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Report of the individual review of the greenhouse gas inventory of Hungary submitted in 2006*

* In the symbol for this document, 2006 refers to the year in which the inventory was submitted, and not to the year of publication.

CONTENTS

I. Overview

A. Introduction

1. This report covers the in-country review of the 2006 greenhouse gas (GHG) inventory submission of Hungary, coordinated by the United Nations Framework Convention on Climate Change (UNFCCC) secretariat, in accordance with decision 19/CP.8. The review took place from 5 to 10 March 2007 in Budapest, Hungary, and was conducted by the following team of nominated experts from the roster of experts: generalist – Ms. Katarina Mareckova (Slovakia, European Community); energy – Ms. Kristin Rypdal (Norway); industrial processes – Mr. William Kojo Agyemang-Bonsu (Ghana); agriculture – Mr. Michael McGettigan (Ireland); land use, land-use change and forestry (LULUCF) – Mr. Hector Ginzo (Argentina); waste – Ms. Sirintornthep Towprayoon (Thailand). Ms. Katarina Mareckova and Ms. Sirintornthep Towprayoon were the lead reviewers. The review was coordinated by Ms. Ruta Bubniene and Mr. Javier Hanna (UNFCCC secretariat).

2. In accordance with the "Guidelines for the technical review of greenhouse gas inventories from Parties included in Annex I to the Convention" (the UNFCCC review guidelines), a draft version of this report was communicated to the Government of Hungary, which provided comments that were considered and incorporated, as appropriate, in this final version of the report.

B. Inventory submission and other sources of information

3. In its 2006 submission, Hungary submitted a complete set of common reporting format (CRF) tables for the base year (averaged value for the three years 1985–1987) and for the years 1985–2004, and a national inventory report (NIR). The full list of materials used during the review is provided in the annex to this report.

4. After the in-country review, following the recommendations of the expert review team (ERT), Hungary submitted revised CRF tables for the years 1990 and 2004.

C. Emission profiles and trends

5. In 2004, total[1] national GHG emissions in Hungary amounted to 78,997.50 Gg carbon dioxide (CO_2) equivalent[2] and had decreased by 31.6 per cent since the base year. The most important GHG in Hungary was CO_2, contributing 76.1 per cent to total national GHG emissions expressed in CO_2 equivalent, followed by nitrous oxide (N_2O), 12.9 per cent, and methane (CH_4), 9.9 per cent. Hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulphur hexafluoride (SF_6) taken together contributed 1.1 per cent of the overall GHG emissions in the country. The energy sector accounted for 76.1 per cent of total national GHG emissions, followed by agriculture (11.5 per cent), industrial processes (7.3 per cent), waste (4.8 per cent) and solvent and other product use (0.4 per cent). Emissions decreased in all sectors except waste between the base year and 2004, the most significant reductions being in industrial processes (45.3 per cent) and agriculture (48.2 per cent). Net removals from

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

[2] In this report, the values for total and sectoral emissions in the base year and in 2004 reflect the revised estimates submitted by Hungary in the course of the review. These estimates differ from Hungary's GHG inventory submitted in 2006.

LULUCF increased by 101.7 per cent over the same period. Emissions of CO_2, CH_4 and N_2O (excluding LULUCF) decreased by 30.0, 22.7 and 47.1 per cent, respectively. Actual emissions of fluorinated gases increased by 158.9 per cent compared to the base year. Emission trends in Hungary are comparable with those in other countries with an economy in transition.

6. Tables 1 and 2 show the GHG emissions by gas and by sector, respectively.

Table 1. Greenhouse gas emissions by gas, 1990–2004

GHG emissions	Gg CO_2 equivalent								Change
	Base year Convention[a]	1990	1995	2000	2001	2002	2003	2004[a]	BY–2004 (%)
CO_2 (with LULUCF)	83 025.8	69 084.6	53 582.9	55 486.5	55 779.2	54 039.8	56 819.4	54 541.9	–34.3
CO_2 (without LULUCF)	85 795.5	72 934.2	61 655.1	58 735.1	60 260.4	58 623.0	61 686.4	60 089.0	–30.0
CH_4	10 169.3	11 948.7	10 052.5	10 100.8	10 356.3	9 759.9	9 519.7	7 862.5	–22.7
N_2O	19 226.8	18 929.4	12 437.6	12 511.5	13 370.6	12 475.1	12 306.6	10 170.0	–47.1
HFCs	NA,NE,NO	NA,NE,NO	1.7	205.7	280.7	403.5	498.7	525.5	NA
PFCs	268.5	270.8	166.8	211.3	199.1	203.3	189.6	201.1	–25.1
SF_6	81.0	39.9	70.1	140.1	107.4	119.6	161.9	178.2	119.9

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

[a] The values of emissions in the base year and in 2004 reflect the revised estimates submitted by Hungary in the course of the review on 20 April 2007. These estimates differ from Hungary's GHG inventory submitted in 2006.

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

Sectors	Gg CO_2 equivalent								Change
	Base year Convention[a]	1990	1995	2000	2001	2002	2003	2004[a]	BY–2004 (%)
Energy	84 006.3	73 822.2	64 051.4	60 576.6	62 258.8	60 776.7	63 999.4	60 083.0	–28.5
Industrial processes	10 551.1	8 462.8	4 779.3	5 665.2	5 868.3	5 034.1	5 211.1	5 769.2	–45.3
Solvent and other product use	384.5	311.7	250.4	235.8	263.4	208.3	274.6	336.6	–12.4
Agriculture	17 495.7	16 447.3	10 445.0	10 315.8	10 759.5	10 684.1	10 130.4	9 055.0	–48.2
LULUCF	–2 736.5	–3 820.6	–8 047.9	–3 219.2	–4 453.1	–4 554.9	–4 838.4	–5 518.3	101.7
Waste	3 070.3	5 050.1	4 833.5	5 081.7	5 396.4	4 852.8	4 718.7	3 753.7	22.3
Other	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total (with LULUCF)	112 771.5	100 273.4	76 311.7	78 655.9	80 093.3	77 001.1	79 495.9	73 479.2	–34.8
Total (without LULUCF)	115 507.9	104 094.1	84 359.7	81 875.0	84 546.4	81 556.1	84 334.3	78 997.5	–31.6

Note: BY = Base year; LULUCF = Land use, land-use change and forestry; NA = Not applicable.

[a] The values of emissions in the base year and in 2004 reflect the revised estimates submitted by Hungary in the course of the review on 20 April 2007. These estimates differ from Hungary's GHG inventory submitted in 2006.

D. Key categories

7. Hungary has reported key category tier 1 and tier 2 analyses, using both level and trend assessment, as part of its 2006 submission. The NIR gives a transparent description of how the key category analyses were determined. The tier 1 key category analyses performed by Hungary and the secretariat[3] produced similar results. The few differences between them can be explained by the fact that Hungary did not include the LULUCF sector in the analysis and merged the N_2O emissions of different types of fuel from stationary combustion into one category. During the in-country review, a revised key category analysis including LULUCF was provided to the ERT.

8. Priority areas for inventory improvements have largely been determined on the basis of those key categories that are the largest contributors to total emissions. Among the categories identified by Hungary and the ERT as warranting the use of higher-tier methods, limitations on the availability of activity data (AD) and national/source-specific emission factors (EFs) continue to prevent the development of such methods. Several key categories in the energy, industrial processes, agriculture and waste sectors are currently estimated using a tier 1 approach. The ERT noted that systematic key category analyses should be used to prioritize improvements to and the development of the inventory.

E. Main findings

9. The ERT acknowledges that in the 2006 submission the completeness, consistency and comparability of Hungary's GHG emissions inventory, including the completeness of the CRF tables and the transparency of the NIR, have improved compared to the previous (2005) submission. The ERT noted that there are still elements where further elaboration in line with the Intergovernmental Panel on Climate Change (IPCC) *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (hereinafter referred to as the IPCC good practice guidance) and the "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual inventories" (hereinafter referred to as the UNFCCC reporting guidelines) is needed.

10. The description of the institutional arrangements and procedures for inventory preparation given in the NIR is not complete and does not fully reflect the latest developments in the country. Additional information on the legal and procedural arrangements was provided to the ERT after the in-country review. The ERT recommends Hungary to elaborate the relevant sections of the NIR and provide summary information on the legal, institutional and procedural arrangements, as well as information on quality assurance/quality control (QA/QC) activities for the inventory preparation, in its next NIR.

11. The NIR provides the information needed to enable the ERT to assess the inventory. The emissions factors (EFs) used are in general consistent and comparable with other reporting Parties. However, for a number of categories the EFs used are not appropriately explained or documented in the NIR: these include N_2O emissions for a number of stationary combustion sources (public electricity and heat production, manufacturing industries and combustion, and other sectors), N_2O emissions from gasoline in road transportation, CH_4 emissions from coal mining and handling – underground mines, CH_4 emissions from oil and natural gas, CH_4 emissions from enteric fermentation – dairy cattle, N_2O emissions from nitrogen-fixing crops, N_2O emissions from crop residue, N_2O emissions from animal

[3] 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* (hereinafter referred to as the IPCC good practice guidance for LULUCF). Key categories according to the tier 1 trend assessment were also identified for those Parties that provided a full set of CRF tables for the base year. 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.

manure applied to soils, N_2O emissions from nitrogen leaching and run-off, and CH_4 emissions from waste-water handling. Additional information should also be provided to improve the transparency of the calculations and make it possible for the ERT to assess the appropriateness of the methods and EFs used. The ERT recommends that Hungary improve the transparency of the NIR on a category-by-category basis in order to make the information provided more robust and to facilitate future reviews.

12. The estimation methods used are generally in line with the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the Revised 1996 IPCC Guidelines) and the IPCC good practice guidance, but there are a few subsectors where methods are not applied appropriately (e.g. enteric fermentation – dairy cattle, and direct N_2O emissions from animal manure applied to the soils).

F. Cross-cutting topics

1. Completeness

13. Hungary has provided inventory data for the base year (the average of the three years 1985–1987) and the years 1985–2004, and included most of the CRF tables required with data on all relevant gases, sectors and source/sink categories. The notation keys are used throughout the tables. Those categories that are reported as "not estimated" ("NE") or "included elsewhere" ("IE") are explained in CRF table 9. The CRF tables are generally complete, with a few exceptions which are described in the relevant sectoral chapters of the NIR.

14. The ERT noted that Hungary has not reported N_2O emissions from human sewage, CH_4 emissions from distribution of oil products, emissions from flaring of oil and gas, and a few industrial processes categories (e.g., CO_2 from nitric acid production) which were assessed by national experts as negligible. The ERT recommends that Hungary estimate all the missing emissions in its next submission. After the in-country review, Hungary provided estimates of N_2O emissions from human sewage for the base year and 2004 in accordance with the recommendation of the ERT.

15. The ERT noted that emissions of HFC-365mfc were included in Hungary's national totals for 2004. However, no global warming potential (GWP) for this gas is provided by the IPCC in its second assessment report. The ERT recommends that emission estimates from this category be reported in CRF table 9 and not included in the national totals until a GWP for this gas is agreed by the UNFCCC. After the in-country review, Hungary followed the recommendation of the ERT by provided revised estimates for 2004 excluding emissions of HFC-365mfc from national totals.

2. Transparency

16. The ERT noted that the transparency of the information reported in the CRF tables and the NIR has improved since the previous (2005) submission, but it needs further elaboration if it is to be fully transparent. The NIR sections relating to institutional arrangements and procedures for data collection, reporting and archiving need to be more detailed and transparent and should also cover sector-specific arrangements.

17. Moreover, the description in the NIR of the methodologies used should be improved by giving more detailed information. The ERT noted that in some categories of the energy and agriculture sectors an adequate rationale for the choice of methods and EFs is not given (see details in the sectoral sections below). The ERT recommends Hungary to clearly reference in the NIR the EFs used and explain their trends, and to provide the necessary information to support the applicability of country-specific EFs and methods.

3. Recalculations and time-series consistency

18. The ERT noted that recalculations of the time series from the base year to 2004 reported by Hungary had been undertaken in the energy, industrial processes, agriculture and waste sectors. The rationale for these recalculations is not provided in the NIR. The major recalculations for 2003 include CO_2 emissions in the energy and industrial processes sectors, HFC emissions in the industrial processes sector and N_2O emissions in the energy sector. During the in-country review Hungary informed the ERT that in the energy sector the recalculations were undertaken in order to apply more appropriate EFs for lignite combustion; that in the industrial processes sector recalculations were undertaken to include recently obtained AD for glass, tile and brick production; and that in the waste-water handling category and the agriculture sector mistakes in calculations had been identified and corrected. The ERT recommends that Hungary provide complete explanations of the rationale for all recalculations in its next NIR.

19. The effect of the recalculations on the estimates of total national emissions in the base year as reported in the 2006 submission was an increase of 921.30 Gg CO_2 equivalent, or 0.8 per cent, while in 2003 the effect was an increase of 1,115.08 Gg CO_2 equivalent, or 1.3 per cent. The information on recalculations provided in the NIR and the CRF tables is not consistent. The ERT recommends that Hungary make consistent the information on recalculations provided in the NIR and the CRF tables in its next submissions.

4. Uncertainties

20. Hungary has provided uncertainty estimates according to the tier 1 method of the IPCC good practice guidance for all sectors. The ERT noted that a number of the inputs, both for EFs and for AD, are based on expert judgment only. According to the NIR, the estimates for CO_2 emissions have the lowest uncertainties, while the estimates for N_2O emissions from fuel combustion have the highest uncertainties. The estimated combined uncertainty for 2004 in the total emissions is 5.2 per cent and the uncertainty in the trend is 2.4 per cent, while the uncertainties range between 2 and 4 per cent for the CO_2 emission estimates, between 15 and 25 per cent for CH_4, and between 80 and 90 per cent for N_2O.

5. Verification and quality assurance/quality control approaches

21. The ERT noted that the quality of the information reported in the CRF tables and the NIR has improved since the previous (2005) submission. Some quality control routines were implemented during the calculation process by inventory experts, but the ERT identified a number of areas where QA/QC procedures were apparently not implemented. This has led to errors, inconsistencies and non-transparent use of methods and EFs in some sectors.

22. Hungary has not developed a complete QA/QC plan in accordance with the IPCC good practice guidance. The Hungarian Meteorological Service GHG Division, as the body responsible for the preparation of the inventory, is in the process of seeking accreditation under International Organization for Standardization (ISO) standard 9001. The QA/QC plan (QA/QC TERV in Hungarian) of the GHG Division was shown to the ERT during the in-country review. According to this document the director of the Hungarian Meteorological Service has nominated a quality manager responsible for coordination of QA/QC activities in the course of inventory preparation. Responsibility for particular sectoral activities is delegated to GHG Division sectoral experts. The document also specifies the deadlines for the completion of checks and controls. External experts and contractors are responsible for parallel checking of the consistency and completeness of both the AD and the emission estimates. The QA/QC plan also includes a checking table (ME 04-16/B01) with detailed records of checking activities, documentation files, and records of changes and recalculations. The QA/QC plan presented also includes procedures for annual updating of the QA/QC procedures. External audit of the system was planned for March 2007.

23. The ERT acknowledges that significant improvements to Hungary's QA/QC activities have been achieved, but it considers that the QA/QC plan provided during the review is rather general and does not fully ensure adequate quality of the national GHG inventory. The ERT recommends that Hungary further elaborate the existing QA/QC plan in line with the requirements of the IPCC good practice guidance, in particular the routines for internal/external sectoral cross-checks of documents related to submissions, such as the CRF tables, reports and documentation, and that archiving procedures should be elaborated in more detail. In addition, the ERT recommends that Hungary develop and document extensive checking procedures (tier 2) for identified key categories as well as guidance for inventory improvements. The procedure for official approval of recalculations should be incorporated into the QA/QC plan. According to additional documentation and information submitted to the ERT after the in-country review of Hungary's national system, the GHG Division passed the ISO 9001:2000 audit in March 2007. The updated QA/QC plan was provided, but in Hungarian. The ERT recommends Hungary to provide detailed information in English with its next submission.

6. Follow-up to previous reviews

24. The ERT acknowledges the improvements that Hungary has achieved in its institutional and procedural arrangements, the development of a basic QA/QC plan, and the establishment of a centralized archiving system. However, it noted that all the elements of Hungary's arrangements and procedures for inventory preparation require further elaboration if they are to be in line with the IPCC good practice guidance.

25. The ERT also recognizes that Hungary has improved its emissions estimates in the industrial processes sector by improving the completeness of its AD, and in the agriculture and waste sectors by correcting calculations.

G. Areas for further improvement

1. Identified by the Party

26. The NIR and the national experts (during the review) identified several areas for improvement. For example, Hungary indicated that all relevant data will be gradually included in the centralized archiving system, that the QA/QC plan will be updated by August 2007, and that it is working to improve its estimates in the LULUCF sector and to meet the provisions of decision 13/CP.9. Regarding sectoral improvements, the NIR identifies the following items:

(a) Improvements to the consistency and accuracy of the time-series data for the CH_4 and N_2O EFs in the energy sector;

(b) A more accurate EF on the basis of measurements and a longer data series for nitric acid production;

(c) Further refining of the consumption data for consumption of halocarbons and SF_6, primarily as regards final use;

(d) Further enhancement to the accuracy of the information on the rearing and feeding conditions of feedstock and use of tier 2 methods for the most important categories (dairy cows and other cattle) under enteric fermentation;

(e) Calculating country-specific EFs and use of tier 2 methods for the most important categories (dairy cows, other cattle, swine) under manure management;

(f) Further verification of both the AD and the background inventory information for the forest land category;

(g) Obtaining more precise data and detailed information on municipal solid waste disposal sites and waste-water treatment, and completing the AD on industrial waste incinerators.

2. Identified by the ERT

27. The ERT identified the following cross-cutting issues for improvement. Hungary should:

(a) Improve the transparency of the NIR, in particular by providing more precise descriptions of methodologies and EFs that are country-specific;

(b) Include the LULUCF sector in the key category analyses in its next submission;

(c) Further elaborate its QA/QC procedures for key sources and provide more detailed information in English in the next submission;

(d) Improve the management of the archiving system.

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

II. Energy

A. Sector overview

29. In 2004, the energy sector in Hungary accounted for 76.1 per cent of total national GHG emissions. Among the different categories, energy industries (1.A.1) is the most important (with 32.3 per cent of total sectoral emissions), followed by other sectors (1.A.4) (with 29.7 per cent of total sectoral emissions). Total sectoral emissions decreased by 28.5 per cent between the base year and 2004. This was due to reductions in emissions in energy industries (by 23.6 per cent) and other sectors (by 28.7 per cent). Emissions from transport (1.A.3) increased by 36.5 per cent from the base year.

30. All the main IPCC categories and gases are covered for the energy sector. The sectoral background data tables are essentially complete for 2004. However, some categories, most importantly petroleum refining (1.A.1b), manufacture of solid fuels and other energy industries (1.A.1c), civil aviation (aviation gasoline) (1.A.3a) and distribution of natural gas (1.B.2.b.iv), are reported as "IE". As a follow-up of the review the ERT was informed that emissions from distribution of natural gas (1.B.2.b.iv) were reported separately in the CRF tables of the inventory submission prepared after the 2006 submission. Hungary is encouraged to try to find practical solutions to increase the transparency of its reporting for these categories.

31. The reporting of the energy sector is generally transparent. However, the ERT recommends that the NIR should be improved with respect to the description of methods used, the origin of EFs and conversion factors, and how they relate to Hungarian technologies and sector-specific QA/QC procedures.

32. The ERT identified some discrepancies between the CRF data and the data from the International Energy Agency. For natural gas the discrepancy can be explained by use of different net calorific values in the statistics. Hungary is encouraged to investigate the reasons for these differences and to provide an explanation in its future NIRs.

B. Reference and sectoral approaches

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

33. CO_2 emissions from fuel combustion have been calculated using the reference and sectoral approaches. For the year 2004 there is a difference of –0.4 per cent in the CO_2 emissions estimate

between the reference approach and the sectoral approaches, as reported originally in the 2006 submission. The difference in fuel consumption is 1 per cent. The differences for individual fuels are generally small and were explained by Hungary during the in-country visit. The ERT encourages Hungary to better document the calculation of CO_2 emissions using the reference approach (including assumptions about energy stored) in its next NIR and to explain any differences.

2. International bunker fuels

34. Emissions from aviation bunkers are reported separately and are not included in total national emissions. Marine bunkers are not relevant because the volume of international river transport, according to Hungary, is minimal. CO_2 emissions from aviation bunkers fluctuate from year to year and Hungary is encouraged to explain these changes in its future NIRs.

3. Feedstocks and non-energy use of fuels

35. AD for non-energy use of fuels are included in the energy sector (fuel combustion (1.A)). However, emissions from this category are reported under the industrial processes sector. Hungary is encouraged, in line with the Revised 1996 IPCC Guidelines, to reallocate AD for feedstocks and non-energy use of fuels and emissions to the industrial processes sector in the interests of greater transparency. Hungary is also encouraged to document in the NIR how non-energy use of fuel has been estimated, and the amount of fuel for non-energy use used in the sectoral approach, and to implement appropriate QA procedures.

4. Country-specific issues

36. Hungary reports 20 Gg of CH_4 emissions in 2004 from wells drilled at the Great Plain subsurface waters under other – stationary (1.A.5a). This estimate is currently based on expert judgement. The ERT was informed that Hungary is planning to improve these estimates in future by collecting and analysing data from the wells. The ERT recommends Hungary to reallocate these emissions to the oil and natural gas category (1.B.2). As a follow-up to the review the ERT was informed that emissions from this category were reported separately in the CRF tables of the inventory submission prepared after the 2006 submission.

C. Key categories

1. Stationary combustion: liquid, solid and gaseous fuels – CO_2

37. Hungary has used CO_2 EFs for coal taken from the European Union (EU) emissions trading scheme (ETS) data for estimating CO_2 emissions from energy industries. The ERT welcomes this improvement and encourages Hungary to include information on QA/QC and verification procedures undertaken and to document the collection of these data better in its future NIRs.

2. Stationary combustion: liquid, solid and gaseous fuels – N_2O

38. The N_2O implied emission factors (IEFs) reported for public electricity and heat production for the complete time series (in 2004, 14 kg/TJ for liquid and solid fuels and 2.8 kg/TJ for gaseous fuels) are among the highest of reporting Parties and are much higher than the IPCC default values (0.6 kg/TJ, 1.4 kg/TJ and 0.1 kg/TJ, respectively). During the review visit Hungary explained that the EFs are the result of a literature review, but the ERT was not given information on the exact source for these EFs and how these country-specific EFs correspond to Hungarian combustion technologies. Hungary is invited either to use the IPCC default EFs or to provide better documentation to support its choice of country-specific EFs. After the in-country review, in response to the ERT's recommendations, Hungary submitted revised EFs for liquid and solid fuels for the base year and 2004. The revised EFs were derived from recently published recognized international scientific literature. For natural gas, Hungary

has provided sufficient documentation on the value used in the original submission and the ERT agreed that this value was appropriate.

3. Stationary combustion: gaseous fuels – N_2O

39. The N_2O IEF reported for gaseous fuels from iron and steel and other categories under manufacturing industries and construction for the complete time series (3.0 kg/TJ) is among the highest of the reporting Parties and much higher than the IPCC default value (0.1 kg/TJ). During the review visit Hungary explained that these EFs are the result of a literature review, but the ERT was not given information on the exact source for them or on how these country-specific EFs correspond to Hungarian combustion technologies. Hungary is encouraged either to use the IPCC default EFs or to provide better documentation to support its choice of country-specific EFs. After the in-country visit, Hungary provided adequate documentation to support the value used in the original submission and the ERT agreed that it was appropriate.

4. Road transportation: gasoline and diesel oil – N_2O

40. Hungary has used a constant IEF of 15 kg/TJ for emissions from gasoline vehicles for the complete time series. This is the highest IEF of all reporting Parties for the base year and for 2004 is among the highest. The ERT recommends Hungary to revise the EFs for all years of the time series taking into account that cars with catalytic converters probably did not exist in the base year and have been introduced gradually over time. Furthermore, Hungary should explore the possibility of implementing higher-tier methods for road transportation and use bottom-up calculations to verify the estimates derived using energy statistics.

41. Similarly, the IEF for diesel oil (6 kg/TJ) is the highest among reporting Parties and above the IPCC default range (3–4 kg/TJ) for the complete time series. Hungary is invited to justify the use of this EF or to revise it.

42. After the in-country visit, in response to the ERT's recommendations, Hungary submitted revised EFs for gasoline and diesel oil in line with the recommendations of the ERT and provided documentation as well as the rationale for choosing the revised EFs for the base year and 2004 (2.44 and 3.90 kg/TJ for gasoline and diesel, respectively, for 2004).

5. Railways: liquid fuels – CO_2

43. The CO_2 IEF values fluctuate from year to year, although fuel composition is expected to be constant. The ERT encourages Hungary to check the data and if necessary reallocate fuel possibly used for heating purposes to the appropriate category. Hungary is also encouraged to include documentation on the estimation method used for this category in its next NIR.

6. Stationary combustion: liquid fuels – CO_2

44. The CO_2 IEFs for the residential category are the lowest or among the lowest of reporting Parties for the period 1997–2004 (ranging from 63.91 t/TJ to 62.44 t/TJ) and this value decreased by 10.5 per cent between the base year and 2004. Hungary explained that this is due to changes in the fuel mix. However, this low average value is not explained by the information given in the NIR (e.g. the value for liquefied petroleum gas (LPG) there is 63.1 t/TJ). Hungary is invited to explain the reasons for these low IEFs and the decrease in this value. During the in-country visit Hungary provided additional documentation to the ERT; however, the ERT recommends Hungary to review its assumptions regarding the fraction of fuel unoxidized, in particular for LPG, in its next submission.

7. Stationary combustion: liquid, solid and gaseous fuels – N_2O

45. The N_2O IEFs for some combinations of categories and fuels, namely solid fuels (from 14.0 kg/TJ to 12.03 kg/TJ) and gaseous fuels (24.00 kg/TJ) in the residential category, and liquid (from 30.87 kg/TJ to 30.06 kg/TJ) and gaseous fuels (30.00 kg/TJ) in the agriculture/forestry/fisheries category, are among the highest of reporting Parties and much higher than the IPCC default values (1.4 kg/TJ, 0.6 kg/TJ and 0.1 kg/TJ for solid, liquid and gaseous fuels, respectively). Hungary is invited either to use the IPCC default EFs or to provide better documentation to support its choice of country-specific EFs. After the in-country visit, in response to the ERT's recommendations, Hungary submitted revised EFs for liquid, gaseous and solid fuels for the base year and 2004. The revised EFs were derived from recently published recognized international scientific literature.

8. Coal mining and handling – CH_4

46. Hungary is encouraged to better explain in the NIR the rationale for using low country-specific EFs for the period between the base year and 2004 (an almost constant EF value of 0.22 kg/t for surface mines, and EFs ranging from 4.10 to 4.48 kg/t for underground mines), which are among the lowest of reporting Parties and outside the IPCC default range (4.50–16.75 kg/t for underground mines), and to implement appropriate QA/QC procedures. Hungary is also encouraged to verify the split of the AD between surface and underground mines. Furthermore, Hungary may wish to consider including emissions from closed mines in its inventory. During the in-country visit, Hungary made additional documentation available to the ERT which increased the transparency of the country-specific EFs. Hungary is recommended to include this information in the NIR of its future submissions.

9. Oil and natural gas – CH_4

47. Hungary reports emissions from natural gas distribution together with natural gas transmission. However, the AD included in the CRF tables only include distribution. Hungary assumes the use of Western technologies in the country and uses EFs from the IPCC good practice guidance. Hungary is encouraged to collect country-specific EFs for natural gas transmission and distribution, reflecting changes in technology over time, and to increase the transparency of its reporting. As a follow-up to the review the ERT was informed that emissions from this category were reported separately in the CRF tables of the inventory submission prepared after the 2006 submission.

48. AD and CH_4 emissions from oil – distribution of oil products, and AD and CH_4, CO_2 and N_2O emissions from flaring of oil and natural gas, are reported as "NE". During the in-country visit the ERT was informed that emissions from flaring will be included in Hungary's future submissions. The ERT also encourages Hungary to estimate emissions from the distribution of oil products.

49. The IEFs for oil and gas production are much lower in 2004 than in previous years. Hungary informed the ERT that this is a mistake and that these IEFs were corrected in its inventory submission prepared after the 2006 submission.

D. Non-key categories

1. Civil aviation – CO_2

50. Emissions from domestic aviation are reported as "IE" and emissions and AD are reported under road transportation (1.A.3b). Although these emissions are small, Hungary is encouraged to report them separately in its future submissions.

2. Solid fuel transformation – CO_2, CH_4 and N_2O

51. Emissions for this category were reported using the notation key "not occurring" ("NO"). After the review the ERT was informed by Hungary that these emissions should be reported as "IE". Hungary is encouraged to provide a separate estimate for this category in its future submissions.

III. Industrial processes and solvent and other product use

A. Sector overview

52. In 2004, total GHG emissions from the industrial processes sector in Hungary amounted to 5,769.24 Gg CO_2 equivalent. The sector accounted for 7.3 per cent of total national GHG emissions in 2004. For the year 2004 the largest category was chemical industry, accounting for 43.4 per cent of the emissions from the sector, followed by mineral products (35.4 per cent), consumption of halocarbons and SF_6 (12.2 per cent) and metal production (8.9 per cent).

53. The emission trends for all gases in the Hungarian industrial processes sector show a number of inconsistencies. Hungary's NIR does not provide enough information on the overview of the sector or on the sector's contribution to overall national emissions, nor are the general trends in emissions and the drivers behind these trends discussed. To avoid having review teams continuously requesting explanations for changes in the trends of key categories in this sector, Hungary may wish to consider providing further details on such factors as (a) the economic downturn of the early 1990s and the subsequent shutting down of some industrial plants, and (b) the revamping of and/or replacement of obsolete technologies in some industrial plants, leading to high GHG emissions in the base year (averaged value for the three years 1985–1987) and drastic reductions in emissions in the early 1990s.

B. Key categories

1. Cement production – CO_2

54. In its 2006 submission, Hungary used the IPCC tier 3 methodology for the first time to estimate CO_2 emissions from this category. Using the carbonate content of the raw material, it calculated the CO_2 emissions using stoichiometric ratios. Hungary indicates in the NIR that there is a certain amount of magnesium carbonate ($MgCO_3$) in the raw material used for clinker production but it has not estimated the corresponding emissions using the appropriate stoichiometric ratios, as was done for calcium carbonate ($CaCO_3$), even though the NIR indicates that this was done. The ERT recommends that in its next submission Hungary estimate the CO_2 emissions from $MgCO_3$ in order to ensure completeness in this category.

2. Ammonia production – CO_2

55. In its 2006 submission, Hungary estimated CO_2 emissions from ammonia production for the first time, using the recommended IPCC methodology (i.e., estimating emissions from natural gas consumption). It has, however, filled in the CRF tables with AD for ammonia production. During the in-country review the ERT went through the background calculation worksheets and realized that Hungary, correctly, has used the natural gas consumption data for the CO_2 emission estimates. The ERT recommends that Hungary ensure that the appropriate AD are reflected in the CRF tables in its future submissions.

3. Nitric acid production – N_2O and CO_2

56. Hungary uses plant-specific methodologies and EFs to estimate these N_2O and CO_2 emissions. The EFs used are high compared with those of other Parties (the range is 0.00132–0.013672 t/t). Hungary explained during the initial review visit that the nitric acid plants are very old, were established

before 1975 and have GIAP technology (a technology developed by the Russian State Research and Design Institute of Nitrogen and Organic Synthesis Products), which is classified in the IPCC good practice guidance as older (pre-1975) plants that do not have non-selective catalytic reduction (NSCR). Hungary calculates the CO_2 emissions associated with the nitric acid production but does not include them in the total emissions from this category. Even though they are small compared to the N_2O emissions, the ERT recommends Hungary to include these emissions in its next submission. The uncertainty associated with the EFs used by Hungary is high (30–40 per cent). The ERT encourages Hungary to continue its efforts to measure actual N_2O emissions in order to reduce the uncertainty associated with the EFs used.

C. Non-key categories

1. Other (Carbon black) – CH_4

57. Hungary produces activated carbon but does not include CH_4 emissions from this category in the national total. During the in-country review Hungary explained that there is only one plant in the country and the AD are therefore confidential; moreover, the plant will be decommissioned in the near future. For the sake of completeness, the ERT encourages Hungary to report the CH_4 emissions from this plant until it is decommissioned. After the in-country review Hungary calculated the CH_4 emissions from this plant and confirmed that they will be included in the national total.

2. Consumption of halocarbons and SF_6 – HFCs

58. Hungary includes emissions estimates from HFC-365mfc in the inventory for 2004. However, no global warming potential (GWP) for this gas is provided by the IPCC in its second assessment report. The ERT recommends that emission estimates from this category be reported in CRF table 9 and not included in the national totals until a GWP for this gas is agreed by the UNFCCC. After the in-country review, Hungary removed emissions estimates for HFC-365mfc from the national totals.

IV. Agriculture

A. Sector overview

59. In 2004 the agriculture sector in Hungary accounted for 11.5 per cent of total national GHG emissions, with 78.5 per cent of emissions in this sector consisting of N_2O. Emissions in 2004 were 48.2 per cent lower than in the base year (averaged value for the three years 1985–1987), mainly due to large reductions in the populations of cattle, sheep, pigs and poultry after 1988 following the political changes in Hungary. Hungary's key category tier 1 level assessment reported in the NIR (which excludes LULUCF) identifies N_2O emissions from direct soil emissions, indirect emissions and manure management categories, and CH_4 emissions from enteric fermentation as key categories in 2004, accounting for 12.7 per cent[4] of total national GHG emissions. N_2O emissions from agricultural soils are the dominant category in the sector, contributing 65.5 per cent of emissions from agriculture in 2004. N_2O Direct emissions due to crop residues and indirect emissions from leaching together accounted for 45.2 per cent of reported emissions in the agricultural soils category in 2004.

60. The NIR provides only a basic description of how the inventory for the agriculture sector is compiled and it lacks much of the detail that is needed to support a complete technical assessment of the emission estimates. The ERT was informed that the agriculture chapter of Hungary's NIR is prepared in a joint effort by the Institute for Breeding and Animal Nutrition, which compiles the emissions estimates and the CRF tables, and the inventory compiler institution. Following successive recalculations and gap-filling of the CRF time series over recent submissions, a complete and consistent set of annual

[4] This value differs from the value reported in the revised estimates submitted by Hungary in the course of the review that are used in this report.

inventories is now available for the sector. All relevant emission categories and gases are accounted for and compliance with the requirements of the UNFCCC reporting guidelines is satisfactory. No recalculations are reported in the 2006 submission.

61. The methodologies and EFs used by Hungary for emissions from agriculture are largely those of the Revised 1996 IPCC Guidelines, with partial implementation of the IPCC good practice guidance. Hungary estimates emissions in a number of categories on the basis that the agricultural practices and conditions that existed in the base year matched those of Western Europe and this situation still applies. Accordingly, the relevant parameters are applied for all years of the time series, despite the general decline in agriculture in the country. Following this in-country review, the ERT was satisfied that Hungary is justified in retaining this approach. The basic AD for agriculture provided by the Hungarian Central Statistics Office (HCSO) and the Agriculture Economics Research Institute are of a high standard and the inventory compiler has worked closely with the statistical offices to ensure that the key data have been used in a consistent way over the period 1985–2004.

B. Key categories

1. Enteric fermentation – CH_4

62. This key category accounted for 1.9 per cent of national total emissions in 2004 and accounted for 16.5 per cent of emissions in the agriculture sector. High-quality data on all relevant livestock populations are provided by the HCSO, based on three separate annual surveys. The tier 1 method is applied and the EFs are the IPCC default values for dairy cattle, adjusted on the basis of annual milk yield, the IPCC West European value in the case of non-dairy cattle and the IPCC default values for developed countries for all other livestock categories. Except in the case of dairy cattle, the EFs chosen remain constant across all years.

63. Hungary's regression equation for the calculation of the CH_4 EF for dairy cattle is based on the three values given in table 4.3 of the Revised 1996 IPCC Guidelines and their corresponding milk yields. While the EFs calculated obviously lie within the range of the defaults, the Revised 1996 IPCC Guidelines give no basis for using discrete default values representing different regions of the world in the way Hungary has done. The milk yield is very high and the 30 per cent increase over the period 1985–2002 is at odds with the large overall decline in agriculture and with the statement in the NIR that there were no changes in technologies or feeding over this period that would affect emissions. It is clear that the dairy cattle population has changed considerably in regard to composition and animal numbers, and detailed information about the animals and particularly their feed is therefore needed to support the high EF for CH_4 based solely on average milk yield. During the in-country visit the ERT requested Hungary to report further information so that feed energy could be reconciled with animal type and their high levels of CH_4 production, and with the chosen value of 100 kg/year for nitrogen (N) excretion by dairy cattle. In response to the ERT's questions on this issue, the Party provided the results of a preliminary tier 2 EF analysis and additional statements regarding the development of the national dairy cattle herd, and these did substantiate the relatively high EFs used in Hungary. The relationship with milk yield maintains time-series consistency. The information provided should be elaborated in Hungary's next NIR and the tier 2 results should be applied as soon as possible.

2. Manure management – N_2O

64. This key category accounted for 12.9 per cent of emissions in the agriculture sector and for 1.5 per cent of total national emissions in 2004. Hungary applies west European rates of N-excretion for all livestock categories and retains the same distribution of excreted nitrogen per animal waste management system (AWMS) in all years. Some justification for this is provided in section 6.3.3 of the NIR. Tier 1 default EFs have been used to estimate N_2O emissions. The management of animal wastes in solid storage, which is dominated by cattle manures, accounts for more than 95 per cent of N_2O

emissions from manure management annually in Hungary. The ERT recommends Hungary to elaborate further the information provided on this category in its next NIR.

3. Direct soil emissions – N_2O

65. Direct emissions of N_2O from agricultural soils accounted for 38.9 per cent of emissions in the agriculture sector in 2004 and for 4.5 per cent of total national emissions. According to the 2006 submission, the crop residue category was the largest contributor to nitrogen inputs in 2004, and the NIR states that the input is from burning. It was established during the review that this reference to burning is incorrect, but it is not clear from the NIR how the nitrogen inputs associated with the crops listed are quantified because the production amounts and calculation parameters are not provided.

66. The contribution of crop residues to N_2O emissions in the 2006 submission appears rather high. On examining Hungary's calculation sheets, the ERT found that these emissions are overestimated due to (a) incorrect accounting for nitrogen inputs from N-fixing forage crops (see paragraph 68 below) and (b) the inclusion of grass and other fodders in the range of non-N-fixing crops that Hungary uses to quantify the total N input to soils from crop residues (F_{CR}). During the review the ERT advised Hungary that annual fodder crops would not normally produce residues to be subsequently incorporated into soil. Hungary accepted the ERT's finding and undertook to revise the estimate of F_{CR} in line with the IPCC good practice guidance. The revised emission estimates were submitted for the base year and 2004 following the review and are in accordance with the ERT's recommendation and the IPCC good practice guidance.

67. Direct N_2O emissions from animal manures have been calculated using the Revised 1996 IPCC Guidelines instead of equation 4.23 of the IPCC good practice guidance, which results in these emissions being slightly underestimated. Following the review Hungary revised its estimates for this source category and new estimates fully in line with the IPCC good practice guidance were submitted for the base year and 2004.

68. Examination of calculation sheets provided to the ERT during the review showed that forage crops make up approximately 80 per cent of the 2004 N-fixing crop production that Hungary accounts for in estimating the direct N_2O emissions associated with N-fixing. It has used the tier 1 method of the Revised 1996 IPCC Guidelines to calculate the amount of nitrogen fixed by N-fixing crops (F_{BN}) for all N-fixing crops, rather than the IPCC good practice guidance equations, resulting in an overestimation of nitrogen inputs due to N-fixing forage crops. Hungary accepted the ERT's recommendation that it revise its estimates for this category using equations 4.26 and 4.27 of the IPCC good practice guidance, and following the review submitted revised estimates in line with the ERT's recommendation for the base year and 2004 using the tier 1b method.

4. Indirect emissions – N_2O

69. The calculation sheets made available to the ERT during the review show that the N inputs from atmospheric deposition and leaching reported in CRF table 4.D are correctly and consistently estimated for the full time series using the data in CRF table 4.B(b) and the default values of fraction of synthetic fertilizer N applied to soils that volatizes as ammonia (NH_3) and nitrogen oxide (NO_X) ($Frac_{GASF}$), the fraction of livestock N excretion that volatilizes as NH_3 and NO_X ($Frac_{GASM}$), and the fraction of N input to soils that is lost through leaching and run-off ($Frac_{LEACH}$), which remain constant across all years.

70. In the 2006 submission, nitrogen leaching and run-off is the second largest source of N_2O emissions under the agricultural soils category for 2004, accounting for almost 17 per cent of total emissions in this category. The contribution from leaching appears rather high in relation to the various direct N_2O emissions in category 4.D. This is partly due to the use of the IPCC default value of 0.3 for $Frac_{LEACH}$. Hungary should reconsider how appropriate this value is given that nitrogen inputs have been

greatly reduced in recent years compared to the base year. Hungary plans to review this parameter as part of the further development of its inventory for the agriculture sector.

V. Land use, land-use change and forestry

A. Sector overview

71. In 2004, the LULUCF sector in Hungary represented a net sink of 5,518.28 Gg CO_2 equivalent, off-setting 7.0 per cent of total national emissions. The trend of CO_2 net removals by the sector shows an increase of 100.3 per cent between the base year and 2004. Hungary did not include the LULUCF sector in its key category analysis, but the secretariat identified four LULUCF key categories, namely forest land remaining forest land (5.A.1), land converted to forest land (5.A.2), cropland remaining cropland (5.B.1) and land converted to cropland (5.B.2). The ERT recommends Hungary to include the LULUCF sector in the key category analysis of its next submission. All wetlands in Hungary are protected and therefore considered unmanaged.

72. Hungary does not have a QA/QC system in place for the LULUCF sector. Uncertainties in general have not been estimated for most categories and gases; the exception is data on soil carbon content in cropland, which as reported in the NIR are very variable across the time series, mostly due to the methodology used for collecting the information and a reclassification of a large part of arable land that occurred in 1993. The ERT was informed during the in-country review that whole time series for carbon in soil will be recalculated.

73. In 2004, Hungary's reporting was incomplete because some carbon pools had not been estimated; for example, forest dead organic matter and carbon in forest soils. A model was constructed which predicted that forest soils are not sources of carbon; the ERT considers that the model should be validated with field data. Alternatively, Hungary can accept that changes in forest soil carbon are zero in the long run (tier 1 of the IPCC good practice guidance for LULUCF). Hungary's reporting in some CRF tables lacks transparency; for example, all entries for forest land converted to cropland (5.B.2) are reported as "IE", indicating that these parameters are reported under other land converted to forest land (5.A.2.5). Hungary explained to the ERT that the emissions from forest land converted to cropland were reported in the category forest land remaining forest land because it was not possible to identify the relevant land conversions. The ERT recommends Hungary to address in its next submission the problem of identifying and measuring land conversions, because of the large changes in net CO_2 emissions they might represent. Hungary should use the notation keys which best represent any particular situation, and pay particular attention to avoiding circular references. For its next inventory submission, the ERT advises Hungary to check and correct (if necessary) all the CRF tables for LULUCF.

74. A major improvement in the 2006 submission has been the calculation of the carbon accumulation data for forest land remaining forest land (5.A.1) and lands (mostly cropland and grassland) converted to forest land (5.A.2) from the base year to 2004. Hungary informed the ERT that the estimation of emissions/removals from forest land will be improved as regards the proper accounting of biomass changes in deforested lands, and of soil carbon in all forest lands, in the future. The ERT encourages Hungary to implement these improvements in its next submission.

B. Key categories

1. Forest land remaining forest land – CO_2

75. The secretariat identified forest land remaining forest land – CO_2 (5.A.1) as a key category in 2004. In this year, CO_2 removals from the category forest land remaining forest land accounted for 73.2 per cent of LULUCF CO_2 removals. The methodology used for estimating carbon stock changes in the biomass pool in this category was the stock change method adapted from the IPCC good practice guidance for LULUCF, combining both country-specific data (tier 2) and IPCC default values (tier 1).

Removals of CO_2 from the forest land category between the base year and 2004 show a linear and increasing trend (70.7 per cent). This trend shows a rate of 204 Gg CO_2/year^{-1} of carbon sequestration of old standing forests, after deduction of harvested timber and losses due to occasional and small wildfires. The sink represented by young (i.e., not mature) forests is addressed in paragraph 73.

2. Land converted to forest land – CO_2

76. The secretariat identified land converted to forest land – CO_2 (5.A.2) as a key category in 2004. This category is not disaggregated into land-use classes. Only changes in living biomass carbon stocks are reported; neither changes in carbon stocks in dead biomass nor changes in carbon stocks in soils have been estimated. Removals of CO_2 from changes in living biomass were calculated using a tier 2 method (from the IPCC good practice guidance for LULUCF) and country-specific expansion factors, and accounted for 15.1 per cent of LULUCF CO_2 removals in 2004. Between 1990 and 2004 this category showed a statistically non-significant increasing trend at a rate of 118 Gg CO_2/year. The mean removal of CO_2 for the whole period is more representative of the behaviour of this category: the mean value ± uncertainty is 444.4 Gg CO_2 ±132 per cent. This large variability is a consequence of the current imprecise identification of several land-use change areas referred to above. The implementation of a tier 2 system for identifying and tracking changes in land use will probably enable Hungary to estimate removals of CO_2 from living biomass, as well as emissions/removals of CO_2 from both changes in dead biomass stocks and changes in soils, more accurately.

3. Cropland remaining cropland – CO_2

77. The cropland category as a whole accounted for 11.7 per cent of net CO_2 removals by LULUCF in 2004. This category was identified by the secretariat as a key category in 2004. For the complete time series, only the carbon in the organic matter of cropland soils has been estimated using the tier 1 methodology from the IPCC good practice guidance for LULUCF. Changes in living biomass carbon stocks and dead biomass carbon stocks are assumed to be zero (tier 1 of the IPCC good practice guidance for LULUCF). This category accounted for 52.8 per cent of total CO_2 removals in the category cropland in 2004. Between 1990 and 2004, the behaviour of this category was highly irregular: in some years (1990, 1991, 1995, 1997 and 2003) it was a source of CO_2. From the addition of lime and other liming substances to cropland soils, 12.01 Gg of CO_2 were emitted, equivalent to 1.8 per cent of the amount of CO_2 sequestered in soil organic matter. As this category does not show a statistically significant trend between 1990 and 2004, the mean emission of CO_2 for the period best represents its characteristics: the mean value ± uncertainty is 55.7 Gg CO_2 ±134.5 per cent. The great variability in the data reflects the difficulties Hungary had and has in identifying land-use changes (both locations and size), including in the cropland category. The ERT urges Hungary to address this problem, because this is a key category which could change the estimates of the total carbon balance of the whole LULUCF category if it is thoroughly assessed.

4. Land converted to cropland – CO_2

78. The lands converted to cropland were grasslands. Changes in living biomass carbon stocks and dead biomass carbon stocks in this category are assumed to be zero (tier 1 of the IPCC good practice guidance for LULUCF). Emissions and removals have been calculated for soil carbon stock changes using a tier 1 method and default EFs. This category was identified by the secretariat as a key category in 2004. It accounted for 47.2 per cent of total CO_2 removals in the category cropland in 2004. Between 1990 and 2004, the behaviour of this category was highly irregular: in some years (1990, 1992, 1993, 1994, 1995, 1997, 1998 and 2003) it was a source of CO_2. As this category does not show a statistically significant trend between 1990 and 2004, the mean emission of CO_2 for the period best represents its characteristics: the mean value ± uncertainty is 4.5 Gg CO_2 ± 4,094 per cent. Once again, this extremely great variability in the data reflects the difficulty Hungary had and has in identifying land-use changes (both locations and size). The ERT urges Hungary to address this problem, because this is a key category

which could change the estimates of the total carbon balance of the whole LULUCF category if it is thoroughly assessed.

C. Non-key categories

Biomass burning – CH_4 and N_2O

79. Emissions of CH_4 and N_2O from slash burning are equivalent to 0.5 per cent and 0.05 per cent, respectively, of the total net removals of the LULUCF sector in 2004. They were estimated using a tier 1 method and default EFs from the IPCC good practice guidance for LULUCF. These emissions have been estimated in such a way as to maintain consistency with reporting in previous years.

VI. Waste

A. Sector overview

80. In 2004, the waste sector in Hungary accounted for 4.8 per cent of total national GHG emissions, with the category solid waste disposal on land making the largest contribution (75.4 per cent of emissions from the sector). Emissions from the sector increased by 22.3 per cent between the base year (averaged value for the three years 1985–1987) and 2004. Increasing CH_4 emissions from solid waste disposal on land (by 47.6 per cent compared to the base year) accounted for most of this change. The ERT noted that the inventory is not complete in terms of N_2O emissions from human sewage from the base year to 2004, as these are reported as "NE".

81. According to the NIR, recalculations have been done for the base year and the period 1991–2000. The ERT noted inconsistencies in the information provided in the NIR and the CRF tables, and recommends Hungary to explain clearly and in detail the rationale for the recalculations in its next NIR in order to increase the transparency of its reporting.

82. The ERT noted during the in-country review that there was no formal QA/QC system in place. Only for waste incineration are QA/QC activities performed in compliance with the ISO 9000 series. Uncertainties are estimated for all categories in the waste sector.

83. Hungary plans to improve the quality of the waste sector inventory using data from surveys which started in 2001 with the application of the National Act and Waste Management Plan. In addition, more precise data will be obtained after the entry into force of a new regulation in compliance with EU requirements. Precise data on municipal solid waste disposal sites (SWDS) were also to be completed in 2006; and Hungary informed the ERT that the data from waste-water handling will be improved with the application of a national law that introduces a new system for standardized reporting by entrepreneurs.

84. After the in-country review Hungary revised its estimates for the waste sector according to the ERT's recommendations and to be in line with the IPCC good practice guidance. Three major revisions have been made: (a) the tier 2 method has been used to estimate CH_4 emissions from SWDS; (b) estimates of N_2O emissions from human sewage have been provided for the whole time series; and (c) some parameters for the estimation of CH_4 emissions have been revised and applied to the domestic, commercial and industrial waste-water treatment-related categories. These revisions to the estimates resulted in a reduction in the estimates of total emissions by the sector of 43.5 per cent in the base year and of 19.7 per cent in 2004 compared to the 2006 inventory submission. The CRF tables with revised estimates contain IEFs that fit within the range of values that is characteristic for the region.

B. Key categories

1. Solid waste disposal on land – CH_4

85. Hungary has used a tier 1 country-specific methodology for estimating CH_4 emissions for the whole time series for this category. Estimates using the tier 1 method of the Revised 1996 IPCC Guidelines are also reported in the NIR. The results for both methods are very similar.

86. Hungary has used data on collected waste supplied by the HCSO. The ERT noted that CH_4 recovery is reported in the CRF tables from 1998 until 2004, with a significant increase in 2003. However, the NIR does not give any information on recovery. The ERT also noted that the value of degradable organic carbon (DOC) in the CRF tables should be reported according to the recommendations of the Revised 1996 IPCC Guidelines. The ERT recommends Hungary to improve the transparency of its reporting by providing more detailed explanations in its next NIR. After the in-country review, Hungary informed the ERT that it had corrected the DOC values in the CRF tables.

87. Hungary was recommended to use the tier 2 method for estimating emissions from SWDS in the last two review reports. During the in-country review the ERT was informed of the development of a database of landfill sites using a geographic information system (GIS) map, and encouraged Hungary to make the best possible use of the existing information, which will support the use of higher-tier methods.

88. After the in-country review Hungary revised its estimates of emissions from SWDS using a tier 2 method in line with the IPCC good practice guidance. The revision of the estimates led to reductions in estimated CH_4 emissions from SWDS by 51.3 per cent in the base year and by 19.3 per cent in 2004 compared to the 2006 inventory submission.

89. The ERT welcomes Hungary's plan to further improve the quality of the inventory by using actual waste composition data supplied by the counties instead of those currently used, which refer only to Budapest.

2. Waste-water handling – CH_4

90. Hungary has used the default method of the Revised 1996 IPCC Guidelines to estimate CH_4 emissions from domestic, commercial and industrial waste-water handling, using population data and data reported by regional inspectorates.

91. Hungary has used the IPCC default value of 0.25 kg/kg degradable organic component as the EF and a methane conversion factor (MCF) of 1. The NIR reports that part of the municipal waste-water streams undergoes aerobic degradation without methane production. During the in-country review the ERT found that this fraction of waste water treated aerobically had not been taken into account in the estimation, which may lead to emissions being overestimated. The ERT recommended Hungary to recalculate CH_4 emissions from domestic, commercial and industrial waste water taking into account the existing country-specific data on fractions of waste water treated. In addition, the ERT recommended Hungary to use the maximum methane producing capacity (Bo) in terms of biochemical oxygen demand (BOD) instead of chemical oxygen demand (COD).

92. After the in-country review, Hungary revised its estimates of emissions from domestic and commercial waste-water handling in accordance with the ERT's recommendations and used the same improved principle for estimating industrial waste water emissions. This revision led to reductions in the estimates of CH_4 emissions in this category by 39.5 per cent in the base year and by 43.3 per cent in 2004 compared with the 2006 inventory submission. For these revised estimates Hungary used MCF values of 0.5 for septic systems and 0.15 for treatment plants. The BOD value was changed from 50 to 60 g/person/day, and the Bo from 0.25 to 0.6 kg CH_4/kg BOD, to be in line with the IPCC good practice guidance. The ERT recommends that Hungary report the changes to these parameters in its next NIR.

C. Non-key categories

1. Waste-water handling – N_2O

93. The ERT noted that N_2O emissions from human sewage are not estimated in the 2006 inventory, as previous review reports have pointed out. After the in-country review, however, Hungary included estimates of N_2O emissions from human sewage for the whole time series in its revised CRF tables. This led to an increase of estimated N_2O emissions in the base year and 2004 by 0.67 Gg. These increases are equivalent to 3.8 per cent in the base year and 4.4 per cent in 2004 in the total emissions of the waste sector compared to the 2006 submission.

94. These emissions were decreasing in the early 1990s but showing an increasing trend from 1998 due to the changes in the per capita protein consumption as reported by the Hungarian Agricultural Economics Research Institute and the Food and Agriculture Organization of the United Nations.

2. Waste incineration – N_2O

95. The N_2O emissions reported come mainly from the only municipal incineration plant with power co-generation in the country, located in Budapest. This plant has been in operation since 1976. The time series of N_2O emissions is affected by the reconstruction of this plant from time to time. Emissions in 1990 were lower in terms of CO_2 and higher in terms of N_2O than they were in 2004, due to the reconstruction of the plant in recent years mentioned above. For the year 2004 industrial waste incineration was also taken into account, although these data are not complete.

96. Since 24 MW of electricity are produced in this plant from waste incineration, the ERT recommends Hungary to allocate these emissions to the energy sector. The ERT also encourages Hungary to use plant-specific values for N_2O emissions from the flue gas measurements of the incinerator to improve the quality of the inventory in its future submissions.

VII. Conclusions and recommendations

97. Hungary has provided its GHG inventory data for the base year (the average of the three years 1985, 1986 and 1987) and the years 1985–2004, and included most of the tables required with data on all relevant gases and categories. Hungary's GHG inventory is in general accurate, as defined in the UNFCCC reporting guidelines and is consistent with the Revised 1996 IPCC Guidelines and the IPCC good practice guidance.

98. During the in-country review the ERT identified a small number of categories where the methods or EFs used were not fully in accordance with the IPCC good practice guidance and might lead to overestimations of emissions in the base year or underestimations of emissions in the latest years. The ERT recommended that Hungary revise its estimates for these categories. After the in-country review, Hungary provided revised estimates for these categories for the base year and 2004 in accordance with the recommendations of the ERT and in line with the IPCC good practice guidance.

99. In the course of the review, the ERT formulated a number of recommendations relating to the completeness and transparency of Hungary's GHG inventory submission. The key recommendations[5] are that Hungary should:

- Elaborate the relevant sections of the NIR and provide summary information on the legal, institutional and procedural arrangements, as well as information on QA/QC activities for the inventory preparation, in its next NIR;

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

- Provide a more detailed description of the approaches taken and the underlying assumptions used for the uncertainty estimates in the NIR;
- Improve transparency of estimates by providing in its NIR more precise descriptions and documentation of methodologies and EFs that differ from the IPCC, and better explain the fluctuations in IEFs;
- Improve consistency by cross-checking information provided in the NIR with the information in the CRF tables;
- Strengthen its institutional capacity by ensuring adequate long-term financial support for inventory-related contracts and arrangements and by encouraging inventory experts to attend the UNFCCC training courses;
- Collect AD and develop well documented country-specific EFs for use with higher tier methods for key categories.

Annex

Documents and information used during the review

A. Reference documents

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B. Additional information provided by the Party

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