COMPLIANCE COMMITTEE

CC/ERT/IRR/2007/18
19 November 2007

Report of the review of the initial report of Sweden

Note by the secretariat

The report of the review of the initial report of Sweden was published on 19 November 2007. For purposes of rule 10, paragraph 2, of the rules of procedure of the Compliance Committee (annex to decision 4/CMP.2), the report is considered received by the secretariat on the same date. This report, FCCC/IRR/2007/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

UNFCCC Framework Convention on Climate Change

Distr.
GENERAL

FCCC/IRR/2007/SWE
19 November 2007

ENGLISH ONLY

Report of the review of the initial report of Sweden

According to decision 13/CMP.1, each Annex I Party with a commitment inscribed in Annex B to the Kyoto Protocol shall submit to the secretariat, prior to 1 January 2007 or one year after the entry into force of the Kyoto Protocol for that Party, whichever is later, a report (the 'initial report') to facilitate the calculation of the Party's assigned amount pursuant to Article 3, paragraphs 7 and 8, of the Kyoto Protocol, and to demonstrate its capacity to account for emissions and the assigned amount. This report reflects the results of the review of the initial report of Sweden conducted by an expert review team in accordance with Article 8 of the Kyoto Protocol.

CONTENTS

I. Introduction and summary

A. Introduction

1. This report covers the in-country review of the initial report of Sweden, coordinated by the United Nations Framework Convention on Climate Change (UNFCCC) secretariat, in accordance with the guidelines for review under Article 8 of the Kyoto Protocol (decision 22/CMP.1). The review took place from 23 to 28 April 2007 in Stockholm, Sweden, and was conducted by the following team of nominated experts from the roster of experts: generalist – Mr. Jim Penman (United Kingdom of Great Britain and Northern Ireland); energy – Mr. Amit Garg (India); industrial processes and solvent and other product use – Mr. Koen Smekens (Belgium); agriculture – Mr. Vitor Gois Ferreira (Portugal); land use, land-use change and forestry (LULUCF) – Mr. Leandro Buendia (Philippines); waste – Ms. Sirintornthep Twoprayoon (Thailand). Mr. Amit Garg and Mr. Jim Penman were the lead reviewers. In addition the expert review team (ERT) reviewed the national system, the national registry, and the calculations of the Party's assigned amount and commitment period reserve, and took note of the LULUCF parameters and the elected Article 3, paragraph 4 activities. The review was coordinated by Mr. Harald Diaz-Bone (UNFCCC secretariat).

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

B. Summary

1. Timeliness

3. Decision 13/CMP.1 requests Parties to submit their initial report prior to 1 January 2007 or one year after the entry into force of the Kyoto Protocol for that Party, whichever is later. The initial report of Sweden was submitted on 19 December 2006, which is in compliance with decision 13/CMP.1. On 19 December 2006 Sweden also submitted a greenhouse gas (GHG) inventory that had been revised since its original 2006 GHG inventory submission made in April 2006. The Party resubmitted its GHG inventory on 11 June 2007 in response to questions raised by the ERT during the course of the in-country visit. The initial report refers to the revised inventory submission.

2. Completeness

4. Table 1 below provides information on the mandatory elements that have been included in the initial report and reflects revised values for the assigned amount and the commitment period reserve provided by the Party resulting from the review process. These revisions result from revised estimates for GHG emissions from iron and steel (see para. 47), perfluorocarbon (PFC) emissions from aluminium production (see para. 59), and methane (CH_4) emissions from enteric fermentation (see paras. 69 and 71), which changed the estimate for total GHG emissions in the base year from 72,281.599 Gg carbon dioxide (CO_2) eq., as originally reported by the Party, to 72,151.646 Gg CO_2 eq.

Table 1. Summary of the reporting on mandatory elements in the initial report

Item	Provided	Value/year/comment
Complete GHG inventory from the base year (1990) to the most recent year available (2004)	Yes	The inventory is complete apart from a few exceptions identified below.
Base year for HFCs, PFCs and SF_6	Yes	1995
Agreement under Article 4	Yes	Target under the EU burden-sharing agreement: 104 per cent of total GHG emissions in the base year
LULUCF parameters	Yes	Minimum tree crown cover: 10% Minimum land area: 0.5 ha Minimum tree height: 5 m
Election of and accounting period for Article 3, paragraphs 3 and 4, activities, for the first commitment period	Yes	Forest management elected; Entire commitment period for accounting activities under Articles 3.3 and 3.4
Calculation of the assigned amount in accordance with Article 3, paragraphs 7 and 8	Yes	375 864 317 tonnes CO_2 eq.
Calculation of the assigned amount in accordance with Article 3, paragraphs 7 and 8, revised value		375 188 561 tonnes CO_2 eq.
Calculation of the commitment period reserve	Yes	338 277 885 tonnes CO_2 eq.
Calculation of the commitment period reserve, revised value		337 669 705 tonnes CO_2 eq.
Description of national system in accordance with the guidelines for national systems under Article 5, paragraph 1	Yes	
Description of national registry in accordance with the requirements contained in the annex to decision 13/CMP.1, the annex to decision 5/CMP.1 and the technical standards for data exchange between registry systems adopted by the COP/MOP	Yes	

5. The information in the initial report covers all elements as required by decision 13/CMP.1, chapter I of decision 15/CMP.1, and relevant decisions of the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol (CMP).

3. Transparency

6. Although the information in the national inventory report (NIR), which forms part of the initial report, is clear and accessible, the ERT noted that greater use of tabular and graphic material and technical annexes could improve transparency at the level of individual source categories.

4. Emission profile in the base year, trends and emission reduction target

7. In the base year (1990 for CO_2, CH_4 and nitrous oxide (N_2O), and 1995 for hydroflourocarbons (HFCs), PFCs and sulphur hexaflouride (SF_6), the most important GHG in Sweden was CO_2, contributing 78.0 per cent to total[1] national GHG emissions expressed in CO_2 eq., followed by N_2O, 11.8 per cent, and CH_4, 9.3 per cent (see figure 1). HFCs, PFCs, and SF_6 taken together contributed 0.8 per cent of overall GHG emissions in the base year. The energy sector accounted for 74.0 per cent of the total GHG emissions in the base year, followed by agriculture (13.0 per cent), industrial processes (8.2 per cent) and waste (4.3 per cent) (see figure 2). Total GHG emissions (excluding LULUCF) amounted to 72,151.646 Gg CO_2 eq. and decreased by 3.5 per cent from the base year to 2004. The trends for the different gases and sectors are reasonable and reflect significant policies introduced by Sweden to mitigate its GHG emissions.

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

Figure 1. Shares of gases in total GHG emissions, base year

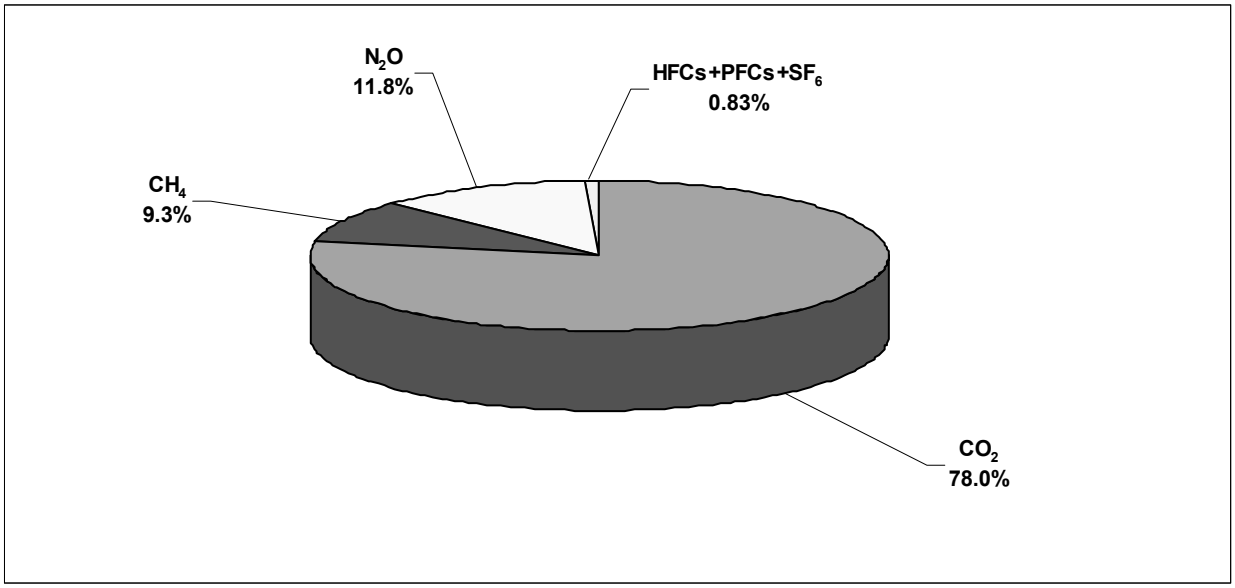
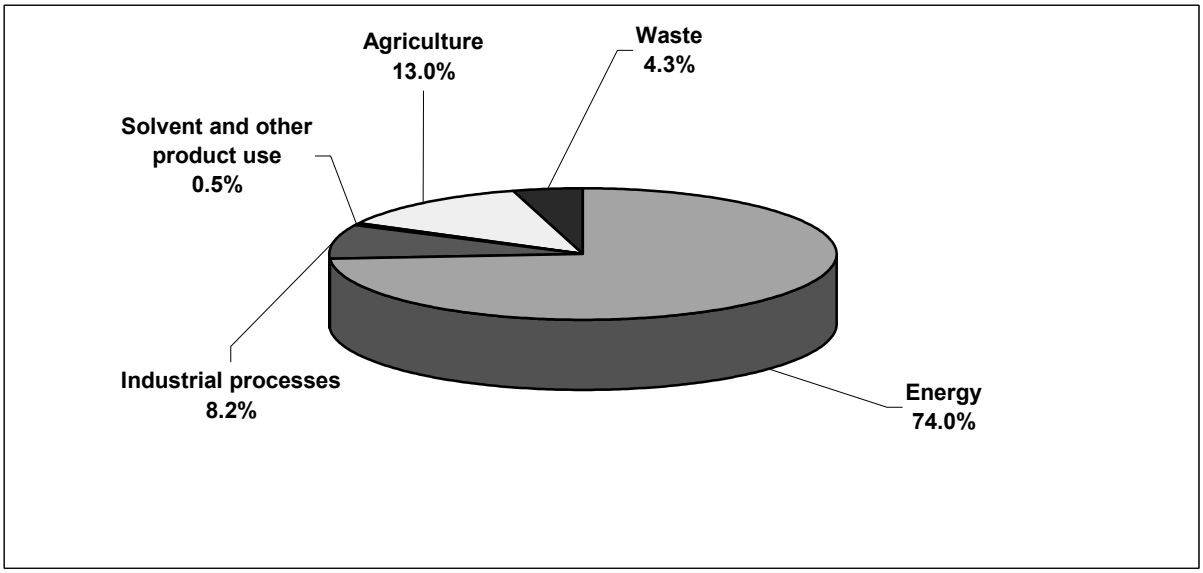


Figure 2. Shares of sectors in total GHG emissions, base year



8. Tables 2 and 3 show the GHG emissions by gas and by sector, respectively.

Table 2. Greenhouse gas emissions by gas, 1990–2004

GHG emissions (without LULUCF)	Gg CO_2 equivalent								Change
	Base year[a]	1990	1995	2000	2001	2002	2003	2004[a]	BY to 2004 (%)
CO_2	56 301.08	56 301.08	58 043.03	53 358.42	54 102.36	55 260.02	56 333.59	55 239.35	–1.9
CH_4	6 719.22	6 719.22	6 676.88	6 080.69	6 060.22	5 885.86	5 725.39	5 739.34	–14.6
N_2O	8 534.73	8 534.73	8 383.22	7 889.25	7 767.21	7 713.26	7 652.65	7 645.05	–10.4
HFCs	126.44	3.85	126.44	550.26	594.91	644.03	685.71	743.28	487.9
PFCs	343.43	376.82	343.43	240.52	235.61	260.91	258.30	253.98	–26.0
SF_6	126.74	107.47	126.74	93.51	111.46	103.94	69.07	82.71	–34.7

Note: BY = Base year; LULUCF = Land use, land-use change and forestry.

[a] Sweden submitted revised estimates for the years 1990–2004 in the course of the initial review on 11 June 2007. These estimates differ from Sweden's GHG inventory submitted in 2006.

Table 3. Greenhouse gas emissions by sector, 1990–2004

Sectors	Gg CO_2 equivalent								Change
	Base year[a]	1990	1995	2000	2001	2002	2003	2004[a]	BY to 2004 (%)
Energy	53 398.14	53 398.14	55 237.56	50 735.21	51 263.16	52 567.30	53 509.20	52 365.62	–1.9
Industrial processes	5 901.00	5 792.52	5 906.04	5 832.05	5 991.79	5 900.15	6 007.42	6 071.70	2.9
Solvent and other product use	332.49	332.49	308.62	277.59	268.58	265.50	273.89	283.68	–14.7
Agriculture	9 406.54	9 406.54	9 321.94	8 762.79	8 785.15	8 720.63	8 585.86	8 636.39	–8.2
LULUCF	NA	–22 117.31	–17 077.14	–18 113.78	–16 157.88	–16 508.26	–16 339.30	–16 478.92	NA
Waste	3 113.48	3 113.48	2 925.59	2 605.01	2 563.08	2 414.43	2 348.36	2 346.32	–24.6
Other	NO	NO	NO	NO	NA NO	NA NO	NA NO	NA NO	NA
Total (with LULUCF)	NA	49,925.86	56,622.61	50,098.87	52,713.89	53,359.75	54,385.43	53,224.80	NA
Total (without LULUCF)	72 151.65	72 043.17	73 699.75	68 212.65	68 871.76	69 868.01	70 724.73	69 703.72	–3.4

Note: BY = Base year; LULUCF = Land use, land-use change and forestry; NA = Not applicable; NO = Not occurring.

[a] Sweden submitted revised estimates for the years 1990–2004 in the course of the initial review on 11 June 2007. These estimates differ from Sweden's GHG inventory submitted in 2006.

9. Sweden's quantified emission limitation is 92 per cent of base year emissions as included in Annex B to the Kyoto Protocol. As Sweden is part of the European Community, whose member States will meet their reduction commitment jointly in accordance with Article 4 of the Kyoto Protocol, Sweden's quantified emission limitation is 104 per cent of base year emissions. Sweden's assigned amount is calculated based on the Party's Article 4 commitment.

II. Technical assessment of the elements reviewed

A. National system for the estimation of anthropogenic GHG emissions by sources and sinks

10. Sweden's national system is in accordance with the guidelines for national systems under Article 5, paragraph 1, of the Kyoto Protocol (decision 19/CMP.1). All the necessary elements are in place and the ERT noted in particular the clarity with which Ordinance 2005:626 defines the legal basis and the duties of the constituent agencies, authorities and organizations involved.

11. Table 4 shows which of the elements of the national system are included and described in the initial report.

Table 4. Summary of reporting on the specific functions of the national system

Reporting element	Provided	Comments
Inventory planning		
Designated single national entity*	Yes	See section II.A.1
Defined/allocated specific responsibilities for inventory development process*	Yes	See section II.A.1
Established process for approving the inventory*	Yes	See section II.A.1
Quality assurance/quality control plan*	Yes	See section II.A.2
Ways to improve inventory quality	Yes	See section II.B.3
Inventory preparation		
Key category analysis*	Yes	See section II.B.1
Estimates prepared in line with IPCC guidelines and IPCC good practice guidance*	Yes	See section II.B.2
Sufficient activity data and emission factor collected to support methodology*	Yes	See section II.B
Quantitative uncertainty analysis*	Yes	See section II.B.2
Recalculations*	Yes	See section II.B.2
General QC (tier 1) procedures implemented*	Yes	See section II.A.2
Source/sink category-specific QC (tier 2) procedures implemented	Yes	See section II.A.2
Basic review by experts not involved in inventory	Yes	See section II.A.2
Extensive review for key categories	Yes	See section II.A.2
Periodic internal review of inventory preparation	Yes	See section II.A.2
Inventory management		
Archive inventory information*	Yes	See section II.A.3
Archive at single location	Yes	See section II.A.3
Provide ERT with access to archived information*	Yes	See section II.A.3
Respond to requests for clarifying inventory information during review process*	Yes	See section II.A.1

* Mandatory elements of the national system.

1. Institutional, legal and procedural arrangements

12. During the in-country visit, Sweden explained the institutional arrangements, as part of the national system, for preparation of the inventory. The Ministry for Sustainable Development is the designated single national entity. Other agencies and organizations are also involved in the preparation of the inventory and have defined and allocated specific responsibilities for the inventory development process. The Swedish Environmental Protection Agency (SwEPA) coordinates the inventory and the

external peer review processes and is the statutory authority responsible to the government. Under contract to SwEPA, consultants who are part of the Swedish Methodology for Environmental Data (SMED) consortium compile the NIR and the common reporting format (CRF) tables associated with it. Relevant government agencies are responsible for providing the necessary data to SMED. Sweden makes extensive use of electronic data transfer in a way that has great advantages in version control and minimizing transcription errors between agencies.

13. Sweden has an established process for the official consideration and approval of the inventory, including recalculations, prior to its submission and for responding to issues raised by the inventory review. The Ministry for Sustainable Development has overall responsibility and conducts inter-service consultation before the inventory is submitted to the UNFCCC secretariat and the European Commission. Prior to this, the inventory undergoes national and international peer review coordinated by SwEPA. All the working documentations associated with any inventory submission is archived annually by SwEPA. The archive is referenced by individual source categories. During the in-country visit the ERT's requests for information were met efficiently by SwEPA.

2. Quality assurance/quality control

14. Sweden has developed an impressive quality assurance/quality control (QA/QC) system based on a database system developed by the Swedish Meteorological and Hydrological Institute as an assignment job for the Swedish EPA. This is 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 includes general (tier 1) QC procedures, source/sink category-specific (tier 2) procedures, identification of QC coordinators and procedures for internal review. There is a clearly defined progression as the annual inventory passes steps in the quality control process and an internal review by SMED, prior to the national and international stages of peer review, by staff who have not been involved with the preparation process. These latter stages are organized by SwEPA.

3. Inventory management

15. Sweden has an effective centralized archiving system. Ordinance 2005:626 defines the data providers and the information they must provide. This is incorporated into the working documentation associated with an inventory submission, which is archived annually by SwEPA. The archive is referenced by individual source categories. Microdata are archived by data providers in accordance with general law, and are traceable via the archived working documentation.

B. Greenhouse gas inventory

16. In its initial report submission, Sweden submitted a functionally complete set of CRF tables for the years 1990 to 2004 and an NIR. Where needed the ERT also referred to the 2005 submission.

17. During the review Sweden provided the ERT with additional information sources. These documents are not part of the initial report submission but are in many cases referenced in the NIR. The full list of materials used during the review is provided in the annex to this report.

1. Key categories

18. Sweden has reported a key category tier 1 analysis, both level and trend assessment, as part of its initial report submission. Key category analyses are provided with and without the LULUCF sector. Key category analysis is used in choosing methodologies. The ERT noted that the key category analysis is more disaggregated in the energy sector than in other sectors, and that this is intended to facilitate communication of the results to stakeholders. The ERT noted that this approach is an acceptable variation of good practice reflecting national circumstances.

19. The key category analyses performed by Sweden and the secretariat[2] produced similar results, although comparison is not completely straightforward because of the greater level of disaggregation used by Sweden in the energy sector. Sweden has used key category analysis for the development of the inventory and the results in terms of choice of methodologies are consistent with what would be expected on the basis of the secretariat's analysis.

2. Cross-cutting topics

20. The inventory is in line with the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the Revised 1996 IPCC Guidelines), the IPCC good practice guidance and the IPCC *Good Practice Guidance for Land Use, Land-Use Change and Forestry* (hereinafter referred to as the IPCC good practice guidance for LULUCF). Specific issues and recommendations regarding the application of the IPCC guidance are made in this section and in the sectoral sections of this report below.

21. The inventory has been compiled in accordance with Article 7, paragraph 1, and decision 15/CMP.1.

Completeness

22. The inventory is complete in terms of geographical coverage, years, sectors and gases. Potential emissions as well as actual emissions are reported for fluorinated compounds. CRF table 9(a) identifies categories that are not estimated. These include fugitive emissions from oil and gas activities (1.B.2) and CH_4 emissions from industrial and commercial waste water (6.B) as well as CH_4 from some industrial process emissions. The ERT noted that omission of these sources does not lead to overestimation of base year emissions and is therefore conservative. The ERT understands that Sweden believes these emissions to be small, but recommends that the availability of data be reviewed, for possible future inclusion.

Transparency

23. The NIR provides a good overview of the methods used to estimate emissions and extensive references are provided to background material. The ERT's task would have been easier if the NIR had provided more methodological detail so that the relationship between activity data (AD), emission factors (EFs) and equivalent parameters and emission estimates was clear, and if the reasons for apparent outliers or anomalies in implied emission factors (IEFs) had been easier to understand. This would have reduced the number of questions and requests for background material during the review. The ERT recommends that the accessible style of the NIR be retained, but that more use be made of tabular and graphic material and annexes to convey the methodological detail.

Consistency

24. The inventory is generally consistent, although the ERT recommends that greater use be made of interpolation to represent actual conditions in particular years, and to avoid apparent outliers. This is discussed further below under agriculture and LULUCF.

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[2] The secretariat identified, for each Party, those source categories that are key categories in terms of their absolute level of emissions, applying the tier 1 level assessment as described in the IPCC *Good Practice Guidance for Land Use, Land-use Change and Forestry* for the base year or base year period as well as the latest inventory year. Key categories according to the tier 1 trend assessment were also identified. 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.

Comparability

25. The ERT considers Sweden's inventory to be comparable with those of other Parties in its use of the IPCC methodologies, including methodologies adapted to national circumstances, and its use of the UNFCCC reporting formats.

Accuracy

26. The ERT considers Sweden's inventory to be accurate in that it does not contain either systematic overestimation or systematic underestimation, so far as can be judged, and in that uncertainties have been reduced as far as is practicable. Uncertainties have been estimated. The ERT recommends Sweden to include in its uncertainty analysis an allowance for correlations between categories and to provide an estimate of the uncertainty in the emission trend in its future GHG inventories.

Recalculations and time-series consistency

27. The ERT noted that Sweden's well-developed review system and systematic approach to recording suggestions for improvement are well adapted to identifying the need for recalculations on the basis of revised AD or new scientific information. The national system applies to recalculated estimates as well as other estimates, and will in the same way ensure that they are prepared in accordance with the IPCC good practice guidance. Recalculations are identified in the NIR and the CRF.

28. The ERT noted that recalculations reported by the Party of the time series from the base year to 2004 had been undertaken in the energy, industrial process, agriculture and waste sectors to take into account revisions to AD and methods. The major recalculation was in the land-use change and forestry sector, where adoption of the IPCC 2003 good practice guidance for land use, land-use change and forestry has resulted in more comprehensive coverage and improvements in data quality. The recalculations are explained in the NIR and the overall effect on estimated emissions in the 2006 inventory submission (made in December 2006) compared with the 2005 submission is small – a decrease in estimated base year emissions by 0.029 per cent, and an increase in estimated emissions in 2003 by 0.571 per cent. With the revisions that were made as a consequence of this in-depth review, these percentages became a decrease of 0.22 per cent in the figures for base year emissions and an increase of 0.51 per cent in estimated emissions in 2003 (both compared with the estimates made in the 2005 submission).

Uncertainties

29. Sweden has provided an uncertainty analysis for each source category and for the inventory as a whole, following the tier 1 method in the IPCC good practice guidance. The uncertainty analysis uses information on the probability distributions from sectoral experts and is cross-referenced to source categories in the CRF. This information is documented using expert protocols designed to comply with the advice in the IPCC good practice guidance. The ERT acknowledged that this is a systematic approach. The NIR presents results without adjustment for correlation between categories; the ERT noted that this may result in underestimation of the overall uncertainty. The ERT encourages the Party to undertake an analysis with correlated categories aggregated. The ERT also encourages the Party to undertake an analysis of the uncertainty in the emission trend. Both these activities are in accordance with the IPCC good practice guidance.

30. The estimated uncertainty in total emissions falls from 6.93 per cent for 2003 emission estimated in 2005 to 5.84 per cent for 2004 emissions estimated in 2006.

3. Areas for further improvement identified by the Party

31. The NIR identifies planned improvements, including in the energy sector (revised EFs) and for LULUCF (inclusion of below-ground dead wood and improvements to the estimation of other pools).

4. Areas for further improvement identified by the ERT

32. The ERT identified the following cross-cutting issues for improvement. The Party should:

(a) Consider whether estimates could in fact be made of sources that are currently not estimated (see para. 22);

(b) Make greater use of graphic and tabular material, possibly in annexes, to improve the transparency of the NIR (see para. 23);

(c) Increase the use of interpolation to represent actual conditions and remove apparent outliers (see para. 24);

(d) Extend the uncertainty analysis to take account of correlations between data and to estimate trend uncertainties (see paras. 26 and 29).

33. Recommended improvements relating to specific source categories are presented in the relevant sector sections of this report.

5. Energy

Sector overview

34. In 1990, the energy sector accounted for 74.0 per cent of Sweden's total GHG emissions (excluding LULUCF). Fuel consumption accounted for 98.3 per cent of emissions from the sector, and fugitive CH_4 emissions for 1.7 per cent. CO_2 accounted for 96.7 per cent of GHG emissions in the sector in 1990. The largest source was transport, followed by manufacturing industries and construction, other sectors (1.A.4), and energy industries, contributing 34.5, 21.5, 21.1 and 19.5 per cent to the energy sector's total GHG emissions, respectively, in 1990. Between 1990 and 2004, GHG emissions from the energy sector decreased by 1.9 per cent.

35. The coverage of source categories and gases is almost complete for the base year emissions, although Sweden has not reported emissions from fugitive emissions (coke ovens), and coal, oil and natural gas systems (1.B.1a, 1.B.1b, 1.B.2aiii, 1.B.2av, 1.B.2c venting, 1.B.2c flaring ii), indicating that they are insignificant. The ERT recommends that Sweden provide in its next NIR a short calculation to support this assumption.

36. AD and a number of EF were recalculated for the 2006 submission as compared to those in the 2005 submission, resulting in a reduction in estimated sectoral emissions in 1990, by 0.4 per cent. The source categories with the greatest changes in estimated base year emissions between the two submissions are liquid fuels (1.A.4c), liquid fuels and biomass (1.A.2d), liquid fuels (1.A.2a), and gaseous and other fuels (1.A.1a). However, the ERT noted that the explanation in the NIR for these revisions is not transparent and recommends Sweden to provide more complete explanations in its next NIR.

37. The ERT recommends that Sweden institutionalize system-level checks to minimize the risk of missing plants or data in its future submissions. These QC checks could include an independent sectoral expert review of AD, and cross-checking by SMED sectoral experts to check the CRF tables and the NIR to explain the reasons for the large inter-annual variations in emissions from key sources (in both level assessment and trend assessment). QA could be improved by including specific questions in the annual

energy surveys of the industry on additional data/information, for example, on the quantity of plastics being burned for energy purposes, and any other relevant background data.

38. The ERT was informed during the review that the Swedish Energy Agency has now been given responsibility for assessing the net calorific values and EFs for all fuels. The ERT appreciates this as it will improve the transparency, consistency and accuracy of the emission estimates.

39. The ERT noted that the recalculations carried out have been useful, and have increased the accuracy and transparency of the inventory. The NIR explains the recalculations well. However, the ERT noted that there is scope for better explanation to provide greater transparency on the rationale and the method used for the recalculations, for example, by providing details of revised AD and EFs, plants not included earlier, and reasons for the omission of other sources in the past.

40. Sweden collects energy data from postal sample surveys sent to all working units. Quarterly fuel statistics are based on the sample for the annual industrial energy statistics, except for electricity and heat production, for which there are quarterly fuel statistics based on a comprehensive survey. Data are collected from all companies in electricity and heat production, all companies in the pulp and paper industry, and all companies in manufacturing industry with more than nine employees and annual fuel combustion of more than 325 toe. Sweden informed the ERT that these data are of high quality. Some data, for example, biogas statistics, are collected over the telephone. The ERT suggests that this practice be reviewed since it may make it more difficult to achieve good practice in documenting the collection and in archiving AD.

41. Data from the European Union (EU) emissions trading scheme (ETS) have been used to reallocate AD in several subsectors (1.A.2a, 1.A.2c, 1.A.2d) for some years following the results of an SMED study. The ERT encourages the Party to cross-check these reallocations with sectoral experts in future, according to good practice for quality control.

Reference and sectoral approaches

42. CO_2 emissions from fuel combustion have been calculated using the reference approach and the sectoral approach. For 1990, the CO_2 emission estimates calculated using the reference approach are 1.43 per cent higher than those calculated by the sectoral approach. For 2004, the reference approach estimate is 11.4 per cent higher. Explanations are provided in the documentation box of CRF table 1.A(c) in terms of fugitive and industrial process emissions. In addition, the NIR provides explanations for the fluctuations in the differences between the two approaches over the years.

43. The apparent consumption reported to the UNFCCC corresponds to that reported to the International Energy Agency (IEA) for Sweden, within about 4 per cent for most years. The growth of total apparent consumption is 3 per cent according to the CRF and 5 per cent according to the IEA. The apparent consumption of liquid fuels is usually higher in the CRFs than in the IEA data. This difference is mostly due to differences in stock changes and (to a lesser extent) to differences in international bunkers. Moreover lubricants and ethane, which are reported to the IEA, are not reported in the CRF. Sweden indicated to the ERT that lubricants are reported in non-energy use of fuels in CRF, while the data on ethane are not used. The ERT recommends that Sweden reconcile its reporting to the IEA with its reporting in the CRF.

International bunker fuels

44. In the CRF tables, the ERT noted discrepancies between table 1.C and table 1.A(b) for jet kerosene (international aviation) in 1990, and for gas/diesel oil and residual fuel oil (international marine bunkers) for all years. A brief comparison between the IEA and CRF datasets indicates that the discrepancies are a result of differences in units, definitions and routines for data revision. For example, jet gasoline consumption reported as domestic aviation in the IEA data is reported as military aviation

(1.A.5b) in the CRF tables. The ERT recommends that Sweden reconcile its reporting to the IEA with its reporting in the CRF.

Feedstocks and non-energy use of fuels

45. In the iron and steel subsector (1.A.2a), Sweden provided the ERT with carbon flow accounting for one of the two major steel plants in Sweden, and with the carbon flows (a) as reported by the plant and (b) as estimated using the CRF. The difference between the two was less than 5 per cent. Sweden also provided detailed energy flows for this source category, indicating that all emissions from energy use are indeed accounted for. However, the ERT noted that part of the emissions due to energy use is accounted for in the industrial processes source category 2.C.1 (about 49 per cent for 1990 and 40 per cent for 2004). The ERT recommends that Sweden follow the IPCC good practice guidance in accounting all energy use emissions to the energy sector.

Key categories

46. A new model (ARTEMIS) has been used for emissions from road transport. Detailed surveys are conducted annually on parameters such as number of vehicles registered, energy consumption, age profile, driving cycles and cold starts. The time-series information available from these detailed surveys has been used in the ARTEMIS model, thus improving the accuracy of the road transport emission estimates.

Iron and steel: liquid fuels – all GHGs

47. During the in-country visit, Sweden indicated that there is possible double counting of heavy fuel oil consumption at one iron and steel plant for the year 1990, associated with an overestimation of base year emissions by 122.06 Gg CO_2 eq. The base year estimate for GHG emissions from iron and steel has now been revised downwards (from 1,194.56 to 1,072.50 Gg CO_2 eq.) and this is reflected in the recalculated assigned amount.

Petroleum refining: refinery gas – CO_2

48. The CO_2 emission estimates fluctuate widely. The Swedish experts explained during the in-country visit that part of refinery gas produced is used internally by the refineries, and the energy balance is also reflected in the estimation of these emissions. The ERT recommends Sweden to provide clear and detailed explanations for the fluctuations in these emissions in its next NIR.

Other manufacturing industries and construction: liquid fuels – CO_2

49. According to the NIR (page 87), "activity data for several fuels, especially for solid and liquid fuels, and several plants has been revised by adding or exchanging data in 1990–2003, due to new information from the plant". Estimated CO_2 emissions in 1990 are higher than in 1991 – by 371 Gg CO_2 for liquid fuels alone and by 285 Gg CO_2 for all fuels combined. The explanations for this in the NIR are not clear. After examining a detailed analysis of industry-level and fuel-level data provided after the in-country review by Sweden, the ERT concluded that there is no possible misallocation among the various fuels and industries, and no double counting. The decrease in emissions between 1990, 1991 and 1992 is reflected in the underlying AD and is probably due to the temporary decrease in economic activity in the early 1990s. Sweden has also re-checked the fuel reallocation for the period 1990–2003 and found no discrepancy.

Civil aviation (liquid fuels) and aviation bunkers – CO_2

50. The allocation of fuel between civil aviation and aviation bunkers is not transparently described in the NIR, especially for the period 1990–1994. On the basis of additional material provided following the in-country visit, the ERT concluded that the estimates of total CO_2 emissions from aviation for the

period 1990–1994 are based on high-quality data on the supply and delivery of petroleum products, and are consistent with the estimates for subsequent years. Total CO_2 emissions are then split between domestic and international traffic, based on estimates of domestic CO_2 emissions provided by the Swedish Civil Aviation Authority (SCAA). The estimate of domestic emissions for 1990 has been calculated based on the share of domestic emissions for 1998, which is approximately 29 per cent. To adjust for the relative development of domestic and international traffic since 1990, this is multiplied by a factor of 1.16 to reflect the larger share of domestic traffic in 1990. (This factor is the share of domestic landing/take-offs (LTO) in 1990 divided by the share of domestic LTO in 1998. Based on LTO data from the SCAA, this is
0.724/0.626 = 1.156, or 1.16 to two decimal places.) The share of domestic CO_2 emissions in 1990 is consequently estimated to be 1.16 x 29, or 34 per cent. International emissions are estimated as total emissions minus domestic emissions. Emissions from domestic and international aviation are split between LTO and cruise on the basis of the mean value for LTO cycles for domestic and international flights in the years 1995–2000. The ERT recommends that Sweden aim for greater transparency in reporting how fuel consumption is split between domestic and international aviation.

6. Industrial processes and solvent and other product use

Sector overview

51. In the base year (1990 for CO_2, CH_4 and N_2O, and 1995 for HFCs, PFCs and SF_6), emissions from industrial processes and solvent and other product use accounted for about 6,233 Gg CO_2 eq., or 8.6 per cent of total national GHG emissions, of which the industrial processes sector accounted for 8.2 per cent. CO_2 accounted for about 74.5 per cent, N_2O for about 15.9 per cent and PFCs for 5.5 per cent of the sectors' GHG emissions in the base year.

52. Between 1990 and 2004 the GHG emissions of these sectors increased by 3.8 per cent, from 6,125 to 6,355 Gg CO_2 eq. The major increase occurred within industrial processes, for which emissions rose by 4.8 per cent, or 279 Gg CO_2 eq., mainly due to an increase of 740 Gg CO_2 eq. in HFC emissions, partially offset by reductions of 368 Gg CO_2 eq. in N_2O and 123 Gg CO_2 eq. in PFCs. Emissions from solvents decreased by about 15 per cent, or 49 Gg CO_2 eq., resulting from a decrease of CO_2 emissions, by 105 Gg, offset by an increase of 56 Gg N_2O.

53. Sweden's inventory of emissions by these sectors is functionally complete, and the missing sources reported (for CH_4 and N_2O) are estimated to be small. Completeness is ensured by reviews of the annual industrial environmental reports which are presented annually by the local authority boards and other competent authorities. In addition, SwEPA undertook a national review for the 2006 submission. Sweden has the necessary QA/QC procedures and institutional arrangements in place. For the fluorinated gases, both potential and actual, Sweden has introduced in its 2006 inventory submission a new calculation method based on product registries and product allocation. This approach resulted in these emissions being recalculated for the whole time period but has considerably improved the quality of the reporting for these gases.

54. The methods used for calculating emissions by subcategory are not all reported in a transparent or consistent manner, including for some key categories. The time series for most categories, including some key categories, contain some inconsistencies, partly because different basic data sources are available or have been used. Gaps in the underlying data time series are often filled by interpolation using data from known years, since the data cannot be retrieved from companies which no longer exist. The national peer review performed before the 2006 submission has improved the quality of the reporting and the coverage of this sector. The use of a country-specific allocation rule for some CO_2 emissions within the industrial processes sector reduces comparability with other Parties' IEFs.

Key categories

Iron and steel production – CO_2

55. CO_2 emissions from the iron and steel industry is identified as a key category in both the level and trend assessments. They amounted to 1,796 Gg CO_2 eq., or 28.8 per cent of the industrial processes and solvent and other product use emissions, in the base year. Sweden uses a country-specific method to estimate and allocate the CO_2 emissions from primary (pig) iron production. Sweden calculates these CO_2 emissions based on the total amount of blast furnace gas consumed. In addition it accounts for these emissions in the (sub)sectors where the blast furnace gas is combusted, including in some (sub)categories in the energy sector. This results in lower emissions, and hence a lower IEF, compared to other Parties for this category's CO_2 emissions since not all blast furnace gas is combusted in the iron and steel sector; and the emissions of the sectors where blast furnace gas is combusted are consequently higher, since the CO_2 from blast furnace gas combusted is included there. This country-specific method does not change the total amount of CO_2 emitted; it only changes the distribution of emissions between the relevant subcategories. The ERT suggests that Sweden adopt the approach set out in the IPCC good practice guidance, which would facilitate future reviews and comparison between Parties.

Cement production – CO_2

56. CO_2 emissions from cement production is identified as a key category in both the level and trend assessments. In the base year they amounted to 1,272 Gg CO_2 eq., or 20.4 per cent of industrial processes, and solvent and other product use emissions. The tier 2 methodology from the IPCC good practice guidance is used to estimate CO_2 emissions from this sector. Although the IEF is among the higher ones of reporting Parties, Sweden has provided sufficient justification, including information on the use of organic carbon and cement kiln dust, which increase the IEF. Following the recommendation of the ERT, Sweden has agreed to collect or estimate data on the lime (CaO) content of clinker, and to provide this information in its future submissions.

Lime production – CO_2

57. In the base year, CO_2 emissions from lime production, a key category in both the level and trend assessments, amounted to 498 Gg CO_2 eq., or 8.0 per cent of industrial processes and solvent and other product use emissions. Three industries produce emissions from lime – conventional lime production, the sugar industry and the pulp and paper industry.

58. Emissions from conventional lime production are estimated in accordance with the IPCC good practice guidance, but those from the sugar and the pulp and paper industries are not because the AD used are not amounts of lime produced. This leads to an inconsistent and non-transparent emission calculation, especially since removal of CO_2 is also reported for the latter two categories. This CO_2 removal leads to a lower IEF compared to those of other Parties for CO_2 emissions in these two categories. The ERT recommends Sweden to follow the IPCC good practice guidance and also provide transparent information on the estimation of the CO_2 removals.

Aluminium production – PFCs

59. The methodology used to estimate PFC emissions from this sector deviates from the IPCC good practice guidance in that different slope coefficients for the anode effects are used, resulting in a potential overestimation of PFC emission levels in the base year. Following the recommendation of the ERT, Sweden re-estimated and revised the estimated PFC emissions from aluminium production, on the basis of the IPCC good practice guidance methodology. The base year estimate for PFC emissions from aluminium production has now been revised downwards by 45.83 Gg CO_2 eq. (from 380.47 to 334.65 Gg CO_2 eq.) and this is reflected in the recalculated assigned amount. The revised estimation method should be reported transparently in Sweden's next NIR.

Electrical equipment – SF_6

60. In the base year (1995), SF_6 emissions from electrical equipment production amounted to 95 Gg CO_2 eq., or 1.5 per cent of industrial processes, and solvent and other product use emissions. The ERT observed a spike in SF_6 emissions of 24 Gg CO_2 eq. in the base year compared to adjacent years. This spike was accompanied by a production value that was lower than those of adjacent years, as indicated by information provided during the in-country visit. Following the ERT's visit, Sweden explained that the spike in 1995 was due to a broken valve.

Other key categories

61. In the base year, N_2O from nitric acid production amounted to 814 Gg CO_2 eq., or 13.1 per cent of industrial processes, and solvent and other product use emissions. Since two of the three companies that were active in the base year had shut down by 2002, emissions are currently linked to a single source.

62. HFC emissions from consumption of halocarbons and SF_6 amounted to 126 Gg CO_2 eq., or 2.0 per cent of industrial processes, and solvent and other product use emissions, in the base year. As with other Parties, these emissions have increased considerably, to 743 Gg CO_2 eq. by 2004, or 11.7 per cent of industrial processes, and solvent and other product use emissions in that year.

63. CO_2 and N_2O emissions from solvent and other product use amounted, respectively, to 242 Gg and 90 Gg CO_2 eq., or 3.9 per cent and 1.4 per cent of sectoral emissions, in the base year. By 2004, they had reached about 140 Gg CO_2 eq. each, or a share of about 2.2 per cent each in total sectoral emissions.

Non-key categories

Limestone and dolomite use – CO_2

64. The CO_2 emissions originating from the use of limestone and dolomite amounted to 109 Gg CO_2 eq., or 1.8 per cent of sectoral emissions, in the base year. Some limestone use and associated GHG emissions are included in other source categories, for example, the iron and steel industry, where the CO_2 from the limestone used in blast furnaces is added to the CO_2 content of the blast furnace gas. This reallocation of emissions does not change the level of total emissions; it reduces the comparability of the IEFs for the other categories. The ERT recommends that Sweden follow the Revised 1996 IPCC Guidelines and account for all CO_2 emissions from limestone use in category 2.A.3. The ERT recognises that the proposed *2006 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the 2006 IPCC Guidelines), would allow inclusion of these emissions in the sector where the limestone is used, but the 2006 guidelines have not yet been adopted.

Other – CH_4 and N_2O

65. CH_4 and N_2O emissions originating from combustion of cooking liquor in the pulp and paper industries, amounting to 71 Gg CO_2 eq., or 1.1 per cent of sectoral emissions, in the base year, are accounted for in category 2.G, whereas they should be included in 1.A.2d, as well as the biogenic CO_2 emissions associated with this cooking liquor combustion. This is also an allocation issue and does not affect the overall emissions total.

7. Agriculture

Sector overview

66. In the base year (1990), total emissions from the agriculture sector amounted to 9,406.5 Gg CO_2 eq. and accounted for 13.0 per cent of total national emissions. CH_4 accounted for 36.0 per cent of sectoral emissions and 13.0 per cent of total national GHG emissions (excluding LULUCF). N_2O contributed 63.7 per cent of sectoral emissions, and CH_4 accounted for the remainder (36.3 per cent).

Emissions in 2004 were 8.2 per cent lower than in 1990. All relevant source categories and greenhouse gases are reported. CH_4 and N_2O emissions from field burning of agricultural residues are reported as not occurring ("NO"), although in the NIR Sweden reports that this activity is not very common, rather than completely absent. The ERT encourages Sweden to clarify its use of the notation key "NO" for this source category.

67. The inventory relies on several country-specific methodologies, which are well referenced in the NIR and supported by extensive background documentation. In particular, Sweden is using country-specific methodologies or EFs to estimate emissions of CH_4 from enteric fermentation from dairy cattle and non-dairy cattle, CH_4 and N_2O emissions from manure management from dairy cattle, non-dairy cattle and swine, direct N_2O emissions from the application of synthetic fertilizers and animal manure, nitrogen (N)-fixing crops, crop residues and grazing, and indirect N_2O emissions from leaching and run-off. The ERT welcomes these developments but, following previous review reports, recommends that Sweden further increase the transparency of the NIR by providing underlying background information about supporting studies, and clarifying whether the country-specific methods and EFs reflect field data, expert judgement, or compilations from the scientific literature.

68. There remain some inconsistencies in the time series. In general Sweden updates values in the time series only when new studies are available for a given year. As a consequence, the time series in underlying data, IEFs and emissions show significant inter-annual variations which apparently do not correspond to actual variations in practices or activity, but only reflect data availability. The ERT recommends that Sweden use the IPCC good practice guidance to try to improve time trends in order to better represent the real evolution of the activity. The change in statistical definition for the swine subclasses is particularly important. Changes in the definition of subclasses (sows and young females) have led to an unrealistic increase in the number of sows in the period 1994–1996 that does not represent real changes in animal numbers and produces inconsistencies in the time series for AD, IEFs and emissions. The number of sows could be underestimated in the base year, as well as the emission estimates for several categories: CH_4 from enteric fermentation, CH_4 and N_2O from manure management, and N_2O emissions from agricultural soils. Following the recommendation of the ERT, Sweden will consider possible revisions to the time series to remove these statistical effects, but considers that base year emissions have not been underestimated.

Key categories

Enteric fermentation cattle – CH_4

69. Sweden uses country-specific tier 2 EFs for non-dairy cattle – beef cows and growing animals (12–24 months and calves) – which are set individually for each cattle subclass. The EFs for the subclasses are not well documented with the necessary underlying assumptions that could allow comparison with the results from other Parties. The EF used for beef cows (98 kg CH_4/head/yr) is high when compared with the underlying data in the Revised 1996 IPCC Guidelines and is not consistent with the milk yield that Sweden, during the in-country visit, reported as representative of the national flock (1,300 kg milk/head/yr). Sweden acknowledged that this EF and the associated emission estimates could be overestimated in base year and for the whole time series and, following the in-country review, as a result of a reassessment of its country-specific data, has revised downwards the milk yield (to 960 kg milk/head/yr) and the EF for beef cows (by about 20 per cent, to 78.0 kg CH_4/head/year), providing appropriate documentation and justification of the underlying assumptions. The base year estimate for CH_4 emissions from enteric fermentation – non-dairy cattle has now been revised downwards by 1.50 Gg CH_4 (from 60.70 to 59.20 Gg CH_4) and this is reflected in the recalculated assigned amount.

70. Sweden reports a comparatively high tier 2 IEF for dairy cattle, ranging from 118.3 to 129.3 kg/head/year, which is the highest of reporting Parties but nevertheless consistent with the milk yields reported in the Swedish statistical sources. However, the related information (average gross

energy intake (GE) and average CH_4 conversion rate (Y_m)) provided in CRF table 4.A is not consistent with the EF model that Sweden is using or with the trend in the IEF. During the in-country visit, Sweden provided clarification that these values were not actually used in calculations, and the ERT recommends Sweden to revise its CRF reporting to provide only information that is consistent with the estimates.

71. Sweden uses a country-specific tier 2 EF for reindeer (7.7 kg CH_4/head/yr) which is based on studies carried out in Finland and was chosen on the assumption that reindeer are kept under similar conditions in all the Nordic countries. However, the IEFs in the submissions of Norway and Finland are now substantially higher – 11 kg CH_4/head/yr and 19.9 kg CH_4/head/yr, respectively. Following the recommendation of the ERT, Sweden has assessed the Norwegian and Finnish approaches and provided revised estimates on the basis of the latter. The base year estimate for CH_4 emissions from enteric fermentation - reindeer has now been revised upwards by 3.31 Gg CH_4 (from 2.09 to 5.39 Gg CH_4) and this is reflected in the recalculated assigned amount.

Manure management: cattle and swine – CH_4

72. Sweden is using a methane correction factor (MCF) for liquid systems (10 per cent) that is lower than the default value in the IPCC good practice guidance (39 per cent). The value is based on documentation that was provided to the ERT during the in-country visit. However, the recommendations in the documentation provided shows that the MCF values for both liquid systems and solid storage should be revised for swine and cattle. The ERT encourages Sweden to clarify its reasons for not using both recommendations from the underlying study.

73. The fraction of animal waste treatment systems that are liquid systems is based on information from the national statistics office, Statistics Sweden, but inconsistencies were detected in the time series. The resultant time series shows unexpected trends for certain animal types in relation to changes in the origin of the statistical information. For non-dairy cattle there is an increase from 1990 (when it was 30 per cent) to 1996 (41 per cent), and then a sudden decrease to 1997 (28 per cent). For other swine there was an increase from 1990 (44 per cent) to 1996 (63 per cent), and then a sudden decrease to 1997 (24 per cent) and an increase again to 38 per cent in 2004. Following the recommendation of the ERT, Sweden will try to improve the consistency of the time series or provide explanations for the apparent increases and decreases.

Agricultural soils: direct soil emissions – N_2O

74. The NIR is not fully transparent for this source category. Sweden uses a set of country-specific methodologies including different volatilization fractions for N input from manure applied to soils and N excretion on pasture range and paddock, and a country-specific EF for nitrogen input from the application of synthetic fertilizers, N input from manure applied to soils, and N excretion on pasture range and paddock. However, there is no reporting of the values of these parameters for all years. Moreover, Sweden considers two types of situation under N excretion on pasture range and paddock – permanent pastures and grassland – although the NIR does not define these clearly. The ERT acknowledges the use of a higher-level methodology but encourages Sweden to improve the transparency of its reporting.

75. Sweden uses fertilizer sales as AD to estimate N_2O emissions from synthetic fertilizers. The ERT noted that data on fertilizer use would be more appropriate as the AD for this source category.

76. Sweden does not report in CRF table 4.D the quantity of nitrogen in sewage sludge used as fertilizer, which makes it impossible to calculate the IEF and compare it with those of other Parties. The ERT encourages Sweden to improve transparency by reporting the appropriate data.

Agricultural soils: indirect soil emissions – N_2O

77. Sweden does not provide sufficient information in the NIR about the volatilization ratios of ammonia (NH_3) and nitrogen oxide (NO_x) from the use of synthetic fertilizers and the application of animal manure. The methodology and parameters referenced are included in the Swedish Informative Report submitted under the United Nations Economic Commission for Europe Convention on Long-Range Transboundary Air Pollution. In the interests of transparency, the ERT recommends Sweden in its future NIRs to include the relevant information concerning the determination of these volatilization ratios.

Agricultural soils: other – N_2O

78. Sweden estimates emissions of N_2O from mineral soils using a country-specific EF and methodology which, although not explicitly recommended in the Revised 1996 IPCC Guidelines or the IPCC good practice guidance, do not conflict with the underlying considerations in the Revised 1996 IPCC Guidelines. During the review Sweden provided explanations and documentation clarifying that there is no double counting of these emissions with the emission estimates for the other sources of direct N_2O emissions from nitrogen added to soil, and that these emissions are anthropogenic in nature because they result from nitrogen mineralization from sources of nitrogen such as dead roots and soil organic matter. The method takes account of the estimated fraction of emissions at a zero application rate of nitrogen fertilizer that is due to anthropogenic activities on the land, combined with country-specific EFs linked to the rate of application of nitrogen fertilizer. The ERT suggests that more transparent documentation be included in the NIR.

8. Land use, land-use change and forestry

Sector overview

79. In 1990, the LULUCF sector in Sweden was a net sink of carbon of 22,117.307 Gg CO_2 eq. This carbon sink occurs mainly in forest land with some contributions from grassland and settlements. Cropland was a source of CO_2 emissions. In 2004, the sector was a net sink of 16,478.918 Gg CO_2 eq. with most of the carbon stored in forest land and grassland. Settlements and cropland were sources of CO_2 emissions.

80. Sweden represents its total land area in a way that is consistent with the land-use categories provided in the IPCC good practice guidance. The six land-use categories forest land (5.A), cropland (5.B), grassland (5.C), wetlands (5.D), settlements (5.E) and other land (5.F) form the basis on which GHG emissions and removals from land use and land-use conversion are estimated and reported. All forest land, cropland, grassland and settlements are assumed to be managed, while all wetlands and other land are assumed to be unmanaged. The reported land-use categories are linked to the 17 national land-use categories monitored by the Swedish National Inventory of Forests.

Key categories

Forest land, cropland, grassland and settlements – CO_2

81. In the level assessment, four categories were identified as key categories in the base year: CO_2 from forest land remaining forest land (5.A.1); CO_2 from land converted to forest land (5.A.2); CO_2 from cropland remaining cropland (5.B.1); and CO_2 from grassland remaining grassland (5.C.1). For the inventory year 2004, in both the level and trend assessments, two additional categories were identified as key: CO_2 from land converted to grassland (5.C.2); and CO_2 from settlements (5.E). CO_2 emissions from settlements mostly come from conversion of forest land and grassland to settlements.

82. Sweden now uses the stock change method in estimating changes in carbon (C) stocks in biomass, which the ERT considered an improvement in methodology. The ERT noted, however, that the

NIR needs to be more transparent on how this method and related parameters relate to the CRF tables and how C stock changes in biomass are estimated.

83. The ERT appreciated Sweden's effort to improve the estimates of C stock changes in dead organic matter and soils by using a sampling approach, and acknowledged that significant changes are difficult to detect. The ERT supported the Party's approach that a combination of modelling and sample data is the best way forward, combined with continuation of the sampling approach as a means of verification. The ERT encourages the Party to use a Monte Carlo analysis to estimate uncertainties where models are used.

84. Outliers were observed in the trend of CO_2 emissions/removals, C stock changes, and areas. In most cases these outliers coincide with the transition years for data collection (such as 1993 and 2002) indicating a problem of time-series consistency. The ERT recommends the Party to validate these inconsistencies in the time series and to report the findings/revisions in its next NIR.

85. The ERT compared the IEFs for the increase in C stocks in biomass in forest land remaining forest land for Finland, Norway and Sweden. Sweden's value was the lowest (the average is 0.31) as compared to Finland (1.31) and Norway (0.51). The ERT noted that Sweden may be underestimating the C stock increase in living biomass and recommends Sweden to verify these differences and make revisions if necessary.

Non-key categories

Wetlands – CO_2

86. Sweden indicates in the NIR that, as part of forthcoming improvements, N_2O emissions from peat extraction will be considered in future submissions, although estimating these emissions is optional. The IPCC good practice guidance, however, does require the estimation of CO_2 emissions from land converted to wetlands. These CO_2 emissions are associated with either peat extraction or flooding. The ERT recommends Sweden to provide a full estimate in its next submission.

9. Waste

Sector overview

87. In 1990, the waste sector contributed 4.3 per cent of total national emissions. Solid waste disposal sites (SWDS) accounted by far for the largest share (93 per cent) of sectoral emissions. Between the base year and 2004, emissions from waste decreased by 24.6 per cent. Emissions of N_2O from waste water (the second-largest sectoral source in the base year) fell by 28.8 per cent over the same period. Emissions of CO_2 from incineration increased by 219.9 per cent between the base year and 2004.

88. Sweden has improved and changed some parameters such as degradable organic carbon and the degradable organic carbon fraction to take account of current statistical data and to be consistent with the IPCC good practice guidance. Recalculation to take account of these revisions increased estimated sectoral emissions by 11.45 per cent in 1990 and by 17.37 per cent in 2003 compared with the 2005 submission. Sweden has a QA/QC system in place and the uncertainties have been estimated. Although the NIR provides a clear overview of the sector, the ERT noted that transparency would be increased by the addition of more methodological detail, including justification of the parameter values and information on the utilization of gas recovery.

Key categories

Solid waste disposal on land – CH_4

89. Sweden uses a tier 2 methodology to estimate CH_4 emissions from SWDS, with country-specific parameter values. The NIR provides a comparison of the tier 1 and tier 2 methods. Historical data on

type and quantity of waste treated at landfill sites are reported. Sweden has developed policies and regulations on waste management according to the EU Directive as well as promoting waste recycling, which results in declining amounts of waste going to landfill sites.

90. Sweden has used a decay half-life (7.5 years) for waste in landfill that is shorter than the IPCC default value (14 years), although close to the value (7 years) recommended in the 2006 IPCC Guidelines for moderately degrading waste in wet boreal and temperate areas. Sweden indicates that 95 per cent of its landfills are situated in areas where mean annual precipitation is greater than potential evapotranspiration (MAP/PET>1).

91. The amount of gas recovered from landfills increased by 300 per cent between 1990 and 2003, but has now started to decrease because of the dramatic reduction of landfilling of organic waste. The ERT recommends that Sweden provide further information on the utilization of gas recovery in its next NIR. Recovered gas is used for heating, road transportation and electricity production.

Waste incineration – CO_2

92. Sweden has one hazardous waste incineration plant. Only non-biogenic CO_2 emissions are reported. During in-country visit, the ERT was informed that the amount of CH_4 and N_2O emissions was negligible due to the high efficiency of incineration (at temperatures of 1200–1400°C). This is confirmed by periodic measurements. The ERT recommends Sweden to measure these emissions periodically on-site.

Non-key categories

Wastewater handling – N_2O

93. Emissions from wastewater handling have been estimated only for N_2O from industrial and domestic sources using country-specific EFs. Emissions in 2004 were lower than in the base year due to the improvement of nitrogen removal facilities.

94. CH_4 emissions from wastewater treatment have not been estimated. Sweden reports in its NIR that 95 per cent of waste water is treated mechanically, chemically and biologically. During the in-country visit, the ERT was provided with the environmental report (Miljorapport 2006) which indicated the high efficiency of the treatment technology. According to the NIR, sludge from both domestic and industrial organic wastewater treatment plants is landfilled, and associated CH_4 emissions are therefore accounted for under SWDS. The ERT recommends that Sweden use the notation key "not estimated" ("NE") for CH_4 emissions from wastewater treatment, instead of "included elsewhere" ("IE"), in CRF table 6.B.

C. Calculation of the assigned amount

95. The assigned amount pursuant to Article 3, paragraphs 7 and 8, has been calculated in accordance with the annex to decision 13/CMP.1.

96. Sweden's base year is 1990 and the Party has chosen 1995 as the base year for HFCs, PFCs and SF_6. Sweden's quantified emission limitation is 92 per cent as included in Annex B to the Kyoto Protocol. As Sweden is part of the European Community, whose member States will meet their reduction commitment jointly in accordance with Article 4 of the Kyoto Protocol, Sweden's quantified emission limitation is 104 per cent. Sweden's assigned amount is calculated based on the Party's Article 4 commitment.

97. Based on Sweden's original base year emissions, excluding land-use change – 72,281.599 Gg CO_2 eq. – and its Kyoto Protocol target of 104 per cent, the Party calculated its assigned amount to be 375,864,317 tonnes CO_2 eq.

98. In response to inventory issues identified during the review, the Party submitted revised estimates of its base year inventory, which resulted in a recalculation of the assigned amount. Based on the revised estimates for Sweden's base year emissions – 72,151.646 Gg CO_2 eq. – the Party calculates its assigned amount to be 375,188,561 tonnes CO_2 eq. The ERT agrees with this figure.

D. Calculation of the commitment period reserve

99. The calculation of the required level of the commitment period reserve is in accordance with paragraph 6 of the annex to decision 11/CMP.1.

100. Based on its original calculated assigned amount – 375,864,317 tonnes CO_2 eq. – Sweden calculated its commitment period reserve to be 338,277,885 tonnes CO_2 eq.

101. In response to inventory issues identified during the review, the Party submitted revised estimates of its base year inventory, which resulted in a recalculation of the assigned amount. Based on the revised estimates, the Party calculates its commitment period reserve to be 337,669,705 tonnes CO_2 eq. The ERT agrees with this figure.

E. National registry

102. Sweden has provided complete information on its national registry, as required by the reporting guidelines under Article 7, paragraphs 1 and 2, of the Kyoto Protocol (decisions 15/CMP.1 and 13/CMP.1). This information is broadly transparent and in accordance with the guidelines. Some of the information is not clearly indicated in the initial report, for example, conformity with the data exchange standards, procedures to minimize discrepancies, security measures to prevent unauthorized manipulation and to prevent operator error, and disaster management. The ERT recommends Sweden to provide more detailed information in its next annual report.

103. During the initial review, the ERT was provided with additional and updated information on the national registry of Sweden. A test version of the registry software GRETA was presented to the ERT during an online demonstration. GRETA (developed by the British Department of Environment, Food and Rural Affairs) has been chosen as the software for the national registry system. The Swedish Energy Agency hosts the national registry at its premises in Eskilstuna, about 100 km from Stockholm. Table 5 summarizes the information on the mandatory reporting elements on the national registry system, as stipulated by decisions 13/CMP.1 and 15/CMP.1.

Table 5. Summary of information on the national registry system

Reporting element	Provided in the initial report	Comments
Registry administrator		
Name and contact information	Yes	
Cooperation with other Parties in a consolidated system		
Names of other Parties with which Sweden cooperates, or clarification that no such cooperation exists	Yes	
Database structure and capacity of the national registry		
Description of the database structure	Yes	
Description of the capacity of the national registry	Yes	
Conformity with data exchange standards (DES)		
Description of how the national registry conforms to the technical DES between registry systems	Yes	Covered in the Independent Assessment Report (IAR)[a]
Procedures for minimizing and handling of discrepancies		
Description of the procedures employed in the national registry to minimize discrepancies in the transaction of Kyoto Protocol units	Yes	
Description of the steps taken to terminate transactions where a discrepancy is notified and to correct problems in the event of a failure to terminate the transaction	Yes	
Prevention of unauthorized manipulations and operator error		
An overview of security measures employed in the national registry to prevent unauthorized manipulations and to prevent operator error	Yes	
An overview of how these measures are kept up to date	Yes	
User interface of the national registry		
A list of the information publicly accessible by means of the user interface to the national registry	Yes	
The Internet address of the interface to Sweden's national registry	Yes	
Integrity of data storage and recovery		
A description of measures taken to safeguard, maintain and recover data in order to ensure the integrity of data storage and the recovery of registry services in the event of a disaster	Yes	
Test results		
The results of any test procedures that might be available or developed with the aim of testing the performance, procedures and security measures of the national registry undertaken pursuant to the provisions of decision 19/CP.7 relating to the technical standards for data exchange between registry systems	Yes	

[a] Pursuant to decision 16/CP.10, the administrator of the international transaction log (ITL), once registry systems become operational, is requested to facilitate an interactive exercise, including with experts from Parties to the Kyoto Protocol not included in Annex I to the Convention, demonstrating the functioning of the ITL with other registry systems. The results of this exercise will be included in an IAR. They will also be included in the annual report to the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol.

104. During the in-country visit, the ERT was informed that the internal operational test of the registry for network connection was completed on 3 August 2007. Host country representatives informed the ERT that connectivity and interoperability tests with the international transaction log (ITL) were expected to be completed by 20 September 2007. The initialization process was completed by 23 October 2007 and the registry is ready for full operation with the ITL. The ERT understands that the delay was due to late delivery of documentation from the ITL operator, and was not related to the state of readiness of the national registry of Sweden. Information on the registry is publicly available at <http://www.utslappshandel.se/index_eng.html>.

105. The ERT acknowledged the security measures that have been implemented for the national registry of Sweden under the EU ETS. It noted that Sweden attaches high importance, and allocates sufficient resources, to the development, operation and maintenance of the national registry under the Kyoto Protocol. The ERT was also informed about the procedures and security measures in place to minimize discrepancies, terminate transactions and correct problems, and minimize operator error. These

procedures and security measures include: regular staff training, which usually includes participating in testing new builds of the software; a user-friendly interface that is designed to allow users to select from a set of predefined values rather than typing in information; a manual for account holders; clear segregation of duties (e.g. proposing and approving transactions); and several internal checks, reconciliation procedures and field validations that are used both in checks in the user interface (date validation) and in the database (to check that there are sufficient units available for a requested transaction).

106. The ERT took note of the results of the technical assessment of the national registry, including the results of standardized testing, as reported in the independent assessment report (IAR) that was forwarded to the ERT by the administrator of the international transaction log, pursuant to decision 16/CP.10, on 9 November 2007.

107. The ERT reiterated the main findings of this report, including that the registry has fulfilled all of its obligations regarding conformity with the data exchange standards (DES). These obligations include having adequate transaction procedures; adequate security measures to prevent and resolve unauthorized manipulations; and adequate measures for data storage and registry recovery.

108. Based on the results of the technical assessment, as reported in the IAR, the ERT concluded that Sweden's national registry is fully compliant with the registry requirements as defined by decisions 13/CMP.1 and 5/CMP.1, noting that registries do not have obligations regarding operational performance or public availability of information prior to the operational phase.

F. Land use, land-use change and forestry parameters and election of activities

109. Table 6 shows the Party's choice of parameters for forest definition as well as elections for Article 3, paragraphs 3 and 4, activities in accordance with decision 16/CMP.1.

Table 6. Selection of LULUCF parameters

Parameters for forest definition		
Minimum tree cover	10%	
Minimum land area	0.5 ha	
Minimum tree height	5 m	
Elections for Article 3, paragraphs 3 and 4, activities		
Article 3.3 activities	**Election**	**Accounting period**
Afforestation and reforestation	Mandatory	Commitment period
Deforestation	Mandatory	Commitment period
Article 3.4 activities		
Forest land management	Elected	Commitment period
Cropland management	Not elected	Not applicable
Grazing land management	Not elected	Not applicable
Revegetation	Not elected	Not applicable

110. The ERT confirmed that a single value has been reported by Sweden for each of the parameters related to the Party's definition of forest, in accordance with decision 16/CMP.1, and that each single value is within the appropriate range. In addition, Sweden also provided, consistent with the IPCC good practice guidance, the minimum forest width of 10 metres.

III. Conclusions and recommendations

A. Conclusions

111. The ERT concluded that the information provided by Sweden in the initial report and during the review process is complete and in accordance with the relevant provisions of the annex to decision 13/CMP.1, relevant elements of chapter I of the annex to decision 15/CMP.1, and other relevant decisions of the CMP; that the assigned amount pursuant to Article 3, paragraphs 7 and 8, has been calculated in accordance with the annex to decision 13/CMP.1, and is consistent with the revised inventory estimates as submitted and reviewed; that the calculation of the required level of the commitment period reserve is in accordance with paragraph 6 of the annex to decision 11/CMP.1, and is consistent with the revised inventory estimates as submitted and reviewed; and that the LULUCF definitions are within the agreed range.

112. Sweden has in place a national system in accordance with the guidelines for national systems under Article 5, paragraph 1 of the Kyoto Protocol, contained in decision 19/CMP.1. This includes a single national entity, associated institutional arrangements and procedures for official approval, a QA/QC plan, a working archive system, processes for collecting data and developing the estimates, the identification of key categories and processes for making recalculations to improve the inventory.

113. Sweden's GHG inventory is largely complete and is mostly compiled in accordance with the Revised 1996 IPCC Guidelines and the IPCC good practice guidance. The inventory is functionally complete for the base year; some source categories have been identified as not estimated. The omission of these will not lead to overestimation of base year emissions and is therefore conservative.

114. Based on Sweden's base year emissions (72,151.646 Gg CO_2 eq., including the revised estimates provided in the energy, industrial processes and agriculture sectors) and its Kyoto Protocol target (104 per cent) the Party calculates its assigned amount to be 375,188,561 tonnes CO_2 eq. Sweden calculates its commitment period reserve to be 337,669,705 tonnes CO_2 eq. The ERT agrees with these figures.

115. Sweden's choice of the parameters to define forest (minimum tree cover: 10 per cent; minimum land area: 0.5 ha; minimum tree height: 5 m) are in accordance with decision 16/CMP.1. In addition, Sweden has also provided, consistently with the IPCC good practice guidance, a minimum forest width of 10 metres. Sweden has elected to account for forest management activities under Article 3, paragraph 4 of the Kyoto Protocol. It has elected commitment period accounting for the activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol.

116. Based on the results of the in-country review visit and the technical assessment, as reported in the independent assessment report, the ERT concluded that Sweden's national registry is fully compliant with the registry requirements as defined by decisions 13/CMP.1 and 5/CMP.1.

B. Recommendations

117. In the course of the review, the ERT formulated a number of recommendations relating to the completeness and transparency of Sweden's information presented in the initial report. The key recommendations[3] are that Sweden:

(a) Increase the transparency of the inventory by providing more detailed descriptions in the NIR in relation to the CRF;

(b) Review the availability of data for sources of emissions that are currently not estimated;

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

(c) Use interpolation to improve time-series consistency and avoid apparent outliers and anomalies;

(d) Provide explanations or revised data in areas indicated as potential problems during the review.

118. Future reviews of the national system should focus on:

(a) Whether the structure of the NIR and the transparency of the methodological descriptions have been improved;

(b) Progress with the other specific items identified in para. 32 above;

(c) The effective transfer of data between the data providers and the technical production system database, and the use of this information to produce the emission estimates.

C. Questions of implementation

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

Annex I

Documents and information used during the review

A. Reference documents

IPCC. Good practice guidance and uncertainty management in national greenhouse gas inventories, 2000. Available at: <http://www.ipcc-nggip.iges.or.jp/public/gp/english/>.

IPCC. Good practice guidance for land use, land-use change and forestry, 2003. Available at: <http://www.ipcc-nggip.iges.or.jp/public/gpglulucf/gpglulucf.htm>.

IPCC/OECD/IEA. Revised 1996 IPCC Guidelines for national greenhouse gas inventories, volumes 1–3, 1997. Available at: <http://www.ipcc-nggip.iges.or.jp/public/gl/invs1.htm>.

UNFCCC. 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/2004/8. Available at: <http://unfccc.int/resource/docs/2004/sbsta/08.pdf>.

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

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UNFCCC. Guidelines for the preparation of the information required under Article 7 of the Kyoto Protocol. FCCC/KP/CMP/2005/8/Add.2. Available at: <http://unfccc.int/resource/docs/2005/cmp1/eng/08a02.pdf#page=54>.

UNFCCC. Guidelines for review under Article 8 of the Kyoto Protocol. FCCC/KP/CMP/2005/8/Add.3. Available at: <http://unfccc.int/resource/docs/2005/cmp1/eng/08a03.pdf#page=51>.

UNFCCC secretariat. Status report for Sweden. 2006. Available at: <http://unfccc.int/resource/docs/2006/asr/swe.pdf>.

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UNFCCC secretariat. Sweden: Report of the individual review of the greenhouse gas inventory submitted in the year 2005. FCCC/WEB/ARR/2005/SWE. Available at: <http://unfccc.int/resource/docs/2006/arr/swe.pdf>.

UNFCCC secretariat. Sweden: Independent assessment report of the national registry of Sweden. Reg_IAR_SE_2007_1. Will be available at <www.unfccc.int>.

B. Additional information provided by the Party

Responses to questions during the review were received from several national experts and coordinated by Mr. Hans Wrådhe (Swedish Environmental Protection Agency) including additional material on the methodology and assumptions used.

Manual for SMED's Quality System in the Swedish Air Emission Inventories. Swedish Methodology for Environmental Data on behalf of the Swedish EPA, March 2005.

Sweden's National System for Inventory and Reporting in Accordance with the Kyoto Protocol and Decisions within the EU. SwEPA 2005.

Avfallsanlaggningar med deponering. Statistik 2002. RVF (Svenska Renhållningsverksföreningen) Rapport 2003:08. ISSN 1103-4092 [information on utilization of gas recovery].

Sakab. – Norrtorp Behandling avfall, Askab Miljorapport 2006 [document on incineration].

Naturvårdsverket. Deponigasgenerering. Underlag for riktlinjer. Vattenfall Energisystem AB. Rapport 4158. Underlagsrapport-90-talets avfallshantering 1993. SwEPA, 1993.

Miljorapport 2006. M-real Sverige AB, Husum-Wifsta fabriker Husum [environmental report].

Annex II

Acronyms and abbreviations

AD	activity data
C	carbon
CH_4	methane
CITL	Community Independent Transaction Log (European Community)
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
CPR	commitment period reserve
CRF	common reporting format
DES	data exchange standards
EF	emission factor
ERT	expert review team
ETS	emissions trading scheme
EU	European Union
GHG	greenhouse gas; unless indicated otherwise, GHG emissions are the sum of CO_2, CH_4, N_2O, HFCs, PFCs and SF_6 without GHG emissions and removals from LULUCF
HFCs	hydrofluorocarbons
IE	included elsewhere
IEA	International Energy Agency
IEF	implied emission factor
IPCC	Intergovernmental Panel on Climate Change
ITL	international transaction log
kg	kilogram (1 kg = 1 thousand grams)
LTO	landing/take-off
LULUCF	land use, land-use change and forestry
m^3	cubic metre
MCF	methane correction factor
N	nitrogen
N_2O	nitrous oxide
NA	not applicable
NE	not estimated
NIR	national inventory report
NO	not occurring
PFCs	perfluorocarbons
QA/QC	quality assurance/quality control
SCAA	Swedish Civil Aviation Authority
SF_6	sulphur hexafluoride
SMED	Swedish Methodology for Environmental Data
SWDS	solid waste disposal site
SwEPA	Swedish Environmental Protection Agency
toe	tonnes of oil equivalent
TPS	Technical Production System
UNFCCC	United Nations Framework Convention on Climate Change

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