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REPORT ON THE INDIVIDUAL REVIEW OF THE GREENHOUSE GAS INVENTORY OF AUSTRIA SUBMITTED IN THE YEAR 2001[1]

(In-country review)

I. OVERVIEW

A. Introduction

1. The Conference of the Parties (COP), at its fifth session, by its decision 6/CP.5, requested the secretariat to conduct, during the trial period, individual reviews of greenhouse gas (GHG) inventories for a limited number of Parties included in Annex I to the Convention (Annex I Parties) on a voluntary basis, according to the UNFCCC reporting guidelines[2] for the technical review of GHG inventories from Annex I Parties.[3] The secretariat was requested, in doing so, to coordinate the technical reviews and to use different approaches to individual reviews, including desk reviews, centralized reviews and in-country reviews.

2. Austria volunteered for an individual review, and specifically for an in-country review. This review took place from 8 to 13 October 2001 in Vienna, and was coordinated by Mr. Roberto Acosta (UNFCCC secretariat) and Ms Astrid Olsson (UNFCCC secretariat). This in-country review was carried out by a team of nominated experts from the roster of experts. Experts participating in the review were Mr. Samir Amous (Tunisia), Ms Katarina Mareckova (Slovakia), Mr. Tinus Pulles (the Netherlands), Ms Maria Paz Cigaran (Peru), Ms Branca Americano (Brazil), and Mr. Richard Volz (Switzerland). Ms Katarina Mareckova and Mr. Samir Amous were the lead authors of this report.

3. The review team members would like to express their full acknowledgement of the frank and open discussions that they were able to have with the Austrian representatives and for the representatives availability to discuss all aspects and components of the Austrian inventory.

4. At the beginning of the review, the host country officials provided a general overview of inventory preparation, including the national inventory system that had been implemented, as well as the quality management process, followed by presentations by sector. Thereafter, sessions for each sector of the IPCC Guidelines were conducted in parallel. During these sessions, national inventory experts and key persons responsible for the respective sectors made

[1] In the symbol for this document, 2001 refers to the year in which the inventory was submitted, and not to the year of publication. The number (2) indicates that for Austria this is an in-country review report.
[2] 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 (FCCC/CP/1999/7), are referred to in this report as the UNFCCC reporting guidelines.
[3] Document FCCC/CP/1999/7, in particular the UNFCCC review guidelines (pages 109 to 114), and decision 6/CP.5 (pages 121 to 122).

presentations further clarifying the key issues relating to preparations of inventory, and these were followed by a question and answer session. The expert review team (ERT) was then given every opportunity to seek as much clarification as necessary.

5. For all sectors, the discussions centred on a number of aspects: The preliminary findings included in the draft synthesis and assessment (S&A) report of the GHG inventories submitted by Austria in 2001, taking into account the comments made on this S&A report by the Austrian authorities. Austria has identified key source categories, applying tier 1 level assessment as described in the Intergovernmental Panel on Climate Change (IPCC) Good Practice and Uncertainty Management National Greenhouse Gas Inventories, hereinafter referred to as the good practice guidance.[4]

B. Inventory submission and other sources of information

6. In April 2001, the Austrian authorities submitted in both hard and electronic copy, a short version of the national inventory report (NIR) for the years 1990 to 1999.[5] An electronic copy of the common reporting format (CRF) tables was also submitted. These materials formed the basis of the S&A report prepared by the UNFCCC secretariat.

7. The final and complete hard copy of the NIR was submitted to the UNFCCC secretariat at the end of July 2001.

8. The ERT members were provided with a number of supporting documents prior to and during the in-country visit; these included the S&A report prepared by the UNFCCC secretariat for the 2001 submission, and other materials such as the short version of the NIR, the final version of the NIR, the CRF tables, the comments made by the Austrian authorities on the S&A report, and various supporting materials relevant to the review.

9. During the in-country visit, the ERT was also provided with Austrian supporting documents; these are referenced at the end of this report.

C. Emission profile and trends

10. The Austrian GHG emission profile shows a clear domination by the energy sector, and consequently of carbon dioxide (CO_2) the emission picture.

11. According to the 1999 inventory, total Austrian GHG emissions amounted to 79,224 Gg CO_2 equivalents,[6] 69% of these emissions being due to the energy sector. However, considering that the emissions due to energy combustion in the iron and steel industry and in the cement industry are included under industrial processes in the Austrian inventory, the real contribution of the energy sector to GHG emissions could be even higher.

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4 According to a conclusion of the SBSTA at its 12th session, Parties should apply the Good Practice Guidance as far as possible for inventories due in 2001 and 2002, and should use it for inventories due in 2003 and beyond.

5 "Austria's Annual National Greenhouse Gas Inventory 1990-1999", submission to the secretariat of the UNFCCC, Vienna, April 2001.

6 The term "total GHG emissions" refers to the aggregate national emissions based on the CO_2 equivalents excluding LUCF, as reported by Austria. If LUCF were to be included, the net emissions would be 71.6 TG CO_2 equivalents, as shown in the Austrian inventory report.

12. The most important GHG is CO_2, which accounted for 83% of the total GHG emissions, followed by methane (CH_4) with 12%, nitrous oxide (N_2O) with 3%, and the remaining F-gases (HFCs, PFCs and SF_6) contributing 2% of the total emissions, all expressed in CO_2 equivalents.

13. Tables 1 and 2 provide data on emission trends, by gas and by sector. Emissions of CO_2, excluding land-use change and forestry (LUCF), grew by 6% between 1990 and 1999. This growth was driven mainly by the growth of emissions from transport, which rose by 30% during that period. N_2O emissions increased by only 12% for the same period due to a significant increase in emissions due to the transport sector, as a result of introduction of catalytic converters in road transport. On the other hand, the decline of waste disposal in landfills, as a result of the implementation of alternative waste treatment options,[7] led to a significant decrease in total methane emissions, that is, 15.5% within the period 1990-1999. This decrease was also favoured by the development of methane recovery and flaring systems. The other industrial gases have presented very divergent profiles. Emissions due to HFCs have increased dramatically as a result of the phasing out of ozone depleting substances, rising from 4 to 870 Gg CO_2 equivalents within the period 1990-1999. SF_6 saw a 41% growth from 1990 to 1999, while emissions due to PFCs dropped dramatically from 963 to 25 Gg CO_2 equivalents during the same period, due to the cessation of primary aluminum production in 1992.

14. The base year for CO_2, CH_4 and N_2O emissions is 1990. For F-gases, Austria considered 1995 as the base year (table 10, Emission trends).

Table 1. GHG emissions by gas in CO_2 equivalent, 1990-1999 (Gg)

GHG EMISSIONS	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Net CO_2 emissions/removals	52,917	52,520	51,497	50,919	53,895	56,500	59,504	59,195	57,856	58,144
CO_2 emissions (without LUCF)	62,132	66,024	60,154	59,901	61,756	63,754	64,889	66,829	65,489	65,778
CH_4	11,290	11,069	10,804	10,675	10,502	10,279	10,108	9,862	9,640	9,541
N_2O	2,033	2,119	2,136	2,196	2,260	2,275	2,266	2,253	2,282	2,279
HFCs	4	6	9	12	17	546	625	718	816	870
PFCs	963	974	576	48	54	16	15	18	21	25
SF_6	518	683	725	823	1,033	1,175	1,246	1,148	955	730
Total (with net CO_2 emissions/removals)	67,724	67,371	65,748	64,674	67,759	70,790	73,765	73,195	71,570	71,591
Total (without CO_2 from LUCF)	76,939	80,875	74,404	73,656	75,621	78,044	79,150	80,828	79,203	79,224

Table 2. GHG emissions by sector in CO_2 equivalent, 1990-1999 (Gg)

GHG SOURCE AND SINK	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
1. Energy	49,929	54,483	49,669	49,357	50,613	52,389	54,024	54,779	54,238	54,556
2. Industrial processes	14,420	14,063	12,625	12,366	13,220	14,102	13,746	14,828	13,980	13,752
3. Solvent and other product use	755	669	614	593	594	613	612	638	628	628
4. Agriculture	5,591	5,520	5,367	5,334	5,282	5,140	5,077	5,048	5,044	4,958
5. LUCF	-9,215	-13,504	-8,656	-8,982	-7,862	-7,254	-5,385	-7,633	-7,633	-7,633
6. Waste	6,243	6,139	6,129	6,005	5,912	5,799	5,691	5,535	5,313	5,330
7. Other	0	0	0	0	0	0	0	0	0	0

[7] Such as the enhancement of recycling, composting and waste incineration practices.

15. The approach used by the Austrian NIR for identifying and analysing key emission sources met the IPCC good practice guidance requirements.[8] All notation keys, descriptions of identification and results for all source categories included in the NIR are based on the IPCC good practice guidance. In particular, the key source analysis includes all reported GHG and all categories as recommended by the IPCC good practice guidance. As mentioned in the Austrian NIR, the key source identification process resulted in 24 source categories, contributing to 95.75% of total GHG emissions for the year 1999.

D. General assessment of the inventory

1. Completeness of reporting and conformity with the UNFCCC reporting guidelines

The national inventory system for Austria

16. Although the Austrian GHG inventory is compiled according to the UNFCCC reporting guidelines[9] and the Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, hereinafter referred to as the IPCC Guidelines, it is not initially prepared directly for that purpose. In fact, Austria first prepares a comprehensive Austrian Air Emission Inventory (Österreichische Luftschadstoff-Inventur (OLI)), comprising all the air pollutants required by various national and international obligations. OLI is based on CORINAIR, a common European system using very detailed SNAP[10] nomenclature, which since 1995 has been further developed by the European Topic Centre on Air Emissions.

17. Once the CORINAIR database for Austria is completed, it is used for the preparation of the GHG inventory. For that purpose, the CORINAIR source categories has to be converted into IPCC source categories. In order to facilitate this conversion, each activity has an IPCC code that relates to the CRF tables.

Completeness

18. The ERT did not identify any major omissions in the Austrian national inventory, as far as the mandatory reporting requirements were concerned. The CRF tables covered the years 1990 to 1999 for almost all sources and gases, including ozone precursor gases. However, three missing emission sources should be mentioned: N_2O due to manure management, CO_2 due to carbon in soils, and N_2O due to sewage treatment. As mentioned to the ERT, the Austrian authorities intend to include these emission sources in a forthcoming inventory submission.

Transparency

19. In general, the methods and the rationale for selecting activity data and emission factors were appropriately described and well documented (Part II - Section 3), except for the CH_4 emission factors from agricultural soils. Relevant references were also adequately mentioned, and any deviation from the IPCC methodology or missing emission estimates were fully justified. Changes to and recalculations of the inventory results, as compared to the previous submission, were also fully documented in a specific section of the NIR (Part I - Section 3). A section of the NIR was also dedicated to the uncertainty assessment (Part I - Section 4), and the quality

8 In particular, key sources were selected according to their contribution to the country's total GHG inventory, in terms of the absolute level of emissions, the trend in emissions, or both.

9 CRF - version 1.01 as specified by decision 3/CP.5.

10 Selected nomenclature for sources of air pollution.

management process, which is anticipated to improve the inventory in the future (Part II - Section 2).

20. In addition, the CRF tables adequately complemented the presentation of the results and of the methods used.

21. It is the view of the ERT that overall the NIR has transparently reported the inventory results, as well as the methods used for the calculations and the assumptions applied. However, Austria might consider reporting some additional data such as energy balances and biofuel use, in order to improve the transparency of the NIR[11] in future.

22. During the in-country review, Austria provided the ERT with a completed version of table 9 (Completeness) which had not been included in the submission. This new table enabled the ERT to track down the location where emissions marked as included elsewhere ("IE") were included in the submission.

Consistency with the UNFCCC reporting guidelines and the IPCC Guidelines

23. For the preparation of the GHG inventory, the Austrian Federal Environment Agency (UBA) has generally applied the following approach:

(a) Priority is given to emission data reported by the operators of the emission sources, as these data most accurately reflect the actual emissions.

(b) If actual data are not available, national emission factors and activity data are used to calculate the emissions.

(c) If there are no national emission factors, international emission factors are used, either regional ones or IPCC suggested ones.

24. This approach is consistent with the IPCC good practice guidance. For those key source categories where the IPCC good practice guidance was not followed, the UBA has a plan for meeting the IPCC good practice guidance requirements in future.

2. Cross-cutting issues

Institutional arrangements

25. The Austrian emission inventory is by law, under the responsibility of the UBA.[12] Among other international reporting obligations, the Department of Emissions/Climate Protection/Noise Abatement, which is a part of the UBA, is in charge of the preparation of GHG inventories.[13]

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[11] Some supporting materials were provided to the ERT in order to allow for cross-checking of the information provided, in particular elements and files involved in the calculation of the energy balance. However, the amount of effort needed to reconstitute the energy balance, which data were directly used for the inventory, was beyond the time frame of the review.

[12] Environmental Control Act (Umweltkontrollgesetz), (1998): Federal Law Gazette 152/1998.

[13] Decision 3/CP.5 Guidelines for the Preparation of National Communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on Annual Inventories (referring to document FCCC/CP/1999/7).

26. Given the increasing emission monitoring and reporting obligations, Austria has established an emission inventory system, called NISA, on a permanent basis. The development of the NIR for UNFCCC purposes is an integral part of NISA.

27. Among other tasks, the staff members of the Department of Emissions/Climate Protection/Noise Abatement undertake the daily work of inventory preparation,[14] including data collection and compilation and, where required, subcontract to external research or consultancy agencies. The final emission calculations, aggregation of the inventory results, and preparation of the NIR and CRF are also within the responsibility of the Department.

28. At the moment, the Department of Emissions/Climate Protection/Noise Abatement uses published information from relevant institutions, such as Statistics Austria, the Federal Ministry of Agriculture, Forestry, Environment and Water Management, Federal Provinces, the Austrian Federal Economic Chamber, operators of installations covered by the European IPPC Directive, and so on.

Record keeping

29. The NISA team keeps a systematic archive, in both electronic and hard copy form, of all the relevant documentation: correspondence, faxes, studies, guidelines, records of conversations and industry inquiries, and calculation sheets. The inventory server includes five main components: a central database, reports, formularies, documentation and calculation sheets. The central database is maintained in Excel data tables, with automated calculations using Visual Basic Macros.

30. A complete electronic copy of the CRF and the NIR for each year is kept on the computer network at the Department of Emissions/Climate Protection/Noise Abatement. Hard copies of the CRF and the NIR and some supporting documentation are also kept at the Department.

31. It is worth noting that this centralized record keeping and archiving system allows good harmonization of the inventory work, as well as easy internal verification and checking. It also greatly facilitates any external review process.

32. Currently in preparation is an electronic platform for the recording of all inventory data; it will enable the exchange of information among the experts and agencies concerned.

Verification and quality assurance/quality control (QA/QC) approaches

33. Austria has launched a QA/QC management process to ensure emission estimates of a higher quality. This process is described comprehensively in the NIR; it was started in 1999 but has not been fully implemented yet.

34. This QA/QC is to rely on EN 45000,[15] a series of European standards similar to the ISO 9000. As mentioned in the NIR, the QA/QC management approach is meant to ensure full compatibility with the IPCC good practice guidance requirements.

[14] Made up of nine team members.
[15] Of which the relevant features are highlighted in the NIR.

35. The QA/QC management process included two main steps to be implemented within the coming months:

(a) The design of a quality management system for the GHG inventory. This step was achieved, and the supporting documentation was provided to the ERT.[16]

(b) The establishment of an inspection process; including: (i) the designation of an inspection body, (ii) the designation of the accreditation body, and (iii) the accreditation of this inspection body.

36. The NIR included a table describing the timetable of the implementation of the QA/QC process. According to this table, the achievement of the last step of the QA/QC process, before its final establishment, is foreseen for 2002.

37. For the time being, and during the interim period, the QA/QC process is based simply on the three following steps, with no external review process:

(a) Daily work of the inventory team, with internal, but not formal, verification undertaken by the team members;

(b) Internal review of the inventory results by the Director of the Department of Emissions/Climate Protection/Noise Abatement;

(c) Review of the inventory results by the Federal Ministry of the Environment.

38. It is the view of the ERT that the QA/QC system under implementation should result in a significant qualitative improvement of the Austrian inventory, and should be considered as one of the strongest assets of the Austrian inventory system.

Recalculations

39. The Austrian NIR included a comprehensive section giving the recalculations made to the previous inventory submission.[17] The major part of these recalculations were made necessary because of the revision of the energy balance of Austria, and of the data relating to the use of F-gases.[18] Some other minor recalculations, for waste and industrial processes, were also made.

40. The NIR has transparently and comprehensively reported the changes to the energy data which occurred between the 2000 and the 2001 submissions. This has greatly facilitated the cross-checking of any year of the inventory submission. The new figures for total GHG emissions, as well as those for CO_2, CH_4 and N_2O, are also reported in detail for both the 2000 and the 2001 submissions.

Uncertainties

41. A section was dedicated to the comprehensive analysis of uncertainties in the Austrian inventory. This section constitutes a strong component of the NIR. It describes the results for three GHG (CO_2, CH_4 and N_2O), as well as the overall uncertainty level, for the years 1990 to

[16] See references 1, 2 and 3, at the end of this report.

[17] Refer to Part I, Section 3 of the NIR.

[18] Revisions for HFCs, PFCs and SF_6 as a result of a new study led to a 2.1% change in GHG emissions for the base year 1995.

1997. Uncertainties are analysed according to two aspects: systematic uncertainty and random uncertainty.

42. This section was prepared on the basis of a specific study ordered by the UBA and completed in February 2001,[19] as referenced in the NIR. This study was provided to the ERT during the in-country review. Compilation, prioritization, uncertainty assessment and Monte Carlo analysis are addressed in greater detail. A longer list of references is also included in this report. It should be noted that this report includes the uncertainties for the underlying data (activities and emission factors), from which overall CO_2, CH_4 and N_2O uncertainty levels were derived.[20] Uncertainty estimates were broadly consistent with IPCC default values.

43. According to the Austrian NIR, the overall systematic uncertainty assessment has dropped slightly during the period 1990-1997, decreasing from 9.8% to 8.9%. As mentioned by the NIR however, this trend has resulted from an increase in the CO_2 contribution to total GHG emissions, which uncertainty level is much lower than for the other gases.[21]

3. Issues relating to previous reviews

44. No review of the Austrian inventory submission has been carried out previously.

4. Areas for further improvement

45. The ERT was impressed by the quality of the Austrian inventory system and encourages Austria to continue working in that direction, and progressing towards removing the existing gaps. The ERT noted the following areas for further improvement:

46. *Verification*: The ERT encourages Austria to implement the QA/QC and verification system effectively, and to report on that system for possible replication by other Parties, and in the interest of the UNFCCC process as a whole. The ERT further encourages Austria to consider extending QA/QC to the source-level emission data and to check whether the direct emission determination methods, as provided by the emission point sources, are appropriately audited and comply with the IPCC 1996 Guidelines and with the IPCC good practice guidance.

47. *Methodologies*: Austria is encouraged to allocate emissions to their appropriate sources, in order to improve international comparability. In particular, Austria may consider moving emissions due to energy combustion in the iron and steel, and cement industries from industrial processes to energy.

48. *Reporting*: Austria may wish to consider: (i) including additional analysis of emission trends, when presenting the inventory results. In particular, it would be useful to explain some major fluctuations that occurred for some sources within the reported period (ii) mentioning or presenting the emissions of ozone precursor gases (CO, NO_x, NMVOCs), or at least referring to the results relating to these gases, which are included in the annex section of the NIR, (iii) disaggregating emission estimates as far as possible, in order to allow for better transparency, (iv) reporting additional data in the NIR, such as the energy balance and biofuel use, in order to

[19] See reference 5, at the end of this report.

[20] Activity data uncertainties were provided for the major sources. Emission factor uncertainties were provided on a gas by gas basis, in an aggregated way (for instance, aggregate uncertainties were provided for emission factors from energy combustion).

[21] In 1997 the systematic uncertainty for CO_2 was 2.1% versus 47.4% and 85.9% for CH_4 and N_2O respectively.

simplify the understanding of the inventory results by any third Party, and also to ensure a better transparency.

49. The ERT also encourages Austria to use the notation keys in a more appropriate way in order to avoid any confusion.

50. *Completeness*: Austria is encouraged to consider in its future inventories some missing sources such as N_2O due to manure management, CO_2 due to carbon in soils, and N_2O due to sewage treatment.

51. Other areas for further improvement appear in each sectoral section of this review report.

52. It is the view of the ERT that the Austrian inventory reflects to the best of our knowledge Austria's emission profile, and that the NIR and CRF were mostly consistent with the IPCC Guidelines and UNFCCC reporting guidelines for estimating and reporting emissions.

II. ENERGY

A. Sector overview

53. Energy accounted for almost 70% of Austria's total GHG emissions excluding LUCF. Energy also accounted for 81% of CO_2 emissions and 37% of N_2O emissions in 1999. Considering that part of the emissions from energy consumption in the iron and steel industry and in the cement industry is allocated to industrial processes, this share could be even more important.

54. From 1990 to 1999 total CO_2 equivalent emissions from energy increased by 9%. Within them, CO_2 emissions increased by 9%, CH_4 decreased by 24% and N_2O increased by 45%.

55. The energy key source categories identified in the inventory accounted for 67% of all GHG emissions.

56. The main key source is CO_2 emissions from road transportation diesel oil with 13.6% of GHG emissions. This source has grown significantly, i.e. 105.5% during the period 1990-1999.

57. The key source category analysis is influenced by a number of choices made by Austria in terms of the placing of emissions. For example, "manufacturing industries and construction" would be more important in the key source ranking if the emissions from energy consumption due to the iron and steel industry and the cement industry were allocated to the energy sector. In addition, CO_2 due to fugitive emissions would not stand as a key source if CO_2 emissions from combustion in the refinery sector were allocated to its appropriate source category.

58. Austria used a qualitative approach for the trend assessment of key sources. The only key source identified in the trend analysis in the energy sector is CO_2 emissions from other fuel use in the energy fuel combustion manufacturing industries and construction section.

59. Using tier 1 to assess trend key sources, some energy emission sources were found to contribute more than 1%. The main key source in the trend analysis is also CO_2 emissions from road transportation diesel oil.

1. Institutional arrangements

60. See paragraphs 25 to 28.

2. Completeness

61. All gases and sources/sink categories from the energy sector are estimated in accordance with the IPCC Guidelines. However, the sources/sink categories are more aggregate than those listed in the IPCC Guidelines.

62. All energy CRF tables are filled in, with the exception of table 8 (Recalculation).

63. Emissions from combustion of liquid fuels from petroleum refining are reported as fugitive emissions from refining oil instead of emissions from combustion of liquid fuels from petroleum refining in the sector energy industries.

64. Emissions from the different subsectors of manufacturing industries and construction are not shown because they are brought together under other sectors than manufacturing industries and construction, except iron and steel and cement, which are included in the industrial processes sector. This is due to the unavailability of detailed sectoral energy data.

65. Austria provided a complete version of table 9 (Completeness) to the ERT during the visit. It was not included in the 2001 inventory submission.

66. Notation keys are not always used in an appropriate way. In many tables “0.0” was used when not occurring (“NO”), not estimated (“NE”) or “IE” should have been used instead.

3. Transparency

67. Information presented in both the CRF and NIR is mostly transparent and follows the UNFCCC reporting guidelines. In some cases however, the allocation of emissions as well as the aggregation level used to report emissions in the CRF does not facilitate the replication and assessment of the inventory.

4. Methodologies, emission factors and activity data

68. Two methods were used to estimate emissions: emission data directly reported by the operator of the source (used mainly for large point sources) and emission factors multiplied by the activity data (used mainly for area sources).

69. The first method is considered to be more precise because the information provided by the operator is reliable and controlled by local authorities.

70. For the period 1990-1999, there are two main suppliers of energy statistics: Austrian Institute of Economic Research (WIFO) until 1995 and Statistics Austria from 1996 onwards. Some inconsistencies in the time series 1990-1999 remain. These inconsistencies were reported by Austria which indicated that both Statistics Austria and WIFO have been working on a consistent time series from 1970 onwards.

5. Recalculations

71. The NIR explains the recalculations that were made, referring to changes in the energy balance provided by Statistics Austria. Even if total energy consumption has not changed significantly, shifts from one fuel type to another may have introduced some differences in the 2001 submission from the 2000 submission. No specific table with the emissions recalculations of the energy sector is provided.

6. Uncertainty estimates

72. The uncertainties for the sector are described in a paper, given to the ERT.[22] In the energy sector, activity uncertainties varied between 0.5% (liquid fuels) to 10% (fuel wood, other solid fuels and traffic mileage).

73. Emission factor uncertainties are estimated at 0.5%, 20% and 50% for CO_2, N_2O and CH_4 from combustion, respectively.[23] These are in the range of uncertainties generally expected for the sector.

7. Confidentiality

74. No problem regarding confidentiality was mentioned.

8. Comparison with other international data

75. Austria's energy data system is at the moment not completely compatible with that of EUROSTAT and IEA (see paragraph 70).

B. Conformity with the UNFCCC reporting guidelines and the IPCC Guidelines

76. Estimation of emissions and the presentation of information in the CRF and NIR broadly followed the IPCC Guidelines and were consistent with the UNFCCC reporting guidelines.

C. Reference and sectoral approaches

1. Comparison between reference and sectoral approaches

77. Emissions from the energy sector are estimated following the reference and the sectoral approaches.

78. Two different estimates following the reference approach are reported in the NIR and in the CRF. The estimates presented in the NIR are the correct ones. The CRF tables are not correct, the problem being that Austria used a wrong formula which has since been changed.[24] Another minor problem is the estimate of carbon stored, which should be revised.

79. CO_2 emissions using the reference approach are 19.4% higher than emissions estimated using the sectoral approach. This big difference is due mainly to solid fuel emissions, which present a difference of 131.7%. This difference is due to the non-inclusion in the sectoral

22 See reference 5, at the end of this report.
23 Except N_2O from traffic, which uncertainty was estimated at 70%.
24 The correction will be reflected in the next inventory submission.

approach of coking coal and cement emissions due to fuel combustion. These emissions are taken into account under industrial processes in the sectoral approach and in the energy sector in the reference approach.

2. Treatment of feedstock and non-energy use of fuels

80. Some inconsistencies were found in the estimation of carbon stored. The CRF table 1.A(d) does not clarify the carbon stock estimate, because of the aggregation level, and the total carbon stored does not correspond to the figure reported in table 1.A(b).

81. Fractions of carbon stored are different from those recommended by the IPCC; no explanation is given.

3. International bunker fuels

82. International bunkers are reported from air traffic, the only significant bunker in the country. Austria uses a very detailed model and database for estimating emissions from air traffic.

E. Key sources

83. There are 15 energy key source categories identified in the inventory. The good practice guidance categories are more aggregate but perfectly compatible with the NIR approach. Using the suggested IPCC source categories, the key sources for all GHG emissions are:

Emission Source	Gas	% of total	% accum.
Road transportation – diesel oil	CO_2	13.57	13.57
Stationary – other sectors – liquid	CO_2	8.55	22.12
Road transportation – gasoline	CO_2	8.15	30.27
Manufacturing industries and construction – gaseous	CO_2	7.79	38.06
Public electricity and heat production – gaseous	CO_2	6.64	44.70
Public electricity and heat production – solid	CO_2	4.81	49.51
Stationary – other sectors – gaseous	CO_2	4.69	54.20
Fugitive emissions – other oil	CO_2	3.11	57.31
Public electricity and heat production – liquid	CO_2	2.85	60.16
Manufacturing industries and construction – liquid	CO_2	2.40	62.56
Mobile – agriculture and forestry – diesel	CO_2	1.63	64.19
Stationary – other sectors – solid	CO_2	1.54	65.73
Manufacturing industries and construction – solid	CO_2	0.67	66.40
Road transportation – gasoline	N_2O	0.58	66.98
Manufacturing industries and construction – other	CO_2	0.03	67.01

1. Stationary combustion

84. CO_2 emissions from stationary combustion contributed 39.97% to overall GHG in Austria in 1999 (gaseous fuels 19.1%, liquid fuels 13.8% and solid fuels 7.0%).

Trends

85. From 1990 to 1999 total CO_2 emissions from gaseous fuels increased by 37%. Manufacturing industries and construction increased by 54%, public electricity and heat production increased by 27% and other sectors increased by 28%.

86. From 1990 to 1999 total CO_2 emissions from liquid fuels decreased by 2%. Manufacturing industries and construction decreased by 27%, while public electricity and heat production increased by 22% and other sectors increased 1%.

87. From 1990 to 1999 total CO_2 emissions from solid fuels decreased by 42%. Manufacturing industries and construction decreased by13%, public electricity and heat production decreased by 40%, and other sectors increased 52%.

Methodologies

88. For large point sources, emission data are directly reported by operators of the sources or by associations of operators. Other sources are calculated using national energy statistics and emission factors. There is no source category where a hybrid method (combination of both methods) is used.

2. Mobile combustion for road vehicles

89. Road vehicles contributed 21.7% to overall GHG in Austria in 1999, with 13.57% from diesel engines and 8.15% from petrol engines.

Trends

90. CO_2 emissions increased by 30% from 1990 to 1999. N_2O emissions increased 80% in the same period, explained partly by the introduction of catalytic converters.

Methodologies

91. Transport emissions are estimated by means of the model GLOBEMI which uses many vehicle categories, road performances, specific energy uses and emissions factors. Adjustments are made in the parameter km/vehicle to guarantee consistency with energy consumption in the transport sector.

Activity data

92. New vehicle data are published by Statistics Austria and information on road performance is supplied by Austrian automobile clubs throughout the vehicle inspection system.

Emission factors

93. All the emission factors applied come from *Handbuch der Emissionsfaktoren des Straßenverkehrs – Version 1.1A*, Vienna, 1997.[25]

3. Fugitive emissions from oil & gas operations

94. According to the NIR, CO_2 fugitive emissions from oil and gas operations are a key source and in 1999 contributed 3.11% to overall GHG in Austria. The main reason for the inclusion of this category as a key source is that Austria could not split fugitive emissions from those due to fuel combustion in the refinery sector, and both are reported under a single category.

[25] Reference 6, at the end of this report.

Trends

95. Total CO_2 fugitive emissions from oil and gas operation increased by 22% from 1990 to 1999.

Methodologies

96. Emission data are reported directly by the refinery operators.

F. Areas for further improvement

1. Planned or ongoing work by the Party

97. Austria identified inconsistencies in the energy balance (see paragraph 70) and explained that Statistics Austria and WIFO are already working on a consistent time series from 1970 onwards.

98. Austria identified a software bug in the CRF table 1.A(b) (see paragraph 78). The ERT encourages Austria to correct the correspondent table, as well as those linked with it, in the CRF published in Austria's national inventory.

2. Issues identified by the ERT

99. The ERT encourages Austria to revise the use of notation keys (see paragraph 66).

100. The ERT encourages Austria to report, when possible, data from manufacturing industries and construction disaggregated into subsectors (see paragraph 64). Even if Austria is complying with the guidelines, a more disaggregated report would improve international comparability as well as enable a more detailed analysis of energy GHG emissions.

101. The ERT encourages Austria to report emissions from fuel combustion in the cement industry and in the iron and steel industry in the energy module (see paragraphs 53, 58 and 79). Here again, Austria is complying with the guidelines but the proposed changes would improve international comparability and sectoral analysis.

102. The ERT encourages Austria to allocate emissions from refineries to petroleum refining instead of to fugitive emissions (see paragraphs 63 and 95).

103. The estimates of carbon stored according to the reference approach in tables 1.A(b) and 1.A(d) are not the same (see paragraphs 80 and 81). The ERT encourages Austria to explain this difference and adjust it in the next submission.

III. INDUSTRIAL PROCESSES

A. Sector overview

104. Emissions from industrial processes represented about 17% of total GHG emissions, excluding land-use change and forestry, as reported in Austria's 2001 submission (CO_2 about 15% and HFCs and SF_6, both about 1%). The industrial processes sector has five key sources:

(a) CO_2 from iron and steel production (2C.1): 10% of total GHG emissions

(b) CO_2 from cement production (2A.1): 3% of total GHG emissions

(c) F-gases from consumption from halocarbons and sulphur hexafluoride (2F): 2% of total GHG emissions;

(d) CO_2 from ammonia production (2B.1): 0.6% of total GHG emissions

(e) CO_2 from magnesite sinter plants (2A.7): 0.4% of total GHG emissions).

105. The total GHG emissions of this sector decreased by about 5% between 1990 and 1999. The emissions of PFCs decreased two orders of magnitudes, whereas those of HFCs increased by a factor of almost 300.

Year	GHG SOURCE AND SINK	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Total
	CATEGORIES	CO_2 equivalent (Gg)						
1990	2. Industrial processes	12,747.25	2.96	185.66	3.69	963.17	517.74	14,420.46
1999	2. Industrial processes	11,943.70	2.98	179.63	870.46	25.32	729.90	13,752.00

106. The NIR shows a sharp fall of emissions of F-gases between 1991 and 1993 and a subsequent sharp rise between 1993 and 1995. This is caused by the cessation of primary aluminium production since 1992 and the introduction of HFC-134a since 1995. Since 1995 only one company has introduced this chemical into foam production.

107. Austria appropriately addressed all issues raised in the S&A report.

1. Institutional arrangements

108. Austria uses plant-specific data for its major industrial processes. Local authorities collect these data in accordance with permits issued to the companies. The data are validated by the authorities and, when accepted, used directly in the inventory. For some sources, activity data and emission factors are used.

109. For some pollutants, Austria has implemented in legislation a system of independent auditing for emission reporting by industries (Luftreinhaltegesetz für Kesselanlagen) and is planning to do so for others (implementation of EU IPPC directive and European Pollutant Emission Register (EPER) decisions by 2003). This will bring Austria’s law into line with the good practice guidance.

110. The independent auditors are certified in a procedure determined by law. The Ministry of Trade maintains the list of certified auditors (paragraph 7 of the Luftreinhaltungsgesetz für Kesselanlagen).

2. Completeness

111. All CRF tables for the industrial processes sector were completed for 1990 to 1999.

112. The CRF as submitted by Austria contains an input error, resulting in a (potential/actual) emission ratio for HFC-134a lower than 1 in Table 2(II) Sectoral report for industrial processes - emissions of HFCs, PFCs and SF_6”. Austria will correct this error.

3. Transparency

113. Austria was able to provide to the ERT all explanations and material needed for assessment of the pathway into the inventory of the data on industrial processes emissions.

114. Since some companies report facility total emissions and activity data only, without underlying information, Austria reported such emissions as a single entry in the CRF. Notation keys mark this appropriately.

115. In Table 2(I).A-G Sectoral background data for industrial processes, Austria gave an unclear description for the activity data Production/consumption quantity. This was caused by a misinterpretation and will be corrected in subsequent submissions.

116. Austria provided a completed version of table 9 which was not included in the submission. This new table enabled the ERT to track down the location where emissions marked as “IE” were included in the submission.

4. Recalculations

117. The NIR presents an adequate description of the recalculations applied in the sector. Apart from the allocation of magnesite sintering to another subcategory within the sector, changes are based in some cases on updated reports from individual industries.

5. Uncertainties

118. Austria includes in its NIR a first comprehensive uncertainty analysis. In a study provided by Austria,[26] the uncertainty ranges used are listed, with reference to other studies where available. See above.

B. Consistency with the UNFCCC reporting guidelines and the IPCC Guidelines

119. For this sector, the NIR and CRF are mostly consistent with the IPCC Guidelines and UNFCCC reporting guidelines.

120. Since Austria is implementing legally, but already performing in practice, the requirements of the EU IPPC directive and EU EPER decision, including the provisions of the EPER Guidance Document, emission determination methods for large sources are mostly in line with the good practice guidance.

C. Comparison with international data

121. Austria uses plant-specific production data for iron and steel production reported by Austria’s only iron and steel plant. Activity data for cement production were obtained from the Austrian cement industry organization. The S&A report used United Nations data for an earlier year and hence has different values.

[26] Reference 5, at the end of this report.

D. Key sources

122. The key source analysis made by the Party is consistent with that performed by the secretariat.

1. Iron and steel production – CO_2

Trends

123. The emissions from this source are relatively constant and mainly follow changing production rates in the country. The implied emission factor (IEF) decreases from 2.16 in 1990 to 1.78 in 1999. Since the data are based on emission declarations of one single company, the reason for this decrease is not clear.

Completeness

124. All emissions, including energy-related emissions, are included. Austria did not specify the emissions of different sub-processes within the source. This is reflected in the IEF, which is high compared to those of other Parties. The ERT encourages Austria to specify the contributions of steel plant, blast furnace, sinter plant and coke oven separately within the total emissions reported by the company.

Methodologies

125. Austria uses emissions figures provided by the industry, which do not separate process-related from combustion-related emissions. The company calculates these emissions using a detailed carbon mass balance. The information is available, but the company has asked the UBA not to report the emissions separately by sub-process.

Activity data

126. Activity data are obtained directly from the industry.

Emission factors

127. Emission factors are not used explicitly.

2. Cement production – CO_2

Trends

128. CO_2 emissions from cement production decreased by about 20% between 1994 and 1995. As explained by the Austrian authorities, this decrease was caused by a drop in the volume of production.

Completeness

129. All emissions relating to cement production are included in the CRF.

Methodologies

130. The figure for total CO_2 emissions from cement production in Austria are based on measurements. Austria did not separate process-related emissions from those due to combustion. The ERT recommends Austria to provide these specifies in forthcoming submissions by using

the default emission factor for calcination to estimate process emissions, and to attribute all other emissions to combustion. If the fuel used is not specified, the emissions could be reported under "other fuels".

Activity data

131. Activity data were obtained directly from the industry for the years 1990 to 1996. For 1997 to 1999 another data source was used (the national organization for the cement industry). This leads to a minor inconsistency which Austria plans to adjust.

Emission factors

132. No emission factor has been used.

3. F-gases from consumption from halocarbons and sulphur hexafluoride

Trends

133. Major changes occurred in this source resulting in an increase of a factor of five. Within this source, the emissions of HFC134a have increased by more than a factor of 400 and those of HFC23 by a factor of almost three. Within the group of PFCs, emissions of CF_4 decreased, and those of C_2F_6 increased, by about the same amount.

Completeness

134. The inventory in this sector is based on a very detailed and comprehensive analysis performed by a contractor, and is complete. The ERT appreciates this analysis and recommends the IPCC to use this information when updating default factors in the Guidelines.

Methodologies

135. The NIR describes the method used in this source category in sufficient detail. The method is based on analysis of the pathway of the products through the Austrian economy for each individual gas.

Activity data

136. Activity data were obtained from national statistics and interviews with, and questionnaire responses from, industries and trading companies.

Emission factors

137. Emission factors were derived from the analyses as described in an internal confidential report. The report is confidential since it contains very detailed information on the companies involved.

4. Ammonia production – CO_2

Trends

138. No clear trend is visible in emissions from this source. The emissions follow the variability in production rates.

Completeness

139. All emissions from this source are included in the CRF.

Methodologies

140. Emissions are measured at the only ammonia producer in Austria, using sampling in time and extrapolation to annual loads. The measurements are performed 2 to12 times per year for both CH_4 and CO_2.

Activity data

141. Activity data were obtained directly from the ammonia producer.

Emission factors

142. No emission factors were used.

5. Magnesite sinter plants – CO_2

Trends

143. The emissions follow the activity data. Austria moved this source from Metal production to Mineral products since the product is used as a lining in ovens and not as a metal.

Completeness

144. All emissions within the source category are included.

Methodologies

145. The emissions are estimated from activity data and an emission factor.

Activity data

146. Activity data for magnesite sintering were obtained from national statistics. Activity data are constant since 1995. Austria has checked the constant production rate with the company.

Emission factors

147. The emission factor is derived from an Austrian expert (Mayer, personal communication). This information cannot be assessed. IPCC Guidelines do not provide an emission factor.

E. Non-key sources

148. Primary aluminum production was discontinued in 1992.

149. In nitric acid production, Austria uses an emission factor derived from emission declarations of the only producer in the country between 1995 and 1999. The emission of N_2O at this plant is measured on a regular basis and the company provides production statistics. The emission factor is low as compared to the IPCC default value.

F. Areas for further improvement

1. Planned or ongoing work by the Party

150. Austria plans to base the 1997 to 1999 emissions for cement production on company data rather than on data from the national association, in order to enhance quality and consistency.

151. Austria plans to apply a more detailed method for estimating lime production emissions.

152. Austria will correct the error in potential emissions of HFC-134a reported in the CRF for the years 1990 to 1999.

153. Austria will improve the description of "activity data" in the sectoral background tables for industrial processes.

2. Issues identified by the ERT

154. Although the reporting of emissions in this sector by Austria complies with the guidelines, the comparability with other Parties' submissions could be improved by estimating the combustion and process parts of the emissions in iron and steel and cement and reporting them in the CRF accordingly. The ERT encourages Austria to do so.

155. The ERT encourages Austria to include in its NIR an analysis showing at source level whether emission determination methods already comply with good practice guidance and the IPPC/EPER Guidelines, especially with respect to :

(a) The choice of method for key sources;

(b) The extent to which auditing schemes in legislation comply (or will comply) with the good practice guidance.

IV. AGRICULTURE

A. Sector overview

156. The share of agriculture in national total GHG emissions in 1999 was 6.3%. The agriculture sector is an important contributor of methane and nitrous oxide emissions to national totals in Austria. The agriculture sector includes the key sources: CH_4 enteric fermentation (4.A), CH_4 manure management (4.B), and N_2O and CH_4 from agricultural soils (4.D), as well as the non-key source field burning of agricultural residues (4.F). CRF background tables 4.A, 4.B(a), 4.B(b) and 4.F are filled in partly; table 4.D is not filled in. The NIR chapter on agriculture provides additional information on emission factors and activity data.

CH_4	Total CH_4 [Gg CO_2 eq.]	Enteric fermentation	Manure management	Soils [Gg CO_2 eq.]	Agriculture [Gg CO_2 eq.]	% of national total CH_4
1990	11,298	3,234	567	735	4,557	40.33
1999	9,534	2,688	525	735	3,948	41.41
Difference [%]	-15.61	-16.88	-7.41	0.0	-13.36	

N_2O	Total N_2O [Gg CO_2 eq.]	Enteric fermentation	Animal	Soils [Gg CO_2 eq.]	Agriculture [Gg CO_2 eq.]	% of national total N_2O
1990	2,033	“NO”	“NE”	1,023	1,026	50.47
1999	2,279	“NO”	“NE”	1,011	1,014	44.49
Difference [%]	12.10			-1.17	-1.17	

157. Emissions are estimated using CORINAIR97 source categories. The reported methane emissions from agricultural soils are relatively high as compared to other European countries. N_2O from manure management has not been estimated.

1. Institutional arrangements

158. The emissions from the agricultural sector are compiled by a nominated expert at the UBA in Vienna. The UBA has institutional arrangement with Statistics Austria, which provides activity data on an annual basis. The methods/emission factors are developed/changed based upon work by expert institutes/universities on a contractual basis (University of Agricultural Sciences and Austrian research centres).

2. Completeness

159. All emissions for dairy and non-dairy cattle, swine, sheep, goats, horses and poultry are reported. These livestock categories represent the most significant animal population. Emissions from mules and asses are reported under horses in the CRF tables. Piglets under 20 kg are not included in the current submission, but are planned to be included in the 2003 submission. The additional emissions from this subcategory are expected to be negligible.

160. For the estimated source categories, emission estimates are available consistently for all years from 1990 to 1999. The NIR and CRF explain that the reason for the “NE” categories (N_2O emissions from manure management) is a lack of country-specific emission factors and/or other parameters (such as information about manure management systems).

161. The NIR provides information on how the gaps will be filled. During the in-country review, Austrian officials informed the ERT that they had started projects to develop national emission factors for key source categories and to introduce methods for estimating all emissions occurring in the agricultural sector in line with the IPCC good practice guidance.

162. Emissions reporting in the CRF was complete. All “NE” sources are noted appropriately with notation keys in the CRF sector tables as well as in table 9, which was provided during the visit.

3. Transparency

163. Austria uses CORINAIR97 source categories for emissions estimation. The NIR tables transparently show the relation between these categories and the IPCC categories. The CORINAIR97 categories are fully consistent with IPCC source categories for enteric fermentation and manure management. To increase the comparability of the inventory, however Austria is encouraged to estimate soils emissions for source categories as required in table 4.D.

164. The NIR includes information on methodologies and emission factors used in inventory calculations. Although the NIR provides references for the sources of the emission factors, some

of the assumptions used in developing these emission factors, particularly for enteric fermentation cows, and dairy cows and the emission factors used in the manure management sector are not fully transparent.

165. Austria reports methane emissions from agricultural soils. Assumptions are based on default emission factors (Buwal, 1995; see NIR). However the Austrian experts could not fully explain the assumptions behind these estimates and the reference could not be cross-checked.

166. Because tier 1 approaches have been used, additional information on parameters not used in calculations were not supplied in CRF background tables 4.A, 4.B and 4.D. Data on average milk production, feed digestibility and live weight exist in Austria and would be helpful in order to allow comparison with other countries' inventory submissions.

4. Recalculations

167. Since the 2000 submission, no recalculation in the agricultural sector has been performed, with the sole exception of the soil area activity data for the years 1994, 1995 and 1996, which have been corrected. This small correction did not visibly influence the estimated emissions.

5. Uncertainty estimates

168. Enteric fermentation and manure management are listed in the NIR as being amongst these sources with the highest uncertainty levels. Information on uncertainty of emission estimates for the agricultural sector is not available; however, assessment of uncertainty of activity data and emissions factors is provided.

169. The uncertainty provided for animals' activity data is below 10%; the uncertainty of emission factors for enteric fermentation is considered to be about ±50%. A fixed emission factor is used; therefore the uncertainty may differ across the years.

170. The uncertainty of activity data for manure management emission estimation is the same as for the category enteric fermentation. Information on the uncertainty of emission factors was not provided.

171. Land use is considered to be well described by agricultural statistics, with a 5% uncertainty. The gap in general knowledge leads to a large uncertainty, ±100%, in emission factors for N_2O from agricultural soils.

172. Uncertainties of both activity data and emission factors relating to burning of agricultural residues are assumed to be ±100%.

6. Verification and QA/QC approaches

173. Comprehensive verification procedures are undertaken by Agrar Markt Austria on the agricultural statistics provided by Statistics Austria.[27] The same type of activity data serve in the country as a base for providing subsidies and are therefore carefully double-checked.

27 See NIR pages 110 and 111.

B. Consistency with the UNFCCC reporting guidelines and the IPCC Guidelines

174. The methodologies used to estimate emissions in the agricultural sector, except those used for agricultural soils, are consistent with the IPCC 1996 Guidelines.

175. Emissions of CH_4 and N_2O for all key source categories are estimated using simple methodologies (similar to tier 1) with a mix of IPCC default and country-specific emission factors. This is not fully in line with the good practice guidance, which recommends applying more sophisticated methods.

176. The CRF tables and NIR are largely consistent with the UNFCCC reporting guidelines. All CRF tables are reported appropriately with notation keys. However, filling in the background tables as far as possible and better explanations of the assumptions underlying some specific emission factors in the NIR would increase transparency.

C. Key source analyses

177. The country performed the key source analyses using the tier 1 method (NIR). In the 1999 inventory, CH_4 from enteric fermentation - cattle 3.17%, N_2O from agricultural soils 1.28%, and CH_4 from agricultural soils 0.93%, were among the key sources for the agricultural sector.

178. In the analyses included in the S&A report, CH_4 from enteric fermentation (3.4%), CH_4 from agricultural soils (0.9%), and CH_4 from manure management 0.7%, were key sources.

179. Minor differences between these two analyses could be explained by the use of a different coverage or category split in the emission sources.

D. Methodologies, emission factors and activity data

1. Activity data

180. According to data provided by Statistics Austria, in 1999, agricultural land comprised 41% of the country; there are 217,500 holdings, of which 39% are mountain farms. Austrian agriculture is small-structured with 65% of farms of less than 20 ha and only 3% of farms managing more than 100 ha. More detailed information about the structure of farms in the years 1995 and 1999 is available in *Gruner Bericht 2000*.

181. The NIR provides detailed information on the source of activity data. Statistics Austria reports animal population data annually in a yearbook. These data are based on a regular general census of domestic livestock on 1 December, carried out according to national regulations. The methods are described in *Statistisches Jahrbuch 2001*.

182. The data on fertilizer sales are available. It is assumed that all fertilizers sold are applied in the year of purchase.

183. For the calculations, actual yearly data are used; this is a departure from the IPCC 1996 Guidelines, which recommend the use of a three-year average.

184. The long-term trends show an increase in numbers of horses and goats and a decrease in the cattle population. The long-term changes in sheep, swine and poultry numbers are not significant. The annual changes reach in some cases almost 20%. According to the national

expert, these fluctuations reflect, in most cases, immediate responses of farmers to political decisions (subsidies, regulations, and so on) and to market prices.

2. Methodology and emission factors - key sources

Enteric fermentation

185. Emissions were estimated using a tier 1 approach with country-specific emission factors for cattle and dairy cattle and IPCC default factors for other categories.

186. The same country-specific emission factors for dairy cows were used during the whole period. Average milk production increased between 1990 and 1999 from 3,791 to 4,716 kg/head, and the emission factor for dairy cattle should have reflected this change.

Manure management

187. CH_4 emissions were estimated using a tier 1 approach, with country-specific emission factors. This is consistent with the IPCC recommendations. However, the national emission factors are not referenced in the NIR.

188. In table 4.B(a) all the animals are classified as being in a temperate region. During the review it was agreed with country experts that according to the IPCC classification all of Austria is ‘cool’.

189. N_2O emissions were not estimated. The NIR mentioned a “lack of resources to use IPCC default methodology with default values”, as a supporting argument. In fact, the national experts explained that a lack of appropriate information about manure management systems operated by farmers in the country had prevented them from proceeding with the relevant calculations. It is planned to include these emissions in the 2003 submission.

Agricultural soils

190. Estimated N_2O emissions from agricultural soils contributed 44% to total N_2O emissions in 1999.

191. Austria also estimated CH_4 emissions from agricultural soils. The estimated emissions for 1999 were 6% higher than emissions from manure management.

192. Emissions are estimated using the very simple method for six CORINAR97 source categories with country-specific emission factors. The area of the various crops is multiplied by the corresponding emission factors.

193. The applied emission factors are referenced in the NIR (CH_4 Buwal, 1995; N_2O UBA expert judgement) but the appropriate explanation is missing. Crosschecking was not possible. It is not clear what type of emissions (direct or indirect) are behind these emissions factors.

3. Methodologies and emission factors - non-key sources

Field burning of agricultural residues

194. Non-key sources include CH_4 and N_2O from agricultural residue burning (4.F). The emissions are estimated in CORINAIR97 methodologies (corresponding to tier 1 IPCC) with a

mixture of country-specific and CORINAIR emission factors. The estimated amount of straw (expert judgment) is multiplied by the corresponding emission factor.

195. The burning of agricultural residues has been legally restricted since 1993; and before that it was regulated at regional level. The burning of agricultural residues in Austria is possible on a small scale only, and after obtaining a special permit, with local authorities controlling the whole process.

E. Areas for further improvement

1. Planned or ongoing work by the Party

196. Austria has recognized that enteric fermentation and agricultural soils are key sources and is therefore planning to use more detailed methods by 2003. Officials informed the ERT that there is already an established cooperation between the UBA and relevant partners (such as the University of Agricultural Sciences) for the development of appropriate methods.

197. Austria has funded research into the development of country-specific CH_4 emissions factors from manure management. The country also plans a study to assess manure management systems.

198. In addition, Austria plans to estimate N_2O emissions from manure management for its 2003 submission.

199. The officials have contracted expert institutions (such as the Austrian Research Centre, Seibersdorf) to develop for agricultural soils methods relevant to national circumstances (small organic farms, 39% mountain farms, and so on).

2. Issues identified by the ERT

200. The ERT wishes to encourage further work aimed at developing methods and emission factors in the agricultural sector. This is very valuable research due to the importance of this source for Austria and other European countries. Additionally, this data would assist in improving the IPCC emission factors, which at the current stage tend to reflect the situations of countries with very intensive farming practices. The importance of this emissions category for Austria could increase in the future.

201. As enteric fermentation is a key source, it is recommended that much effort, recognizing national circumstances, be made to implement a more detailed approach for dairy and non-dairy cattle in line with the good practice guidance. Austria might consider revising the fixed emission factors for dairy cows (in relation to average milk production development) for the next submission; the uncertainty assessment for this source category could be revised as well.

202. Before the new methodology is in place, the NIR should attempt to explain clearly the rationale behind emission factors applied in the calculation of methane emissions from manure management.

203. The ERT would like to encourage Austria to estimate preliminary N_2O emissions from manure management using the default IPCC emission factors, until a national method has been developed.

204. The ERT recommends the reconsideration or better documentation of CH_4 emissions from the agricultural soils category. There is no explanation given in the NIR, and no references could be identified concerning special circumstances for Austria, which would explain the high emissions from this source category (arable land) in comparison with other Parties.

V. LAND-USE CHANGE AND FORESTRY

A. Sector overview

205. Austrian forests cover an area of 3.92 mio. ha, which corresponds to 46.8% of the whole country. LUCF constitutes a net sink in the Austrian GHG inventory, offsetting almost 10% of total GHG emissions in 1999. Only changes in forest and other woody biomass stocks are of relevance for Austria. There is a decrease in the net sink from about 12% in 1990 to 10% in 1999.

1. Institutional arrangements

206. The LUCF inventory is developed and integrated into the GHG inventory by the UBA. The data source is the National Forest Inventory (NFI) assessed by the Federal Forest Research Centre (FFRC). Full data sets are archived by these two institutions.

2. Completeness

207. Austria reports on changes in forest and other woody biomass stocks in table 5.A of the CRF. Tables. 5.B (Forest and grassland conversion), 5.C (Abandonment of managed land) 5.D (CO_2 emissions and removals from soils) of the CRF are provided using notation keys. A full set of tables is provided for all years from 1990 to 1999.

208. Even though notation keys are provided only in tables 5.B and 5.C, it can be assumed that changes in biomass stocks are assessed almost completely because they are included in table 5.A. Changes in soil carbon stocks (table 5.D) have not yet been quantified although there are indications that they may occur.

3. Transparency

209. The NIR indicates the country-specific emission and conversion factors. It further makes reference to published reports and articles in which the methodologies and the rationale for choosing them are described.

4. Methodology, emission factors and activities

210. For table 5.A the IPCC methodology is used. Country-specific expansion factors were derived from measurements in case studies and from the literature to convert stem wood volume to biomass weight and to obtain the total estimates including branches, foliage, cones and roots. Total biomass was converted to carbon by conversion factors of 0.49 and 0.48 for coniferous and deciduous trees respectively.

211. The country-specific approach uses the Austrian NFI as a database. The NFI uses the same grid net for surveys which have taken place at approximately five-year intervals since the late 1970s and this grid net provides the most reliable data. It measures both, increment and

removal of stem wood. Annual figures for increment are calculated from the five-year average received from the NFI assessments by a statistical model derived from tree ring data.

212. The annual forest report edited by the Federal Ministry of Agriculture, Forest, Environment and Water Management provides figures reported by forest owners on forestry activities such as harvesting, and on forest damage, but these are not consistent with NFI data. The annual forest reports are used to derive a statistical model for calculating annual removals from forests within one NFI period.

5. Recalculations

213. Changes in forest and other woody biomass stocks (table 5.A) were recalculated in the 1998 inventory for all years since 1990. The rationale was the inclusion of the result of the latest NFI assessed during the years 1992 to 1996. At the same time the UBA, which took over the responsibility for the inventory from a private consultant, invested in the development of more detailed conversion factors as described in the paragraph above.

6. Uncertainty estimates

214. Uncertainty was estimated for changes in forest woody biomass based on the tier 1 approach of the IPCC good practice guidance. A medium uncertainty range of ±30% was found. The uncertainty ranges from ±20 to ±74%; it is high in years with a low net sink and low in years with a high net sink.

7. Verification and QA/QC approaches

215. The NFI data are obtained by means of countrywide measurements and result in low overall uncertainties. They are the most reliable data on woody biomass stocks. An annual survey reporting harvesting by forest owners is used to interpolate individual years between the NFI assessments. The application of data and transformation into the inventory figures is carried out by the UBA and FFRC in cooperation.

B. Conformity with the UNFCCC reporting guidelines and the IPCC Guidelines

216. The Austrian methodology for LUCF is in line with the IPCC Guidelines. As countries are encouraged to use their own detailed inventories for calculating changes in biomass stock, specific emission factors are developed. Instead of three-year averages, annual figures for woody biomass stocks are provided. This is justified by the good quality of the annual data derived.

217. Inventory reporting in the CRF and NIR is consistent with the UNFCCC reporting guidelines. The NIR gives references to publications providing a full understanding of the methods and conversion factors applied.

218. The LUCF inventory and the NFI are published by the UBA and the FFRC respectively.[28] The Austrian forest report is accessible on the homepage of the Federal Ministry of Agriculture, Forest, Environment and Water Management. The data of the Austrian forest report on harvested wood are also published in the statistical yearbook and correspond almost exactly with the FAO statistics on roundwood production.

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[28] It should be noted that the Austrian forest report was published annually in the past only; but the intervals between reports have been extended.

C. Specific source/sink categories

1. 5.A Changes in forest and other woody biomass stocks

219. Changes in forests and other woody biomass offset almost 10% of total GHG emissions in 1999. The relative net sink ranges from 17% in the year 1991 to 7% in 1996. The variation is explained by different growth increments depending mainly on variability in annual weather circumstances and changing harvest activities. From 1990 to 1996 a decreasing trend of net sink is detectable.

220. For the years 1997 to 1999, a constant net sink equivalent to the average of the years 1992 to 1996 is reported. The argument for this is the lack of forest inventory data and the incompleteness of the annual forest survey on harvesting activities reported by forest owners. Extrapolated data from the previous NFI had turned out to be unreliable after checking with results of the last NFI. Annual data from 1997 onwards will therefore be updated and recalculated only after finishing the evaluation of the NFI for 2000 to 2002. This can be expected in the year 2003 or 2004.

221. The estimates cover the overall carbon stock in forests including above- and belowground biomass. They do not include plantations, which are a negligible part of the Austrian forest area (about 0.05 per cent). Fuelwood consumption was inappropriately reported as “NE”, whereas it is in reality included in the total biomass removed.

2. 5.B Forest and grassland conversion, and 5.C Abandonment of managed land

222. Activities concerning tables 5.B and 5.C are not estimated or included elsewhere. The latter applies especially for afforestation and deforestation. The effect of these activities is included in changes of forest and other woody biomass stocks (table 5.A). This is possible according to the IPCC Guidelines and Austria argues that it avoids double counting. The same applies for forest fires, which have been documented in the Austrian forest reports since 1992. However, the non-CO_2 emissions from forest fires are neglected in the inventory. They are expected to be very small because forest fires are very rare in Austria. The burnt woody biomass at no time reached one per cent of the harvested wood.

3. 5.D Emissions and removals from soils – CO_2

223. CO_2 emissions and removals from soils are not estimated. Carbon content of forest soils was assessed in a soil survey carried out during the years 1987 to 1989. Agricultural soils were assessed by countries at different times and in different ways.

224. A modeling approach for forest soils resulted in a sink of 0.5 mio t C per year in the period 1990 to 1996, which corresponds to about 25 per cent of the average sink in forest biomass in the same period. Because there is no possibility of crosschecking these data, they are not reported in the inventory. No data are available for changes in carbon stocks of agricultural soils.

D. Areas for further improvement

1. Planned or ongoing work by the Party

225. The ERT notes that Austria is reassessing forest inventory data, which will provide a sound database for estimating changes in woody biomass stocks for the years subsequent to 1996. Austria also intends to carry out a second survey of forest soils during the years after the NFI data are assessed. These data should provide information on soil carbon stock change and help to validate model approaches.

226. The ERT also notes that Austria intends to develop uncertainty assessment further using inter alia, Monte Carlo simulation.

227. The ERT further notes that Austria is starting a study programme on agricultural activities and their impacts on GHG. Effects of agricultural practices on soil carbon stock will be investigated. It is expected that a first rough estimate of carbon stock changes in agricultural soils will be available in 2003. Figures based upon measurements of soil carbon in Austria will be available only at a later stage. These investigations will also contribute to developing method for estimating emissions and removals from soils.

2. Issues identified by the ERT

228. The ERT appreciates the efforts of the Austrian LUCF team and the quality of the documentation presented. It encourages Austria in its ongoing activities and in publishing the findings in reviewed papers.

229. The figures for changes in woody biomass stocks are constant in the years after 1996, although the Austrian forest report and the Food and Agriculture organization United Nations statistics present variable figures on forest harvesting based upon data reported by the forest owners. This is justified by the fact that these figures do not correspond with the data of the NFI, which are based upon sound statistical measurements. Bearing in mind that the new NFI data will not be provided before 2003 or 2004, this will lead to a period of no fluctuation of six to seven years. The ERT invites Austria to examine possibilities of estimating yearly values continuously with the help of yearly statistics which report not only harvesting but also forest damage caused by biotic and abiotic agents. Such an approach would become even more important if periods between NFI assessments were prolonged. For such data three-year averages could be compiled and they could be marked as being of higher uncertainty than those based on NFI data. However, the ERT recognizes that Austrian use of extrapolations of trends may result in provisional figures which could differ significantly from figures based upon measurements as described above.

230. If the arguments against annually derived data are too strong, Austria could increase transparency by indicating by footnote that the figures in the GHG inventory are averages of a past period. In this case, the ERT would recommend Austria not to extend the intervals between NFI assessments to more than three years.

231. The ERT further invites Austria to check whether, using the information provided by the Austrian forest reports, the removals from the forest could be reported separating commercial and traditional (that is, non commercial) fuelwood uses. Although this would not change the net sink or emissions, it would increase transparency and assist cross-checking with emissions from biomass burning in table 1.A. However, the ERT recognizes the difficulties in providing such

data (for example because fuelwood originates from both commercial fuelwood harvest and traditional fuelwood harvest).

232. Forest fires have a negligible effect on Austrian land-use change and forestry emissions. But this could change in years with unexpected forest fires. For this reason, the Austrian team might consider the possibility of including in the inventory non- CO_2 -GHG emissions due to forest fires. However, the ERT recognizes that the CRF does not address these emissions if such forest fires are not linked with a land-use change.

233. Forest fires in Austria happen accidentally and are not followed by forest conversion, whereas in the IPCC Guidelines, forest fires are requested to be reported in table 5.B only in relation to forest conversion. It is unclear, therefore whether Austria should really report emissions from forest fires. More guidance on this matter would be helpful.

VI. WASTE

A. Sector overview

234. Emissions from the waste sector represented about 6% of total GHG emissions in 1999. Methane emissions, the major GHG from this sector (97%), have dropped by 16% between1990 and 1999 due to the implementation of waste treatment policies. The waste sector has one key source: methane emissions from solid waste disposal sites (SWDS), which represented 5% of Austria's total emissions in 1999.

1. Institutional arrangements

235. The Waste Department of the UBA is responsible for building, updating and analysing the waste database for GHG inventory purposes. It conducts specific studies on different variables (waste composition, oxidation factors, and so on). These studies are not developed on a continuous basis. In the cases of waste treatment plants and "directly deposited waste", further studies would be necessary, but are not developed due to the allocation of resources by Austria to studies on major sources only.

2. Completeness

236. All CRF tables for the waste sector were completed from 1990 to 1999, with minor omissions and/or inconsistencies, which are further detailed. N_2O emissions from human sewage were not reported.

3. Transparency

237. Methodologies, assumptions and background data and studies for estimating emissions were summarized in the NIR, but more clarification may be needed since country-specific methodologies and data are based on many different studies. Background tables were not entirely completed in the CRF, or showed minor inconsistencies, which are explained.

4. Methodologies, emission factors and activity data

238. Every municipality has a municipal waste collection data system (quantities of waste generated, types of waste, final destination: different treatment plants, and so on). The data are

verified by the Province Governor and analysed and published every three years by the Federal Ministry of Agriculture and Forestry, Environment and Water Management.

239. Waste incineration plants make a yearly declaration to the Regional District Office (local licensing authority) about emissions, incinerated wastes and fuel quantities used. Prior to this, the information is audited by an independent party.

240. Methods and emission factors used are country-specific.

5. Recalculations

241. Recalculations were reported in the NIR, but not in the corresponding CRF tables (8(a) and 8(b)).

242. CO_2 emissions from waste incineration were recalculated for the years 1996 – 1998. Data from incineration plants are provided from October to September; the UBA normally utilizes data from previous years for November and December, and adjusts them when a new report is received. CH_4 emissions from wastewater handling were recalculated for the year 1998 due to new statistics on the 1998 population.

B. Conformity with the UNFCCC reporting guidelines and the IPCC Guidelines

243. Reporting of emissions from this sector in the CRF and in the NIR were mostly consistent with the UNFCCC guidelines. Some minor issues and suggested improvement are noted below. Methodologies were broadly consistent with the IPCC good practice guidance.

C. Key sources

1. Methane emissions from SWDS

244. CH_4 emissions per capita decreased by 22.4% between 1990 and 1999. This was caused by the application of waste management policies.[29]

245. Austria divided solid wastes into two categories: residual waste (household waste and similar waste) and directly deposited waste (industrial waste, construction waste). It should be noted that 100% of the SWDS are managed sites.

246. The amount of "residual waste" was taken from different sources, depending on the year.[30] The amount of "directly deposited waste" was assumed to be constant for all years, based on the 1995 figures: 2.9 million tons/year.[31] The methodology used is consistent with the IPCC Guidelines.[32] The main parameters for calculating CH_4 generation were the degradable organic carbon content (DOC) of waste and data from the previous 31 years. The DOC was taken from a study (ref. Hackl & Mauschitz, 1999), involving the following figures: the recovered CH_4 (20%), the concentration of oxidized methane in the upper level (20%) and the fraction of methane in landfill gas (55%).

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[29] From 1989 to 1999, direct landfilling decreased from 63.1% to 28.5% and waste incineration increased from 5.9% to 14.7%.

[30] From 1989 to 1999: Federal Waste Management Plan 1998; from 1960 to 1989: Study (Hackl & Mauschitz, 1999); and for 1973, from Mullerhebung, 1973.

[31] Baumeler et al., 1998.

[32] Could be considered as a tier 2, as based on a study commissioned by the UBA (Häusler, 2001).

247. Regarding the "directly deposited waste", the methodology used is similar to the default IPCC method, and was based on a UBA study (Häusler, 2001). The generation of gas was calculated over 100 years based on the deposited waste of the year 1995 (Baumeler et al, 1998), which is assumed to be constant across the years. The potential formation of landfill gas, for the three different kinds of degradable wastes categories[33] was based on the quantity and carbon flow of each (Häusler, 2001).

D. Non-key sources

1. Wastewater handling

248. The methodology used was country-specific, and was based on data from a local study (Steinlecher et. al,1994). N_2O emissions for human sewage were not estimated, but Austria is planning to provide estimates in its 2002 submission.

249. The background table (table 6.B) has been filled with notation keys as Austria has used direct emission data. Emissions from sludge were reported to be "IE", but the exact location was not provided in the NIR or CRF.

2. Waste incineration

250. Activity data and emissions factors used were country-specific.

251. Incinerated waste in Austria is used for energy purposes, but the emissions were reported under the waste sector.

E. Areas for further improvement

1. Planned or ongoing work by the Party

252. N_2O emissions from human sewage will be estimated for the 2002 submission using the IPCC default methodology.

253. In order to facilitate comparison of emissions among Parties, Austria will report emissions from sludge spreading, and compost production according to the sectors specified in the IPCC Guidelines.

254. Terms used within the text which are not international definitions will be clearly defined (as in the case of definition of residual wastes and directly deposited waste).

2. Issues identified by the ERT

255. Austria has managed to develop a very complete and consistent inventory, based on country-specific data collected from field work and special studies. Nevertheless, some reporting problems were identified, which should be improved for further reports:

(a) All methodologies, parameters and activity data used in the report should be clearly referenced, since many different studies provide the sources of information.

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[33] Well biodegradable waste: 1-20 years, semi-biodegradable waste: 20-100 years, and less biodegradable: >100 years.

(b) The ERT encourages Austria to fill in background CRF tables as far as possible, analysing in each case the information available in the databases and specialized studies. With the studies and database available, most of the cells could be filled in.[34]

(c) The use of notation keys should be applied according to the UNFCCC reporting guidelines. Some identified cases which should be corrected are:

(i) Use of "IE": The use of this notation key should be specified in the CRF table of Completeness (table 9) and in the documentation boxes of each CRF table, specifying the exact allocation of these emissions. This applies to the quantity of incinerated industrial waste and wastewater sludge and their emissions in table 6.C, and to the quantity of CH_4 emissions of sludge in table 6.B).

(ii) Misuse of "IE": It should not be used for emissions that do not occur ("NO"). This applies to the quantity of municipal solid waste unmanaged waste disposal sites and their emissions, in table 6.A.

(d) Emissions from waste incineration of non-biogenic waste for energy purposes should be reported under the energy sector in accordance with the IPCC Guidelines.

256. Even though "directly deposited waste" accounts for 25% of the wastes disposed of in landfills (key source), more research should be done on estimating emissions in a more accurate way, so that the amount of waste is not considered constant over the years.

257. Austria may consider improving data on types of wastes incinerated and emission factors, due to the increasing use of this type of treatment.

[34] Table 6.A - DOC degraded, CH_4 recovery; and table of additional information: CH_4 oxidation factor, composition of landfilled waste consistent with information stated in the NIR for categorization of wastes; table 6.B - additional information - total wastewater and wastewater treated; percentages of aerobic and anaerobic handling systems for industrial wastewater and sludge.

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NB: *No reports or documents were used other than those provided to the team as listed above. Some confidential material was presented but was not provided to the ERT.*

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