in landfills). Within the sector, 69.2 per cent of the emissions were from solid waste disposal on land, followed by 24.9 per cent from wastewater handling. The remaining 5.9 per cent were from waste incineration.

98. The Party has recalculated N_2O emissions from human sewage between the 2011 and 2012 annual submissions as a result of an update of the protein consumption data for 2008 and 2009. The recalculations resulted in an increase in the estimates of N_2O emissions of 2.1 per cent for 2008 and 1.9 per cent for 2009. Total estimated GHG emissions from the waste sector increased by 0.2 per cent for both years.

99. The NIR and the CRF tables provide transparent and complete information on the methods and data sources used to estimate the emissions from the waste sector. However, the use of the notation keys could be further improved: for example, the AD for sludge under wastewater handling is reported as "NE" rather than "NA". The ERT recommends that the Party use the notation key "NA" where no default AD are used in the estimates and explain the notations keys used for the AD and emission estimates in its next annual submission.

100. Sweden has reported the same AD for solid waste disposal on land and for domestic and commercial wastewater for the years 2008–2010. The Party explained that data from the Waste Statistics Regulation were used, which are reported every second year. No AD for 2010 were available prior to the compilation of the 2012 annual submission and, therefore, the AD for 2008 were used for 2009 and 2010. The Party informed the ERT that up-to-date AD will be used in the 2013 annual submission. The ERT welcomes this information and encourages Sweden to make efforts to ensure the timely provision of the AD needed for the sectoral emission estimates.

101. The ERT noted that Sweden has reported a relatively high level of uncertainty for the waste sector. The emission estimates are uncertain because of the simplifications made to the top-down model used and the difficulties involved in estimating many of the parameters. The ERT recommends that the Party include, in its next annual submission, information on its plans to reduce the uncertainty of the emission estimates.

102. Sweden has not reported any sector-specific QA/QC procedures. The ERT encourages the Party to report any planned QA/QC activities, such as comparing the appropriateness of the CH_4 leakage factor used to estimate CH_4 emissions from industrial sludge treatment in anaerobic plants, which is based on data from two plants, against possible new data from any of the other 135 plants in the country.

103. Noting the late publication of the previous review report,[8] the ERT noted that most of the sectoral recommendations contained therein have not yet been implemented by the Party and therefore reiterates them in this review report.

2. Key categories

Solid waste disposal on land – CH_4

104. Sweden has used the IPCC first order decay method with mostly default parameters and country-specific AD to estimate CH_4 emissions from solid waste disposal sites. The ERT reiterates the recommendation made in the previous review report that Sweden develop country-specific parameters to estimate the emissions for this category in its next annual submission. There have been significant changes in national waste management practices since 1990, which have resulted in the reduction of municipal solid waste disposal on land to only 1.0 per cent of total generated household waste for 2010 compared with 43.8 per cent for 1990. All solid waste disposal sites are categorized as managed in Sweden. The ERT welcomes the transparent reporting of this category.

[8] The 2011 annual review report was published on 27 July 2012.

Wastewater handling – CH_4

105. To estimate CH_4 emissions from industrial wastewater, Sweden has chosen a country-specific method, which is based on the CH_4 leakage factor during energy recovery from anaerobic wastewater treatment (assessed in the range of 2–5 per cent and applied as 5 per cent in the inventory). The Party has reported that most of the facilities use aerobic processes, and only five industrial plants (in the pulp and food industries) use anaerobic wastewater processes. Data for the period 1990–2004 were obtained by extrapolating the data for 2005 backwards, because data on energy recovery are only available for the period 2005–2009. In response to a question raised by the ERT during the review on the extrapolation of data for the period 1990–2004, the Party explained that the trend in CH_4 emissions for the period 1990–2004 would be expected to be decreasing rather than increasing, as the number of biogas-producing plants in the pulp and paper industry using anaerobic processes has been reduced in the past 10 years and biogas production in the food industry has existed for less than five years. The ERT recommends that Sweden include the information provided to the ERT during the review in the NIR of its next annual submission in order to document the emission trend.

106. The emission estimates for domestic and commercial wastewater include three components: large wastewater treatment plants with no CH_4 emissions because of the use of aeration in the process; small wastewater treatment plants; and emissions from the population not connected to a wastewater discharge system. The emissions have been estimated on the basis of the IPCC 'check' method. This is not in line with the decision tree for key categories provided in the IPCC good practice guidance. The ERT reiterates the recommendation made in the previous review report that Sweden apply the method from the Revised 1996 IPCC Guidelines in order to improve the accuracy of the emission estimates, or justify why the 'check' method provides more accurate emission estimates, in its next annual submission.

107. The ERT noted that the CH_4 IEF for domestic and commercial wastewater (0.75-1.41 kg/kg degradable organic component (DC)) is consistently the highest reported by Parties (ranging from 0.0009 to 1.4116 kg/kg DC) and has increased by 99.7 per cent over the time series (from 0.75 kg/kg DC in 1990 to 1.41 kg/kg DC in 2010). In the previous stages of the review, the Party explained that the emissions are from small wastewater treatment plants without aeration, while the AD are taken only from the large wastewater treatment plants. The ERT recommends that Sweden report consistent data in the CRF tables or report the AD using the notation key "NA" and provide further information in the documentation box of CRF table 6.B and in the NIR of its next annual submission.

Waste incineration – CO_2

108. Emissions from waste incineration with energy recovery were estimated at a plant-specific level and reported under the energy sector in line with the Revised 1996 IPCC Guidelines. Emissions from the incineration of hazardous waste, and in later years of the times series also from municipal solid waste (MSW) and industrial waste, from one large plant without energy recovery are reported under waste incineration. Sweden has assumed the same carbon content for all waste incinerated at the plant (MSW, hazardous waste and industrial waste) and has applied a country-specific fraction of fossil carbon content of 30.0 per cent based on a study on MSW incineration. In response to a question raised by the ERT during the review, Sweden clarified that it applied a country-specific fraction of fossil carbon content of 30.0 per cent for MSW incineration and of 100.0 per cent for hazardous and industrial waste incineration. The ERT recommends that the Party include the information provided to the ERT during the review in the NIR of its next annual submission.

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

109. In its 2012 annual submission, Sweden has provided emission/removal estimates for afforestation and reforestation, and deforestation activities under Article 3, paragraph 3, of the Kyoto Protocol and for forest management, which the Party has elected under Article 3, paragraph 4, of the Kyoto Protocol. Sweden chose to account for all activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol at the end of the first commitment period. The Party provided all of the required supplementary information on the KP-LULUCF activities in its NIR and in the KP-LULUCF CRF tables, thereby fulfilling the requirements outlined in decision 15/CMP.1, annex, paragraphs 5–9.

110. The Party has made recalculations for the KP-LULUCF activities between the 2011 and 2012 annual submissions following changes in the area of land use and land-use change derived from the NFI for the years 2006–2010, and in the carbon stock changes in living biomass, DOM and soil organic matter on mineral soils for all categories, and following the revision of sample data from the Swedish Forest Soil Inventory. The impact of these recalculations on each KP-LULUCF activity for 2009 is as follows:

(a) Afforestation and reforestation: estimated net GHG removals from units of land not harvested since the beginning of the commitment period decreased by 11.9 per cent (163.18 Gg CO_2 eq);

(b) Deforestation: estimated net GHG emissions decreased by 13.3 per cent (466.71 Gg CO_2 eq);

(c) Forest management: estimated net GHG removals decreased by 13.3 per cent (5,915.27 Gg CO_2 eq).

111. The rationale for the recalculations per activity and their impact are not explained in the NIR. The ERT recommends that Sweden include this information in the next annual submission.

112. Sweden identifies its national boundary as the geographical location of the boundaries of the areas that encompass units of land subject to activities under Article 3, paragraph 3, of the Kyoto Protocol and land subject to elected activities under Article 3, paragraph 4, of the Kyoto Protocol. The Party has adopted approach 3 from the IPCC good practice guidance for LULUCF to report emissions and removals from activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol. The method used to identify land areas is based on the NFI and its system of permanent sample plots, which covers all land-use categories and records land-use transition in any area of land larger than 0 ha. Each sample plot has an identification code and a registered geographical position. The status of activities on sample plots can be traced back from the current year to 1990.

113. The reporting of GHG removals and emissions resulting from all of the Party's activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol is complete and all pools are reported (i.e. above-ground biomass, below-ground biomass, litter, dead wood and soil organic carbon). Direct N_2O emissions are reported for N fertilization and are assumed to occur under forest management; N_2O emissions from disturbance associated with land-use conversion to cropland are reported as occurring under deforestation; and CO_2, CH_4 and N_2O emissions from biomass burning are reported under forest management. CO_2 emissions from liming and all GHG emissions from biomass burning from activities under Article 3, paragraph 3, of the Kyoto Protocol are reported as "NO", with clear

justifications. In the previous review report, the ERT noted that N_2O emissions from the drainage of soils under forest management were reported as "NE" in table NIR-1 but as "NA" in CRF table 5(KP-II)2. This inconsistency remains in the KP-LULUCF CRF tables in the 2012 annual submission. The ERT reiterates the recommendation that Sweden address this inconsistency in its next annual submission. The ERT encourages the Party to include estimates of N_2O emissions from the drainage of soils under forest management in its next annual submission, because, although it is not a mandatory category, the emissions relate to an activity which the Party has elected to report.

114. Sweden has provided estimates of carbon stock changes for all pools under the KP-LULUCF activities using the same methods, EFs, parameters and AD as those used in the inventory for the LULUCF sector under the Convention.

115. As a result of the sampling design used (the latest reported year was previously based on only one fifth (6,000 plots) of the full sample (30,000 plots)), the annual estimates for areas subject to afforestation and reforestation, and deforestation activities and the carbon stock change in those areas was assessed as "highly uncertain" in the 2010 and 2011 annual submissions. In accordance with the requirements under the Kyoto Protocol and decision 15/CMP.1, the accumulated areas subject to afforestation and reforestation, and deforestation shall always increase over time; however, according to Sweden's annual submission, these areas have not always increased. This issue has been repeatedly raised by previous ERTs. For the 2012 annual submission, Sweden has applied an improved statistical method to derive estimates for these activities. The new approach uses a trend extrapolation approach based on re-inventoried plots, to avoid the risk of an incorrect decrease in the area subject to afforestation and reforestation, and deforestation activities and to improve the time-series consistency of the reporting. The areas subject to afforestation and reforestation, and deforestation are accumulated, and, therefore, the extrapolations are based on the trend in the five years prior to the actual year, while the extrapolations for the area under forest management and living biomass for all activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol are based on a running average of the five years prior to the actual year. The ERT recognized that the new approach used by the Party is in line with the IPCC good practice guidance for LULUCF and commends Sweden for the change in the land area representation method.

116. Sweden has calculated uncertainty estimates for the carbon stock changes in all five carbon pools for each of the activities under Article 3, paragraph 3, of the Kyoto Protocol and for forest management on the basis of an estimated sampling error. The uncertainties for other emission categories (CRF tables 5(KP-II)1 to 5(KP-II)5) have been estimated using expert judgement. In the previous annual submission, Sweden explained that the uncertainty for each of the activities under Article 3, paragraph 3, of the Kyoto Protocol and for forest management was relatively high because of the sampling design and statistical method used to estimate the emissions/removals from these activities. In spite of the recommendation made in the previous review report that Sweden make every possible effort to reduce the uncertainty of these estimates, the reported uncertainty has not decreased in the 2012 annual submission and the uncertainty reported for living biomass under deforestation is even higher than in the previous annual submission. The ERT reiterates the recommendations that Sweden make further efforts to reduce the uncertainties and report on the progress made in its next annual submission.

117. The ERT noted that the KP-LULUCF activities are not included in the chapter of the NIR on recalculations and on improvements resulting from the review process. The ERT recommends that Sweden include such information in the next annual submission in order to ensure the transparent reporting of the improvements undertaken.

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

Afforestation and reforestation – CO_2

118. In the 2010 and 2011 annual review reports, the ERT noted that the reported area of land under afforestation and reforestation and the reported area of land converted to forest land differed substantially, while Sweden used the same definition for forest consistently between the LULUCF reporting and the reporting of KP-LULUCF activities, and also used a default transition period of 20 years to identify the "land converted to" categories. Responding to questions raised by the ERT during the review, Sweden explained that the difference between the area of afforestation and reforestation and the area of land converted to forest land was caused by the non-anthropogenic land-use change to forest land under the Convention not covered under the Kyoto Protocol. The ERT recommends that Sweden provide this information in the next annual submission.

119. As the probability of afforestation and reforestation is quite small in Sweden, the Party found it difficult to avoid inter-annual fluctuations in the land area estimates, particularly where the previous approach was used, whereby the random nature of the sampling method used affected the estimates, as discussed in the previous review report. In the 2012 annual submission, the new five-year rolling average approach (see para. 91 above) has resulted in the areas under afforestation and reforestation increasing almost constantly between 2008 and 2010. The ERT welcomes this improvement and further recommends that Sweden verify this approach against the actual annual land-use changes and report on the results of the analysis in the next annual submission.

Deforestation – CO_2

120. Sweden defines deforestation as land-use conversion from forest land to cropland, grassland or settlements. This definition is consistent with the definition contained in the IPCC good practice guidance for LULUCF and the national definitions used for afforestation and reforestation. Information on how harvesting or forest disturbance that is followed by the re-establishment of forest is distinguished from deforestation is provided in the NIR.

121. Units of land subject to deforestation are identified and distinguished from temporal unstocked land areas using a five-year inventory cycle in the field. When the unstocked forest land is confirmed as deforestation in a subsequent field survey, recalculations are performed for the deforested area and for the carbon stock change in deforestation areas reported in previous inventories. This approach is in line with the IPCC good practice guidance for LULUCF.

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

Forest management – CO_2, CH_4 and N_2O

122. The AD for forest management correspond to the definition of forest land according to the Forestry Act. In the previous annual submission, Sweden reported a rather high increase in the area under forest management for 2009 and explained that this was caused by the random nature of the sampling method used. The application of the new approach for the estimation of the area under forest management (see para. 91 above) resulted in the recalculation of the area under forest management for the years 2008–2010, with an almost constantly increasing trend over that period. The ERT welcomes the improved time-series consistency of the estimates.

2. Information on Kyoto Protocol units

Standard electronic format and reports from the national registry

123. Sweden has reported information on its accounting of Kyoto Protocol units in the required SEF tables, as required by decisions 15/CMP.1 and 14/CMP.1. The ERT took note of the findings included in the SIAR on the SEF tables and the SEF comparison report.[9] The SIAR was forwarded to the ERT prior to the review, pursuant to decision 16/CP.10. The ERT reiterated the main findings contained in the SIAR.

124. 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 (CDM) 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.

National registry

125. The ERT took note of the SIAR and its finding that the reported information on the national registry is complete and has been submitted in accordance with the annex to decision 15/CMP.1. The ERT further noted from the SIAR and its finding that the national registry continues to perform the functions set out in the annex to decision 13/CMP.1 and the annex to decision 5/CMP.1, and continues to adhere to the technical standards for data exchange between registry systems in accordance with decisions 16/CP.10 and 12/CMP.1. The national registry also has adequate security, data safeguard and disaster recovery measures in place and its operational performance is adequate.

Calculation of the commitment period reserve

126. Sweden has reported its commitment period reserve in its 2012 annual submission. Based on the submission of revised emission estimates on 4 October 2012, Sweden reported its commitment period reserve to be 331,356,813 t CO_2 eq, based on the national emissions in its most recently reviewed inventory (66,271.36 Gg CO_2 eq). The ERT agrees with this figure.

3. Changes to the national system

127. Sweden reported that there have been no changes to its national system since the previous annual submission. The ERT concluded that the Party's national system continues to be in accordance with the requirements of national systems outlined in decision 19/CMP.1.

4. Changes to the national registry

128. Sweden reported that there have been changes to its national registry since the previous annual submission. The Party described the changes to the software, the security features and the test results in its NIR. The ERT concluded that, taking into account the

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

confirmed changes to the national registry, Sweden'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).

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

129. Sweden did not provide information on changes in its reporting of the minimization of adverse impacts in accordance with Article 3, paragraph 14, of the Kyoto Protocol in its annual submission. The ERT recommends that the Party, in its next annual submission, report any changes in the information provided under Article 3, paragraph 14, in accordance with decision 15/CMP.1, annex, chapter I.H.

130. However, Sweden reported detailed information on the minimization of adverse impacts in accordance with the requirements outlined in decision 15/CMP.1, annex, paragraphs 23 and 24. The ERT concluded that the reported information is complete and transparent.

131. In the section of the NIR on how the Party is striving to implement its commitments in such a way as to minimize adverse social, environmental and economic impacts, Sweden elaborated on the variety of measures in place, including: the use of environmental impact assessments in the decision-making process; consultation procedures and interdisciplinary research efforts; technology transfer; knowledge-building; support for adaptation measures; and the provision of financial support to developing countries. The national climate strategy, which contains a wide range of measures across all sectors, is also considered to minimize the risk of adverse effects.

132. Sweden has also provided information on how it gives priority to the actions set out in decision 15/CMP.1, annex, paragraph 24. The Party has, to a large extent, reformed the energy markets and phased out any market imperfections. Sweden assists developing countries with the transfer of energy-efficient technologies, renewable energy technologies, capacity-building and CDM projects.

III. Conclusions and recommendations

A. Conclusions

133. Sweden made its annual submission on 26 March 2012. The annual submission contains the GHG inventory (comprising CRF tables and an NIR) and supplementary information under Article 7, paragraph 1, of the Kyoto Protocol (information on: activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, Kyoto Protocol units, changes to the national system and the national registry, and the minimization of adverse impacts in accordance with Article 3, paragraph 14, of the Kyoto Protocol). This is in line with decision 15/CMP.1.

134. The ERT concludes that the inventory submission of Sweden has been prepared and reported in accordance with the UNFCCC reporting guidelines. The inventory submission is complete and the Party has submitted a complete set of CRF tables for the years 1990-2010 and an NIR; these are complete in terms of geographical coverage, years, sectors and gases, as well as complete in terms of categories.

135. 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.

136. The Party's inventory is in line with the Revised 1996 IPCC Guidelines, the IPCC good practice guidance and the IPCC good practice guidance for LULUCF, except for some minor allocation issues in the industrial processes sector, and the provision of estimates for N_2O emissions from pasture, range and paddock manure. In response to the list of potential problems and further questions raised by the ERT during the review, Sweden provided estimates for N_2O emissions from pasture, range and paddock manure in line with the IPCC good practice guidance.

137. The Party has made recalculations for the inventory between the 2011 and 2012 annual submissions in response to the 2011 annual review report and following changes in methodologies, AD and EFs. The impact of these recalculations on the national totals is a decrease in the estimated emissions for 2009 of 0.6 per cent. The main recalculations for 2009 took place in the following sectors:

(a) LULUCF: a decrease in the estimate of net removals from forest land of 13.3 per cent (6,095.68 Gg CO_2 eq) and an increase in the estimate of net removals from grassland of 29.7 per cent (170.47 Gg CO_2 eq);

(b) Agriculture: a decrease in the estimate of CH_4 and N_2O emissions from manure management of 17.5 per cent (158.29 Gg CO_2 eq) and a decrease in the estimate of N_2O emissions from agricultural soils of 5.5 per cent (252.46 Gg CO_2 eq);

(c) Energy: an increase in the estimate of CO_2 emissions from energy industries of 1.3 per cent (131.37 Gg CO_2 eq) and a decrease in the estimate of CO_2, CH_4 and N_2O emissions from manufacturing industries and construction of 1.2 per cent (104.65 Gg CO_2 eq).

138. Sweden has provided all mandatory information on activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol in its NIR and in the KP-LULUCF CRF tables in accordance with the requirements outlined in decision 15/CMP.1, annex, paragraphs 5–9. With regard to activities under Article 3, paragraph 4, of the Kyoto Protocol, Sweden elected forest management only and chose to account for all activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol at the end of the commitment period.

139. The Party has made recalculations for the KP-LULUCF activities between the 2011 and 2012 annual submissions in response to the 2011 annual review report, following changes in AD due to a change in the approach used to calculate land areas, following changes in EFs and in order to correct identified errors. The impact of these recalculations on each KP-LULUCF activity for 2009 is as follows:

(a) Afforestation and reforestation: a decrease in estimated net GHG removals from units of land not harvested of 11.9 per cent (163.18 Gg CO_2 eq);

(b) Deforestation: a decrease in estimated net GHG emissions of 13.3 per cent (466.71 Gg CO_2 eq);

(c) Forest management: a decrease in estimated net GHG removals of 13.3 per cent (5,915.27 Gg CO_2 eq).

140. Sweden 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.

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

142. 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 decisions of the CMP.

143. Sweden has reported information under decision 15/CMP.1, annex, chapter I.H, "Minimization of adverse impacts in accordance with Article 3, paragraph 14", as part of its 2012 annual submission. The information is generally complete and transparent.

B. Recommendations

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

Table 6
Recommendations identified by the expert review team

Sector	*Category*	*Recommendation*	*Paragraph reference*
Cross-cutting	Key category analysis	Improve the reporting of the key category analyses for the energy and land use, land-use change and forestry (LULUCF) sectors, and for LULUCF activities under the Kyoto Protocol (KP-LULUCF)	18 and 20
	Uncertainties	Explain which inventory improvements lead to improved uncertainty estimates in the national inventory report (NIR)	23 and 32
	Transparency	Improve the transparency of the reported information on the uncertainty analysis by explaining any remaining "0" values, any changes in the uncertainty values across annual submissions and any plans to reduce the uncertainty of the estimates	24, 57, 101 and 116
	Transparency	Improve the transparency of the reporting across all sectors (see below)	29
	Quality assurance/ quality control	Make efforts to expand the tier 2 quality assurance/quality control (QA/QC) checks to cover the agriculture, LULUCF and waste sectors	32
Energy	Reference approach	Improve the transparency of the reporting of the reference approach (corrected references, units, oxidation factors and comparison of the reference and sectoral approaches)	40–42
	International bunker fuels	Correct the discrepancies between common reporting format (CRF) tables 1.C and 1.A(b) for gas/diesel oil (international marine bunkers) and residual fuel oil (international marine bunkers) for all years of the time series	45
	Feedstocks and non-energy use of fuels	Justify the use of the fraction of carbon stored or reassess the fraction of carbon stored in line with the Intergovernmental	46

Sector	*Category*	*Recommendation*	*Paragraph reference*
		Panel on Climate Change (IPCC) *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories* and the IPCC *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories*	
	Stationary combustion: solid fuels	Include an explanation for the inter-annual variations in the N_2O implied emission factor (IEF) for chemicals – solid fuels	47
		Review the N_2O emission factors (EFs) for public electricity and heat production and provide further justification for the country-specific EFs used	47
	Road transportation	Describe the changes in natural gas consumption by vehicle type across the entire time series	50
	Stationary combustion: other fuels	Provide further justification of the CO_2 IEF for public electricity and heat production and its drop in 1996	51
	Stationary combustion: biomass	Include information on the fuel mix and CH_4 IEF trend in the NIR	52
Industrial processes	Cement production	Correct the reported estimates of CO_2 emissions from the organic carbon content of the raw meal for the entire time series	61
	Limestone production	Provide information on the ratio of limestone to dolomite used in other lime production, and clarify the use of hydraulic lime	
	Aluminium production	Include an explanation of the causes of the increase in PFC emissions from 2009 to 2010 and any other relevant information on the IEF trend	63
	Consumption of halocarbons and SF_6	Continue efforts to provide estimates of emissions from solvent use, explain any recalculations and improve the consistency between the NIR and the CRF tables	67
	Limestone and dolomite use	Continue to provide information on the allocation and any planned changes in the allocation of emissions from the use of limestone and dolomite in primary and secondary production of steel, other metal production, production of clay-based products and glass production	68

Sector	*Category*	*Recommendation*	*Paragraph reference*
Agriculture	General	Improve the transparency of the reporting by including information on: the calculation of the average milk yield, the nitrogen (N) flow model and the IEF trends; and justify the use of country-specific values	73 and 80
	Enteric fermentation	Include values for the average gross energy intake and average CH_4 conversion rate in the NIR for the entire time series	76
	Manure management	Clarify the definition used for animal waste management systems in the NIR	79
		Further justify the use of the national methane conversion factor for liquid manure	80
		Improve the consistency of the CH_4 IEF used for swine and reindeer between the CRF tables and the NIR for the entire time series	81
	Direct soil emissions	Ensure the consistency of the information on N excretion on pasture, range and paddock between CRF tables 4.B(b) and 4.D	83
LULUCF	General	Update the uncertainty values when the input parameters used for the estimates are changed	90
	Forest land and cropland	Include further information on and an analysis of the drivers behind the emission/removal trends	93 and 95
	Biomass burning	Ensure the consistent reporting of CO_2 emissions from biomass burning on land converted to forest land between the LULUCF sector and the KP-LULUCF activities	96
Waste	Solid waste disposal on land	Develop country-specific parameters to estimate the emissions from solid waste disposal on land	104
	Wastewater handling	Include the information on the CH_4 emission trend for the period 1990–2004 which was provided to the expert review team (ERT) during the review in the NIR	105
		Revise the use of the notation keys for activity data reported in the CRF tables when a country-specific method is used	99 and 107
		Replace the IPCC ‘check’ method with the default IPCC method or justify why the ‘check’ method provides more accurate emission estimates	106

Sector	*Category*	*Recommendation*	*Paragraph reference*
	Waste incineration	Include information on the fossil carbon content used for different waste flows, as provided to the ERT during the review	108
KP-LULUCF	General	Include information on the rationale for the recalculations by activity and their impact	111
		Ensure the consistent reporting of N_2O emissions from the drainage of soils between the LULUCF sector and the KP-LULUCF activities	113
		Include the KP-LULUCF activities in the chapter of the NIR on recalculations and on inventory improvements resulting from the review process	117
	Afforestation and reforestation	Include information in the NIR on the reason for the difference between the reported area of afforestation/reforestation and of land converted to forest land	118
		Verify the new approach for estimating the area under afforestation and reforestation against the actual annual land-use changes and report the results of the analysis	119
Article 3, paragraph 14, of the Kyoto Protocol	General	Report any changes in the information provided under Article 3, paragraph 14, of the Kyoto Protocol in accordance with decision 15/CMP.1, annex, chapter I.H	129

IV. Questions of implementation

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

Annex I

Documents and information used during the review

A. Reference documents

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

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

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

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

"Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual inventories". FCCC/SBSTA/2006/9. Available at <http://unfccc.int/resource/docs/2006/sbsta/eng/09.pdf>.

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

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

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

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

Status report for Sweden 2012. Available at <http://unfccc.int/resource/docs/2012/asr/swe.pdf>.

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

FCCC/ARR/2011/SWE. Report of the individual review of the annual submission of Sweden submitted in 2011. Available at <http://unfccc.int/resource/docs/2012/arr/swe.pdf>.

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

2012 annual submission of Sweden:

Common reporting format tables. Available at <http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/swe-2012-crf-04oct.zip>;

Kyoto Protocol – land use, land-use change and forestry tables. Available at <http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/swe-2012-kplulucf-04oct.zip>;

National inventory report. Available at <http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/swe-2012-nir-26mar.zip>;

Standard electronic format tables. Available at <http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/swe-2012-sef-26mar.zip>.

B. Additional information provided by the Party

Responses to questions during the review were received from Ms. Frida Löfström (Swedish Environmental Protection Agency), including additional material on the methodologies and assumptions used. The following documents[1] were also provided by Sweden:

Lena Rodhe, Johnny Ascue, and Marianne Tersmeden. Greenhouse gases from cattle slurry storage. JTI – Institutet for jordburks - och miljoteknic 2008.

Rolf Adolfsson. A review of Swedish crop residue statistics used in the greenhouse gas inventory. Statistics Sweden on behalf of the Swedish EPA. Dec 2005.

Orjan Berglund, Kerstin Berglund and Gustav Sohlenius. Organogen jordbruksmark I Sverige 1999-2008. Swedish University of Agricultural Sciences. 2009.

Annika Gerner. Underlag for revidering av EF for CO_2 fran branngas. Statistika Centralbyran. June 2011.

[1] Reproduced as received from the Party.

Annex II

Acronyms and abbreviations

AD	activity data
CaO	calcium oxide
CDM	clean development mechanism
CH_4	methane
CMP	Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol
CO_2	carbon dioxide
CO_2 eq	carbon dioxide equivalent
CRF	common reporting format
DC	degradable organic component
DOM	dead organic matter
EF	emission factor
ERT	expert review team
EU ETS	European Union emissions trading scheme
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 = 109 joules)
HFCs	hydrofluorocarbons
HWPs	harvested wood products
IE	included elsewhere
IEA	International Energy Agency
IEF	implied emission factor
IPCC	Intergovernmental Panel on Climate Change
ITL	international transaction log
kg	kilogram (1 kg = 1,000 grams)
KP-LULUCF	land use, land-use change and forestry activities under Article 3, paragraph 3, and, if any, Article 3, paragraph 4, of the Kyoto Protocol
LULUCF	land use, land-use change and forestry
MCF	methane conversion factor
MSW	municipal solid waste
N_2O	nitrous oxide
NA	not applicable
NCV	net calorific value
NE	not estimated
NH_3	ammonia
NIR	national inventory report
NO	not occurring
PFCs	perfluorocarbons
QA/QC	quality assurance/quality control
SEF	standard electronic format
SF_6	sulphur hexafluoride
SIAR	standard independent assessment report
Tg	teragram (1 Tg = 1 million tonnes)
TJ	terajoule (1 TJ = 10^{12} joules)
UNFCCC	United Nations Framework Convention on Climate Change