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REPORT OF THE INDIVIDUAL REVIEW OF THE GREENHOUSE GAS INVENTORY OF HUNGARY SUBMITTED IN THE YEAR 2002[1]

(In-country review)

I. OVERVIEW

A. Introduction

1. The Conference of the Parties (COP), by its decisions 6/CP.5 and 34/CP.7, requested the secretariat to conduct individual reviews of greenhouse gas (GHG) inventories submitted by Parties included in Annex I to the Convention (Annex I Parties), according to the UNFCCC guidelines for the technical review of GHG inventories from Annex I Parties, hereinafter referred to as the review guidelines.[2] The principle objectives[3] of the review of the GHG inventories are to ensure that the COP has adequate information on GHG inventories and GHG emission trends, and to examine the information submitted by Annex I Parties in accordance with the UNFCCC reporting guidelines[4] for consistency with those guidelines.

2. Hungary volunteered for an individual in-country review of its 2002 inventory submission, which took place from 23 to 27 September 2002 in Budapest, Hungary. The in-country review was carried out by a team of nominated experts from the roster of experts, and coordinated by the secretariat. Experts participating in the review were as follows: generalist – Mr. Klaus Radunsky (Austria), energy – Mr. Mario Contaldi (Italy), industrial processes – Mr. Luis Conde Alvarez (Mexico), agriculture – Mr. Lin Erda (China), land-use change and forestry – Mr. Wojciech Galinski (Poland), waste and fugitive emissions from fuels – Ms. Elizabeth Scheehle (United States of America). Mr. Lin Erda and Mr. Mario Contaldi were the lead reviewers of this review. The review was coordinated by Ms. Rocio Lichte (UNFCCC secretariat).

3. Three additional inventory experts from countries with economies in transition who had, so far, not participated in the 2000/2001 trial period review process were invited to this review to gain relevant experience. The observer experts were Mr. Krzysztof Olendrzynski (Poland), Mr. Vlad Trusca (Romania) and Mr. Heorhiy Veremiychyk (Ukraine).

4. At the beginning of the review, the host country officials and experts provided a general overview of inventory preparation, including institutional arrangements. Thereafter, sectoral sessions were conducted in parallel. During these sessions, national experts responsible for the respective sectors clarified key issues relating to inventory preparation and this was followed by a question and answer session. Some answers which could not be provided immediately were submitted to the team in the

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[1] In the symbol for this document, 2002 refers to the year in which the inventory was submitted, and not to the year of publication. The number (2) indicates that this is an in-country review report.

[2] For the UNFCCC review guidelines and decision 6/CP.5 see document FCCC/CP/1999/7, pages 109 to 114 and 121 to 122, respectively.

[3] For the objectives of the review of GHG inventories see document FCCC/CP/1999/7, page 109, paragraph 2.

[4] 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.

course of the week. Hungary facilitated the work of the expert review team (ERT) significantly by providing interpreters whenever necessary.[5]

5. In accordance with the UNFCCC review guidelines, a draft version of this report was communicated to the Government of Hungary, which provided comments which were considered and incorporated, as appropriate, in this final version of the report.

B. Inventory submission and other sources of information

1. National inventory report (NIR) and common reporting format (CRF)

6. Hungary submitted an NIR and CRF tables for the year 2000 on 2 May 2002, in hard and electronic copy. In addition, as part of its inventory submission, the Party provided worksheets from the Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories (hereinafter referred to as the IPCC Guidelines) and input data sheets, which were also considered by the ERT. Where necessary, the ERT also used previous years' submissions, such as CRF tables for the years 1998 and 1999, and a report entitled "Information on Climate Change" (similar to an NIR), which was submitted in 2001.

2. Other sources of information

7. The ERT used the status report 2002, parts I and II of the draft 2002 synthesis and assessment (S&A) report, together with the Party's response, and the preliminary key source analysis[6] prepared by the secretariat. The status and S&A reports for previous years were provided for information purposes. Other sources of information used during the review were the UNFCCC reporting and review guidelines and the draft review handbook, which provides additional guidance to ERTs in conducting review activities.

8. During the review the host country provided the ERT with additional information sources. These documents are not part of the inventory submission. The full list of materials used during the review is provided in the annex to this report.

C. Emission profile, trends and key sources

1. Emission profile

9. In the year 2000, the most important GHG in Hungary was carbon dioxide (CO_2), contributing 70 per cent to total[7] national GHG emissions expressed in CO_2 equivalent, followed by nitrous oxide (N_2O) 15 per cent and methane (CH_4) 14 per cent. Hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6) contributed 0.69 per cent of the country's overall GHG emissions. The energy sector accounted for 74 per cent of total GHG emissions followed by agriculture, 17 per cent, and waste and industrial processes, each 4.5 per cent.

2. Emission trends

10. As a country with an economy in transition (EIT), Hungary chose to use the average of the years 1985–1987 as its base year.[8] In the base year, total GHG emissions (excluding land-use change and forestry (LUCF)) amounted to 101,633 Gg CO_2 equivalent, which decreased by 17 per cent by the year 2000. However, any trend analysis in this report is indicative only and has to be considered with care due to the overall inconsistency in the time series of the current Hungarian GHG inventory, as

[5] None of the ERT members were familiar with the Hungarian language and also several of the Hungarian experts did not speak English.

[6] The preliminary key sources identified by the secretariat for Hungary are shown in table 1 of this report.

[7] In this report, the term total emissions refers to the aggregated national GHG emissions expressed in terms of CO_2 equivalent excluding land-use change and forestry, unless otherwise specified.

[8] According to the provisions of Article 4.6 of the Convention and decisions 9/CP.2 and 11/CP.4, Hungary, as an Annex I Party undergoing the process of transition to a market economy, is allowed to use the average of 1985–1987 as its base year.

explained in paragraph 19 below. Between the base year and 2000, CO_2 emissions decreased by 29 per cent, due mainly to decreased energy emissions from 1.A.1 Energy industries and 1.A.4 Other sectors. CH_4 emissions decreased during the same period by 17 per cent due mainly to fugitive emissions from fuels and agriculture, while N_2O emissions increased by 217 per cent over the same period due to a change in methodology for agriculture. For HFCs, PFCs and SF_6, the trend in emissions could be assessed only from 1998 to 2000 due to a lack of data for other years. HFC emissions decreased by 12 per cent (however, the ratio of potential to actual emissions was changed during this period from 42.6 in 1998 to 27.9 in 2000), PFC emissions decreased by 64 per cent and SF_6 emissions by 15 per cent.

3. Key sources

11. As part of its 2002 submission, Hungary reported a tier 1 key source analysis (level assessment only). The key source analysis performed by Hungary and the secretariat produced different results because Hungary based its analysis on table Summary 2 of the CRF, which, among other differences, does not take the fuel split into account. Although Hungary is aware of the underlying rationale of the key source analysis, due to a limitation of resources the key source is not driving an inventory improvement programme. However, Hungary indicated in its draft proposal for a capacity building project[9] that the application of country-specific and technology-specific emission factors as recommended by the IPCC good practice guidance is a specific national priority.

Table 1. Key sources Hungary: level assessment (UNFCCC secretariat)[(a), (b)]

Key source	Gas	Level assessment %	Cumulative total %
Stationary combustion: gas	CO_2	28.4	28
Stationary combustion: coal	CO_2	17.5	46
Direct N_2O emissions from agricultural soils	N_2O	11.0	57
Mobile combustion: road vehicles	CO_2	9.8	67
Stationary combustion: oil	CO_2	8.4	75
Fugitive emissions: oil and gas operations	CH_4	4.7	80
Solid waste disposal sites	CH_4	2.3	82
Indirect N_2O from nitrogen used in agriculture	N_2O	2.3	84
Fugitive emissions: coal mining and handling	CH_4	1.9	86
Enteric fermentation in domestic livestock	CH_4	1.9	88
Cement production	CO_2	1.9	90
Waste-water handling	CH_4	1.3	91
Other transportation	CO_2	1.0	92
Manure management	N_2O	0.9	93
Manure management	CH_4	0.8	94
Stationary combustion	CO_2	0.8	95

(a) The UNFCCC secretariat has identified, for each Party, those source categories that are *key sources* in terms of their absolute level of emissions, applying the tier 1 level assessment as described in the IPCC good practice guidance. Key sources were also identified according to the tier 1 trend assessment for those Parties that provided a full CRF for the base year. The key sources presented in this report are based on the secretariat's preliminary key source assessment. They might differ from key sources that may be identified by the Party itself.

(b) A key source analysis based upon a trend assessment could not be performed due to a lack of emission data for the base year. The key source analysis would probably lead to different results if the suggestions of the ERT for specific sources were taken into account by Hungary in its inventory.

[9] This project has been initiated in implementation of decision 3/CP.7, which focuses on self-assessment for capacity building needs, and is expected to be financed partly by the GEF (Global Environmental Facility).

Table 2. GHG emissions by gas, base year (1985–1987) – 2000 (Gg CO_2 equivalent)

GHGs	Base year [a]	*1985*	*1986*	*1987*	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
CO_2 (with LUCF)	80,579	*NA*	*NA*	*NA*	NA	NA	67,206	64,152	56,734	56,128	54,376	54,960	56,544	54,688	53,189	55,616,44	55,434
CO_2 (without LUCF)	83,676	*NA*	*NA*	*NA*	NA	NA	71,673	67,390	60,557	60,826	59,196	59,758	60,475	58,893	57,600	60,116,52	59,445
CH_4	13,951	*NA*	*NA*	*NA*	NA	NA	11,436	19,196	16,977	16,633	16,299	16,624	17,125	16,599	14,271	14,342	11,613
N_2O	4,005	*NA*	*NA*	*NA*	NA	NA	3,518	1,317	1,542	1,514	1,665	1,533	1,583	1,360	10,862	11,257	12,698
HFCs	NE	*NE*	*NE*	*NE*	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	154	154	135
PFCs	NE	*NE*	*NE*	*NE*	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	597	574	215
SF_6	NE	*NE*	*NE*	*NE*	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	201	101	232
Total (with CO_2 from LUCF)	98,535	*NA*	*NA*	*NA*	NA	NA	82,161	84,666	75,255	74,276	72,341	73,118	75,252	72,648	79,276	82,046	80,327
Total (without CO_2 from LUCF)	101,632	*NA*	*NA*	*NA*	NA	NA	86,628	87,905	79,077	78,974	77,161	77,916	79,183	76,853	83,687	86,546	84,338

Table 3. GHG emissions by sector, base year (1985–1987) – 2000 (Gg CO_2 equivalent)

GHG SOURCE AND SINK CATEGORIES	Base year[a]	*1985*	*1986*	*1987*	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
1. Energy	92,255	*NA*	*NA*	*NA*	NA	NA	78,156	76,330	68,231	68,414	66,549	67,398	68,587	66,343	63,848	65,267	62,100
2. Industrial processes	3,587	*NA*	*NA*	*NA*	NA	NA	3,568	1,383	1,168	1,319	1,397	1,438	1,548	1,588	3,125	3,893	3,826
3. Solvent and other product use	NE	*NE*	*NE*	*NE*	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	28	32	29
4. Agriculture	5,790	*NA*	*NA*	*NA*	NA	NA	4,904	4,042	3,535	3,110	3,095	2,972	2,953	2,842	13,184	13,200	14,455
5. LUCF	-3,097	*NA*	*NA*	*NA*	NA	NA	-4,467	-3,232	-3,816	-4,692	-4,814	-4,791	-3,924	-4,198	-4,405	-4,494	-4,004
6. Waste	NE	*NE*	*NE*	*NE*	NE	NE	NE	6,142	6,135	6,124	6,112	6,100	6,087	6,073	3,495	4,147	3,920
7. Other	NE	*NE*	*NE*	*NE*	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE

Notes :

NA means that the data were not available to the ERT; however, according to the national experts, they have been calculated by Hungary.

NE means not estimated by Hungary.

[a] Average 1985 - 1987. Italic font indicates the years whose data are averaged to estimate the value for the base year.

Table 4. CO_2, CH_4 and N_2O national annual emissions: 1980–2000 (Hungarian National Emission Database)[(a)]

	1980	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
N_2O national annual emissions, Gg																	
Total from combustion	10.5	10.6	10.5	10.8	10.4	10.1	9.3	9.3	8.5	8.9	8.7	8.9	9.2	9.0	8.7	8.9	8.6
Other	36.2	36.8					32.2	27.2	24.7	24.9	26.1	25.5	26.7	26.7	26.6	26.2	26.6
Total	46.7	47.4					41.5	36.5	33.3	33.8	34.8	34.3	35.9	35.7	35.3	35.1	35.2
CO_2 national annual emissions, Gg																	
Total from combustion	92,053.7	88,832.7	87,036.3	87,411.1	84,464.4	80,862.2	76,046.9	72,415.1	65,929.5	65,656.9	63,943.3	63,451.8	67,055.1	64,782.2	62,357.6	62,229.9	59,411.0
Other	26,753.0	25,578.1					24,491.7	21,282.3	20,143.7	19,336.7	18,787.8	19,299.2	19,285.9	19,034.2	19,607.0	19,256.8	19,368.1
Total	118,806.7	114,410.8					100,538.6	93,697.4	86,073.2	84,993.6	82,731.1	82751	86,341.1	83,816.4	81,964.6	81,486.7	78,779.1
CH_4 national annual emissions, Gg																	
Total from combustion	26.5	27.8	25.3	24.8	24.8	22.8	17.9	18.5	14.8	15.0	15.7	16.1	14.0	13.2	11.8	12.1	12.6
Other	702.1	750.3					791.7	728.2	749.3	711.8	703.3	720.4	707..3	693.4	719.6	684.3	716.2
Total	728.6	778.1					809.7	746.7	764.1	726.8	719.1	736.5	721.4	706.5	731.4	696.4	728.9
From population and soil	282.8	283.2					282.9	282.3	276.8	276.7	277.7	278.7	278.4	280.5	280.3	278.8	284.5
Subtotal	1,011.4	1,061.2					1,092.5	1,029.1	1,040.9	1,003.5	996.8	1,015.2	999.8	987.1	1,011.7	975.2	1,013.4

[(a)] The data shown in this table originate from the Hungarian National Emission Database, which, independently from the national inventory, compiles emission data from 1980 onwards. Although the disaggregation of sources does not correspond to the IPCC categorization, these data were provided to the ERT for comparison purposes and have been reproduced in this report.

D. General assessment of the inventory

12. The national inventory submitted by Hungary is still not fully in conformity with the UNFCCC reporting guidelines, due mainly to the lack of complete CRF tables for the entire time series and to other issues identified by the ERT and explained in paragraphs 14–27 below. Progress has; however, been made since the 2000 inventory submission given that Hungary submitted an NIR in the year 2002 for the first time.

13. The methodology used to estimate GHG emissions is consistent with the Revised 1996 IPCC Guidelines only for the years 1998, 1999 and 2000 but not for the previous years, including the base year (average from 1985 to 1987), for which earlier versions of the IPCC Guidelines were used. The IPCC good practice guidance has been applied only partially;[10] for example, for almost all sources, including key sources, only the IPCC default methodology has been used in combination with IPCC default emission factors. For some sources even simpler country-specific methods have been used. A more detailed assessment is provided in sections II–VI of this report.

1. Completeness

14. The inventory for the years 1998 to 2000 is fairly complete with the exception of some sources in the industrial sector, including some subcategories for consumption of halocarbons and SF_6 and some other probably minor sources. More emission data are missing in earlier years; for example, no data relating to halocarbons are available for any years before 1998, no data for waste and international bunkers have been provided for before 1991 and no emission data have been provided for 1988 and 1989. The data cover the total area of Hungary and thus the inventory can be considered to be complete with regard to geographic coverage.

15. CRF tables have been submitted only for the years 1998–2000 but not for the earlier years, including the base year (average 1985-1987). In addition to the CRF tables, Hungary submitted IPCC worksheets for the years 1998 and 1999 as part of its 2000 and 2001 submissions, respectively. IPCC worksheets for the year 2000, though not part of the 2002 submission, were made available to the ERT during the visit.

16. The NIR provides useful information but lacks the necessary detail, such as with regard to the activity data underlying the estimates and how these are linked to national statistical data or with regard to national emission factors (used to calculate emissions of halocarbons and SF_6, for instance) or which default IPCC emission factors have actually been used. In general, background information with regard to specific methodologies (such as process emissions from the iron and steel industry and the aluminium industry) and assumptions (for example in the waste sector) as well as more detailed information on anticipated future improvements in methodologies were not addressed in the NIR.

2. Transparency

17. Transparency has improved compared to previous submissions, since an NIR has been submitted. However, the lack of a full time series of CRF tables for the base year (average 1985-1987) up to the year 1997, as well as the lack of detail in the NIR, still limit transparency, although the IPCC worksheets, where available, provide useful details. The in-country review helped assessment of the inventory in more detail beyond that provided in the submission but a lack of adequate documentation, as well as the availability of background literature in Hungarian only, did not allow replication of more complex procedures, such as for calculation of the emissions of halocarbon or emissions of the steel industry. Another limitation was the confidentiality of some production data (e.g. nitric acid production). External

[10] According to the conclusions of the Subsidiary Body for Scientific and Technological Advice (SBSTA) at its twelfth session, Annex I Parties with economies in transition may phase in the good practice guidance two years later than other Annex I Parties.

sources have not been referenced in the NIR. The ERT noted the lack of transparency, especially with regard to the base year (average 1985-1987), for which no emission estimates on a year-by-year basis, but only averaged estimates were available to the ERT. Due to the limited documentation available, no detailed understanding of the methods and assumptions used was possible for any sources without explanation from the country's experts during the visit.

18. In addition to the NIR Hungary provided, for each IPCC source category, an input data sheet, which gives brief information on the following: source of activity data and emission factors, method used, data gaps, if any, suggestions for future improvements, changes compared to the previous year, uncertainties, and information on any other issues (such as confidentiality). However, the degree of completion of these sheets differs among the various source categories.

3. Recalculations and time-series consistency

19. The ERT noted that recalculations had not been undertaken due to limited resources. Given the changes in compiling the inventory over the years, this introduces a considerable inconsistency in the time series. However, in its subsequent submission Hungary tried as far as possible to take into account the recommendations of previous inventory reviews (although limited by availability of resources and data). Hungary is well aware of the lack of consistency and therefore high priority is given to preparing a consistent time series. It also plans to take any recommendations included in this report into account in the recalculation of the whole time series from the base year (average 1985 – 1987) and onwards. The ERT acknowledges that the planned capacity building project addresses this issue in an appropriate manner with respect to resources and time required. Due to the scope and nature of this task, it is expected that Hungary will be in a position to submit a consistent time series fulfilling UNFCCC requirements only after the year 2005.

4. Uncertainties

20. Hungary provided qualitative information on uncertainties (differentiating between high, medium and low) which is included in the NIR and IPCC input data sheets. This information is based on expert judgement. No additional background information or documentation is available to facilitate understanding of the underlying assumptions and the expert judgement made.

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

21. Although the NIR does not mention verification beyond the reference approach, the ERT acknowledges that it has been common practice by Hungary to compare the emission data for CO_2 and CH_4 as estimated according to the IPCC Guidelines with emission data as estimated on the basis of a national methodology which uses a different reporting format more compatible with the national energy balance. The results of this verification for the year 1999 were made available during the review. In addition, some energy data included in the national energy balance had been verified by comparison with independently collected data. Beyond that verification, no external verification has been made for any sector and also internal QA/QC has not been applied, due to a lack of resources. However, the ERT noted a formal accreditation of the analytical laboratory operated by the Institute for Environmental Management (IEM) under ISO 9000. This seems to be a good basis for the further improvement which is necessary in order to fully implement the IPCC good practice guidance in this regard.

6. Institutional arrangements

22. During the visit, Hungary presented the institutional arrangements for preparation of the inventory. The IEM, which is contracted by the Ministry for the Environment each year separately, has had overall responsibility for the national GHG inventory since 1998, and subcontracts other persons or institutes if necessary and if funding is available. Prior to 1998 the GHG emission inventory was prepared by the System Expert Limited Liability Company. The following agencies/institutions provided information and data necessary for the preparation of the 2000 inventory: Ministry of

Agriculture, Institute for Traffic Science, Hungarian Central Statistical Office, Hungarian Customs and Finance Guard, the Energy Centre, the Emission Information System (EMIR), and the Hungarian Energy Office, as well as industrial associations and plant operators. The ERT noted that the status and the specific tasks of the IEM lack a sound legal basis as does funding, and stressed the need for a long-term arrangement. In addition, the ERT noted the linkage between confidentiality issues, record keeping and archiving and institutional arrangements (see also paragraph 17 on transparency and paragraph 23 on record keeping and archiving). In this context the ERT believes that the implementation of the EPER[11] reporting requirements under European Union (EU) law by the IEM may be very helpful for the further improvement of reporting under the UNFCCC; for example, it might help to overcome problems with regard to confidentiality.

7. Record keeping and archiving

23. Hungary has not yet introduced a centralized archiving system. The ERT noted that the IEM is aware of the problems associated with the lack of such a system (especially in the context of implementation of any future requirements under the Kyoto Protocol). At the IEM some historic data (such as the national energy balance) are archived as hard copy, while other data are available in electronic form only. No compilation of records and/or archives of other data which are relevant as input data for the preparation of the emission inventory are available at the IEM. However, the national experts expressed their intention to establish a complete centralized archiving system, which will also take security issues into account, provided that the necessary funding is available.

8. Issues relating to previous reviews

24. The ERT noted the progress made by Hungary since its submission of the year 2000 in meeting the standards for inventory preparation and reporting under the UNFCCC, for instance by submitting an NIR for the first time. However, many other important reporting requirements, such as a full set of data in the CRF for the whole time series including the base year, could not be fulfilled due to the lack of resources (see also paragraph 19 on time series consistency).

25. Although an NIR was submitted in 2002, it does not include all the necessary information, such as recalculations, additional information on feedstocks, or a separate section clearly identifying changes undertaken with respect to the previous years. Issues already identified in earlier reports could not be fully addressed (see FCCC/WEB/IRI(3)/2000/HUN). Pending availability of resources, it is planned to eliminate these significant shortcomings in the future.

26. The ERT also noted that gaps in the emission data already identified in the above-mentioned review report have not since been closed. This relates, for example, to domestic consumption for aviation, subsectors in the industrial sector (such as limestone and dolomite use) and CH_4 emissions from soil in agriculture.

27. With respect to the sector-specific findings addressed in the draft 2002 S&A report, see sections II–VI of this report.

E. Areas for further improvement

1. Issues identified by the Party

28. The NIR provides information about a capacity building project about which some further details have been brought to the attention of the ERT. According to this written draft proposal, Hungary plans to undertake the following in order to improve the quality of its GHG inventories:

(a) Recalculation to ensure consistency and reliability of the data reported up to 1997;

[11] EPER: European Polluting Emissions Register.

(b) Application of country-specific and technology-specific emission factors for the relevant technologies, as recommended by the IPCC good practice guidance;

(c) Setting up of regulation of procedures (legal requirements, and so on).

The ERT noted that the process of how to proceed further with the capacity building project has not yet been decided.

29. The NIR highlights the need to establish a consistent time series. Hungary confirmed in its response to the draft 2002 S&A report its intention to undertake the necessary recalculations.

2. Issues identified by the ERT

30. The ERT fully supports the areas for improvement raised by Hungary and confirms their priority. In addition, the ERT identifies the following major areas for improvement relating to cross-cutting issues in the inventory:

(a) Preparation of a detailed schedule for implementation of the recalculation project, giving priority to the emissions of the base year;

(b) Preparation of a consistent time series starting from the year 1985, including calculation for the base year;

(c) Improvement of the key source analysis by using emission data disaggregated by fuel;

(d) Addition of key sources based upon trend assessment (this assumes that CRF tables for the base year are available);

(e) Development of a long-term source improvement plan based on key source analysis and the need to reflect in the emission estimates the impact of domestic policies and measures;

(f) Assessment of the availability of input data for key source categories in order to apply higher tier methods and collection of input data, if possible;

(g) Application of higher tier methods (tier 2) for key sources provided that the necessary input data are available;

(h) Removal of any barriers for transfer of confidential data to the IEM including those relating to information on fuel consumption and production by individual plants;

(i) Improvement of the intergovernmental relationships in order to establish a regular and complete transfer of the input data needed;

(j) Provision of quantified uncertainty estimates for key sources;

(k) Improved transparency through the provision of a more detailed NIR, including more precise descriptions of methodologies differing from those of the IPCC;

(l) Improved transparency with regard to the use of the data included in the national energy balance;

(m) Creation of a QA/QC management system to include data checks by staff involved in the various steps of the compilation process;

(n) Establishment of central documentation and archiving;

(o) Increased participation in ERTs of experts from Hungary.

II. ENERGY

A. Sector overview

31. This sector, including fugitive emissions, has contributed about 90.7 per cent to aggregate GHG emissions in the base year. In the period 1998–2000, this sector contributes a lower share, 76–74 per cent. Emissions from the energy sector have reduced by 33 per cent between the base year and 2000, while total emissions have decreased by only 17 per cent during that period. Emission reductions in the energy sector are the main driver behind the emission reduction trend in Hungary. However, any trend assessment in this report is indicative only, given that the time series is not considered to have been estimated in a consistent manner (see also paragraphs 10 and 19 of the overview).

32. Coverage of source categories in the energy sector is in line with the reporting requirements. Due to a lack of a comprehensive time series, the ERT has concentrated its efforts on the year 2000, looking for the link between basic energy data and national statistics, implied emission factors (IEF) and coverage of the various subsectors.

33. IEFs that appeared to be out of range during the previous review stages were all checked with the Party experts. In all cases the reported data were in line with reporting guidelines but there is scope for improved reporting. In most cases it appears that either the inclusion of inappropriate fuels (such as coal derived gases mixed with natural gas) has resulted in a very high IEF or, in the case of low IEF, it was due to the presence in the activity data of relevant quantities of energy used for "non-energy use". Provisions for correcting this situation were discussed with the Party:

(a) The reporting guidelines require only a declaration as to where these gases are reported; so the 2000 inventory is consistent with these guidelines;

(b) For consistency with the reference approach (it must be valid for every type of fuel), coal-derived gases should be added to the solid fuel row. The usual practice of other Annex I Parties is to add up coal-derived gases to the solid fuels row and refinery gases to the liquid fuel row.

34. A few minor reallocations of emissions are required: agriculture machinery fuel reported in "other transportation" should be reallocated to section 1.A.4.c and "unaccounted for" natural gas reported in section 1.A.5 should be reallocated to section 1.A.4.a/b.

1. Completeness

35. The CRF includes estimates of all gases and sources of emissions from the energy sector, as recommended by the IPCC Guidelines. For fuel combustion CH_4 and N_2O emissions, no complete and disaggregated time series according to subsources (1.A.1 – 1.A.5) have been presented in the trend tables (except at the summary level), due to unavailability of the CRF for the base year and the period 1990–1997. Reporting of the energy inventory for 2000 appears to be more complete than that for 1998 and 1999 with respect to additional information required and the use of documentation boxes.

2. Transparency

36. The NIR does not include disaggregated emission factors and activity data underlying the estimates. Moreover, no information is included as to how the original data from the energy balance is transformed into the IPCC formats, for example in the form of a transformation matrix, which has been requested from the Party. The energy balances used for years 1998, 1999 and 2000 were made available to the ERT during the visit.

3. Methodologies, emission factors and activity data

37. Hungary uses the default IPCC tier 1 methodology. However, the quality of the data in the energy balance (with reference to fuel details and to subsector allocation) would allow the country to use tier 2 methodology provided that:

(a) The energy balances uncertainty is properly assessed at source by source level, according to standard statistical practice in other Annex I Parties;

(b) A consistent time series of data is available and verification of emission factors is performed according to the carbon content of fuels.

38. Hungary uses default IPCC emission factors. For the CO_2 emission factors for fuels, Hungary refers to table I–1 of the IPCC Guidelines, Volume 3. For CH_4 and N_2O, Hungary also uses default emission factors. For N_2O in particular, these factors are consistently lower than the average emission factors reported by many other European countries. The Party explains that it compared emission factors from the CORINAIR[12] methodology, upon which many European countries build their inventories, with the IPCC default emission factors. CORINAIR emission factors are always higher than those of the IPCC, the differences ranging from a factor of two to a factor of 100, but are unexplained by either of the two methodologies. According to the IPCC good practice guidance, uncertainties in the estimated emissions of N_2O are very high and can be more than +/-50 per cent. Hungary has decided always to use the IPCC default factors. The comparison study has been made available to the ERT.

39. For energy, most of the activity data are derived from the *Energy Statistical Year-Book 2000* (Energiagazdalkodasi Statisztikai Evkönyv; "Energia Központ" Kht. Energia Informacios Igazgatosaga 1092 Budapest, Raday u.42–44) from the Energy Efficiency, Environment and Energy Information Agency Non-profit Company (hereinafter referred to as the Energy Centre). Other data, and specifically a consistent time series that includes activity data for 1985, 1990 and for 1995–2000, are available in the following publication: Environmental statistical data of Hungary, 2000 (Kornyezetstatisztikai adatok) – Hungarian Central Statistical Office and in the statistical office yearly reports. Further data are available in "Data on Hungary's environment", several years, edited by the Ministry for the Environment and prepared by IEM with emission and energy data collected from main industrial sites (point and area sources for the EMEP grid, Convention on long-range transboundary air pollution) and in the electrical board reports.

40. Energy data used for the inventory are consistent with those reported to the International Energy Agency (IEA).

41. A detailed list of primary production and of imported fuels in 2000 was made available to the ERT. The year 2000 consumption data at sectoral level, with a very detailed subdivision by fuel and by sector, was also made available to the ERT. This data set is in line with the IPCC good practice guidance.

4. Recalculations and time-series consistency

42. For the years prior to 1998 and the base year, inconsistencies in the emission time series were found, *inter alia*, in CRF 2000, table 10s1, source 1.A.5. Data in the CRF format are available only for 1998, 1999 and 2000. Hungary has explained that a proper recalculation of the entire time series and the base year using the CRF could not be performed owing to a lack of resources at IEM. A comprehensive list of energy data exists at the statistical office, but it requires extensive upgrading work due to the different sector aggregation at the sectoral level due to changes in the reporting system during the past 15 years.

43. The published time series of quite complete energy data that includes the years 1985 and 1990 and the period 1995–2000, was delivered to the reviewers, and energy CO_2 emissions estimated using a national methodology are reported to be available from 1985. The ERT has encouraged Hungary to report also on the energy CO_2 emissions calculated according to the national reporting system, even if this is not consistent with IPCC methodology, as long as the trends are consistent. Data for the years 1996, 1997 and 1998 were available in the CORINAIR database and presented to the ERT.

[12] CORINAIR: Atmospheric Emission Inventory for Europe (now: Core Inventory Air).

5. QA/QC

44. No formal QA/QC procedure is applied. IEM has reported that it routinely checks the consistency between the different data sources before reporting data in the CRF. This work has improved the energy balances over time. Moreover, the control checks performed at IEM have shown conflicting data between the fuel consumption estimated by ITS (Institute for Traffic Sciences), using circulation data, and those reported by the Energy Centre; it seems that a non- negligible part of transportation fuels used in Hungary is brought from abroad. Activity data provided in the CRF refer to the Energy Centre estimate.

B. Reference and sectoral approaches

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

45. Basic data from the Energy Centre balances are used to prepare the report to the IEA. For the year 2000, apparent consumption corresponds very closely to IEA data, being only 0.2 per cent higher (draft 2002 S&A report). This small difference is due partly to a more updated energy balance used for CRF reporting and may be found partly in energy equivalents in the solid fuel sector. These differences arise from a different classification of several coals by the Party and the IEA, but they have no influence on the emission figures. In 2000, the emissions calculated using the reference and sectoral approaches are similar; there is a difference of only 0.9 per cent in the energy balance and of 0.3 per cent for the emission balance. These numbers are subjected to slight changes if the corrections suggested by the ERT are taken into consideration.

46. A specific feature of the carbon balance in Hungary is that the emissions calculated from the detailed sectoral approach are higher than those estimated using the reference approach. In most countries the opposite is the case.

2. International bunker fuels

47. No marine bunker fuels are reported, for obvious reasons. No domestic aviation fuel is reported because no regular air transportation exists within Hungary (NO reported). Fuel consumption (gasoline) for the small amount of aviation activity is reported elsewhere, but it is not clear from the CRF reporting where such data have been included. It is reasonable to assume that domestic aviation exists (helicopter services, firefighters, ambulances and so on) and there is a need, therefore, for the development of statistical procedures for estimating fuel consumption from that subsector.

48. The aviation fuel sold is used for international aviation. An emission estimate is given only for CO_2; CH_4 and N_2O emissions have not been estimated.

3. Feedstocks and non-energy use of fuels

49. The reporting of fuels used for feedstocks is adequate and in line with the guidelines' requirements. No estimation is given in the documentation box of the fraction of energy carriers stored in products, which is required by the IPCC good practice guidance. However, some data (on energy stored in products) were provided in the 2000 submission.

C. Key sources (fuel combustion and fugitive)

1. Stationary combustion: gas, coal and oil

50. The gaseous fuel IEF is often higher than that for natural gas. The Party has explained that this source also includes the contributions of coal-derived gases and of refinery gases in the industrial and electricity sectors. In particular, the gaseous fuel IEF for the iron and steel sector is the highest of the reporting Parties (see draft 2002 S&A report, item 1.A.2). Hungary has explained that for this source it totals the contribution of natural gas and coal-derived gases. The Party decided to add

coal-derived gases to the gaseous fuel row for consistency with the work of the IPCC software, which translates IPCC worksheets into the CRF and attributes coal gas emissions to this row.

51. The solid fuel IEF is quite low, although within the IPCC default range. This CO_2 emission factor indicates a rather good quality coal, such as coking coal. Steam coal has a higher emission factor and lignite, which is used quite extensively in other sectors, has an even higher emission factor. The low carbon emissions could not be explained by Hungary; they may be due to an incomplete oxidation case or the use of a country-specific emission factor. More information on this aspect is required in the NIR.

2. Mobile combustion: road vehicles

52. The gasoline emission factor is taken from table I–1 of the IPCC Guidelines (energy). Because this factor generally refers to North American products, the ERT emphasizes that a more country-related emission factor would be the one indicated in table I–36 (IPCC Guidelines, Volume 3) which applies to the European markets. Hungary agreed on the matter; it did not have specific reasons for this choice.

53. The diesel fuel IEF is reported as being the highest of the reporting Parties for the year 2000 (see draft 2002 S&A report). The value is, however, only very slightly (+0.09 per cent) higher than the default emission factor proposed by IPCC (see tables I–1 and I–38/39 of the IPCC Guidelines, Volume 3).

54. For CH_4 emissions from natural gas use, the Party confirmed that notation key NO (not occurring) has to be replaced by an estimate of 0.0036 Gg (see also draft 2002 S&A report).

55. In previous inventories (1998 and 1999), some LPG was reported as used in the transport sector. In 2000 no such use is reported. Hungary has explained that the consumption was negligible and was included elsewhere.

3. Other transportation

56. Hungary reports emissions from agricultural machinery under this source. Usually these emissions are reported under item 1.A.4.c and this fact explains the comment in the draft 2002 S&A report (see energy, 1.A.3.e: Hungary is one of the few cases where "other transportation" appears as a key source). These emissions should be reallocated as explained in paragraph 34 above.

57. Moreover, the N_2O IEF is about twice as low as the CORINAIR average factors, due also to the use of a general default emission factor for fuel combustion and not the specific factor relating to the technology used (available in CORINAIR).

58. Emissions from gas grid compressors should be moved to this section from the "other industries" section, in accordance with the IPCC Guidelines.

4. Stationary combustion: other fuels – CO_2

59. There is no explanation in the CRF nor in the NIR of the industrial sectors included in this category. During the visit, Hungary explained that it included in this section, *inter alia*, refineries, petrochemical plants and natural gas grid compressor stations. This explains the presence of relevant quantities of "other fuels", usually relating to refinery and petrochemical processes. In addition, in the line for reporting "other fuels" in the CRF, the CO_2 IEFs are the second lowest of the reporting Parties (see draft 2002 S&A report, item 1.A.2). The reason for this is that energy used for "non-energy use", such as petrochemicals, is included in the energy activity data and, of course, excluded from the emission data. Details of the energy carriers involved are provided in table 1.A.d, additional information box.

5. Fugitive emissions: solid fuels – CH_4

60. In general, this category appears to the ERT to be transparent and consistent, though the NIR is not transparent and the explanation should be expanded. The activity data are country specific and well

documented in the country but not in the NIR. The emission factors currently used are the default IPCC factors but the national expert has identified sources (the Geological Institute and/or Mine Safety Organization) which may have additional data on more specific *in-situ* values, emission factors or emission measurements to be used in the future.

61. The time series for coal mining is complete and the activity data are easily available and accurate. Coal production fell from 1999 to 2000 due to a move away from coal to natural gas.

62. No information exists on abandoned mines. Although this is not currently included as a methodology in the IPCC Guidelines, methods are under development and such information may prove useful in the future.

63. The CRF reporting needs to include the notation key IE (included elsewhere) for the solid fuel transformation source category to indicate that emissions from coal transformed to coke are accounted for in the fuel combustion sector.

6. Fugitive emissions: oil and natural gas – CH_4

64. The emission estimate for this source is neither transparent nor consistent over time.

Completeness

65. Hungary has a large amount of natural gas which is neither produced nor consumed within the country, and emissions from this source are currently not accounted for. Potentially, this source could be estimated through an estimate of pipeline length for a basic first tier. Since the emission factors vary according to age and type of pipeline, these figures would also be important.

Methodologies and emission factors

66. For natural gas, the emission factor for processing, distribution and transmission was applied to the production sector for the gas produced within Hungary. This methodology is correct, however it only accounts for emissions from processing, distribution, and transmission. Emissions from the production sector need to be accounted for by applying the default emission factor for gas production (140,000-314,000 KG/PJ) to the gas produced to obtain emissions from gas production.

67. The Hungarian inventory attempts to adjust the default methodology to account for high imports of gas since the default emission factors for Eastern Europe for processing, transmission, and distribution are linked to gas production. The adjusted methodology applies the high end of the Western European factor to gas consumption. It should be noted that use of this emission factor might result in an overestimate in emissions for a number of reasons including: 1) Hungary may not process a lot of the imported gas, 2) the Eastern European production-based emission factor may implicitly include emissions from gas consumption, and 3) it is thought that currently the Hungarian gas system is not significantly more wasteful than the average Western European system. However, the approach is conservative and the emission factors are acceptable. Hungary may wish to further examine the gas system and emission factors used and choose a lower emission factor for this system portion in the future. Given that gas systems are a key source and the system is complicated, it is recommended that Hungary consider further examination of the factors and using country specific factors and/or a higher tier methodology such as tier 3 or the refined tier 1 method from the IPCC good practice guidance.

68. For venting and flaring, the Hungarian factor is higher than the Eastern European factor but is within the range. More documentation on the rationale for the higher than average factor would be useful.

69. Additionally, the default venting and flaring factor is based on gas production and the inventory applies the Western European factor to oil production to try to account for venting and flaring from both oil and gas production. However, venting and flaring often occurs at associated oil and gas wells, thus

applying both factors may result in double counting. Hungary may wish to further examine the emission factors.

D. Non-key sources (fuel combustion and fugitives)

1. Road transportation – N_2O

70. The IEF for this source is very low compared to other countries. The Party has declared that it simply multiplies the energy consumption by the IPCC default emission factor from the tier 1 methodology (IPCC Guidelines, Volume 3, table I-8), taking into account the high number of vehicles with two stroke engines.

71. The ERT emphasizes that the actual methodology used by IEM cannot take into consideration the foreseen increase in emissions due to the growing number of vehicles with catalytic converters in Hungary. The use of a proper technology-related methodology to calculate N_2O emissions is strongly recommended for transportation fuels.

2. 1.A.5 – Other

72. In this section some activity data are reported (for gaseous fuels) but not the corresponding emissions. Hungary explains that the activity data reported refer to the "unaccounted for" fraction of the distributed natural gas.

73. The ERT thinks that this gas should not be considered as "unaccounted for". It should be considered as consumed for the following reasons. The standard practice in gas distribution is that it is quite difficult to track all the distributed volumes, because of unreliable low pressure metering, estimated quantities and illegal deliveries. On the other hand, the quantities of gas delivered to the distributors are usually metered continuously using reliable technology.

E. Areas for further improvement

1. Issues identified by the Party

74. Hungary has explained that a proper recalculation of the entire time series and base year according to the CRF could not be performed due to a lack of resources at IEM. A comprehensive list of energy data does exist at the statistical office, but it requires extensive upgrading work due to the different sector aggregation at sectoral level due to changes in the reporting system during the past 15 years.

75. For coal mining, data sources (Geologic Institute and Mine Safety Organization) were noted for to contact in the near future in order to move to a higher tier methodology including country, basin or mine-specific *in-situ* values and emission factors.

2. Issues identified by the ERT

76. In addition to the recommendations relevant for the inventory as a whole (see overview section), the ERT recommends the following specifically for the energy sector:

Energy industries

(a) Allocation should be improved (see reference approach; must be valid for every type of fuel) and in particular coal gases should be added to the solid fuels row and refinery gases to the liquid fuels row;

(b) The notation key C (confidential) should be added to 1.A.1.b Petroleum refining activity data input and notation key IE (included elsewhere) to the emission estimates;

(c) The notation key IE should be added to 1.A.1.c Manufacture of solid fuels activity data input.

Manufacturing industries

(a) Allocation (see reference approach; must be valid for every type of fuel) should be improved and specifically coal gases should be added to the solid fuels row instead of the gaseous fuels row in the iron and steel sectors;

(b) In the sectors chemicals and other, the quantities of energy carriers used for non-energy purposes should be subtracted because they greatly distort the IEF calculation and data presentation;

(c) In the documentation box of table 1.A the industrial sectors included in the other subcategory should be listed.

Transport sector

(a) Higher tier methodology should be used for key sources and specifically for the N_2O emission estimate for road transportation;

(b) The emission factor for fuel used in railways and in navigation should be improved and a more country-specific emission factor be used for gasoline;

(c) Consumption of liquid fuels in agriculture should be moved from 1.A.3.f to source 1.A.4.c;

(d) The notation key IE should be added to the activity data for gasoline in section 1.A.3.a, Civil aviation. Statistics should be improved and domestic consumption for other fuels should be reported;

(e) Consumption in natural gas compressor stations should be reported in section 1.A.3.e.

Other

(a) Allocation should be improved (see reference approach; must be valid for every type of fuel) and specifically the LPG should be separated from the liquid fuels in sources 1.A.4.a and 1.A.4.b, using the other fuel rows;

(b) Emissions from "unaccounted for" natural gas should be considered as having the domestic sector average emission factors, since this is the most probable end use sector for this gas;

(c) CH_4 and N_2O emissions from aviation fuel used in international transport should be estimated;

(d) An estimate of the fraction of energy carriers stored in products should be added, in accordance with the IPCC good practice guidance.

Fugitive emissions from fuel

77. The ERT would recommend the following improvements for natural gas systems:

(a) The completion of a tier 2 or 3 methodology for key sub-sources and/or identified weaknesses in order to be consistent with the IPCC good practice guidance. In particular, the transport sector could be an area for further investigation since it is not covered fully by the default methodology due to Hungary's unique situation. A possible methodology for estimation of gas transported across the country would involve investigating pipeline length, type and age and appropriate emission factors. Compressor stations along the pipeline are another source of emissions which would need to be investigated. Other countries may be a source of data for emission factors but Hungary must ensure that

these factors are appropriate for the Hungarian oil and gas systems. Activity data may be available through industry or the statistics office;

(b) Revision of the emission factors to include production, using an appropriate value for production, separate emission factors for processing, distribution and transmission, and continuing to include leakage from industrial plants and the residential sectors;

(c) The addition of an explanation of the use of a higher than average value for venting and flaring.

III. INDUSTRIAL PROCESSES AND OTHER SOLVENT USE

A. Sector overview

78. In 2000, total GHG emissions from industrial processes amounted to 3,826 Gg CO_2 equivalent and increased by 6.3 per cent from the base year (1985–1987). The ERT noted that these emissions decreased significantly, by 61 per cent, from 1990 to 1991 and increased by 97 per cent from 1997 to 1998. However, 60 per cent of this increase is due to the inclusion of HFCs, PFCs and SF_6 for the first time in 1998. Whereas in the base year 100 per cent of industrial process emissions have been assigned to CO_2 emissions, in 2000 CH_4 (0.4 per cent), N_2O (10.5 per cent) and HFCs, PFCs and SF_6 (15.2 per cent) also contributed to emissions from this sector. Clearly a consistent time series would be needed to assess the actual trend of this sector and, therefore, any trend assessment in this report is only indicative (see also paragraphs 10 and 19 of the overview).

79. In 2000, the most important industrial sector was mineral products, contributing 55 per cent to total emissions, followed by chemical industry (18 per cent) and consumption of halocarbons and SF_6 (10 per cent). Process emissions of coke production and iron production have been included under energy.

80. Solvent and other product use contributed 29 Gg CO_2 equivalents in 2000. Emissions from this sector have been calculated only for 1998–2000. The trend, therefore, has not been assessed. The emissions originate mainly from paint application.

1. Completeness

81. The CRFs for 1998–2000 include estimates for most gases and sources from this sector, as recommended by the IPCC Guidelines. In addition to the process emissions from coke and iron production, the following missing information should be addressed in future submissions: steel production, activity data for various industrial sectors (such as road paving with asphalt, food and drink production), consumption of halocarbons with respect to foam blowing (as the ERT believes that this activity may also occur in Hungary as in other countries), emissions from halocarbons which are imported in products and which are released at decommissioning, emissions of halocarbons from disposal, emissions of halocarbons from fire extinguishers and semiconductor manufacture (if occurring in Hungary), and use of N_2O for anaesthesia.

2. Transparency

82. The information provided in the NIR is not sufficiently detailed for all sources to enable reconstruction of the emission estimates. This relates to missing information on methodologies used (in iron and steel production, aluminium industry). For carbon black and styrene production, activity data were not reported in the CRF for reasons of confidentiality;[13] Hungary however provided emission estimates for those source categories even though they represent only a negligible amount to the total

[13] The UNFCCC reporting guidelines include provisions that allow Parties to protect confidential business information in reporting national inventories. At the time of the review, the treatment of confidential information during the review of annual GHG inventories was under consideration by the SBSTA.

inventory. The ERT notes that some activity data are even confidential for the IEM (nitric acid production).

83. Also due to confidentiality, some emission estimates (such as emissions from nitric acid and carbon black production) have been reported in an aggregated manner under 2.G Other. This makes it difficult to compare Hungary's inventory data with data reported by other Parties.[14]

3. Methodologies, emission factors and activity data

84. The description of methodologies used are not appropriate for all sources, such as the iron and steel industry, aluminium production and consumption of halocarbons, because they are not sufficiently clearly explained to allow replication and assessment of the estimates. According to the NIR, national methodologies have been used to calculate emissions for consumption of halocarbons because the data have not been available to enable use of the recommended IPCC methodologies. However, the ERT believes that these national methodologies are not compatible with the IPCC Guidelines.

85. The source of many activity data is the Central Statistical Office. Some data have been provided by the Association of the Paint Industries, the Hungarian Customs and Finance Guard (direct information to IEM) and others (such as plant operators). Many activity data have not been reported due to confidentiality concerns.

86. Hungary uses emission factors from the IPCC Guidelines, except for cement, consumption of halocarbons and SF_6, for which country-specific emission factors are used.

4. Recalculations and time-series consistency

87. Hungary has not performed any recalculations so far and this limits the consistency of the time-series (see also paragraph 78). It can not be guaranteed by Hungary that all data will be available to allow recalculation of industrial emissions for the entire time series (1985 to 1997) even if the resources are available.

B. Key sources

1. Cement production – CO_2

88. Hungary has used a national emission factor of 0.50 t/t which has been based upon clinker production. In table Summary 3, however, it is indicated that for mineral products the default IPCC emission factor (0.4985 t/t) has been used.

C. Non-key sources

1. Metal production – CO_2

89. Process emissions from iron and coke production are included under the energy sector. The methodology used has not been described.

2. Chemical industry

90. For reasons of confidentiality, some N_2O emission estimates belonging to source category 2.B Chemical industry are reported as IE (included elsewhere) and are aggregated under category 2.G Other "confidential technologies" (N_2O from nitric acid, sulphur recovery and carbon black), and are therefore given without activity data.

[14] See also footnote 13.

3. Consumption of halocarbons and SF_6

91. The country-specific methodology used has been based upon import/export data and assumptions about the relationship between potential and actual emissions for refrigeration and air conditioning equipment. For the year 2000 the following shares of actual emissions have been estimated: HFCs (38.5 per cent) and PFCs (61.5 per cent), based upon information from users. More details are described in a study of IEM for the Ministry for the Environment.

D. Areas for further improvement

1. Issues identified by the ERT

92. The ERT would recommend the following improvements to the industrial processes sector:

(a) Provision of more detailed descriptions of country-specific methodologies used (such as iron and steel industry, aluminium industry);

(b) Provision of emission data for sources which occur in Hungary but for which no data have been estimated up to now;

(c) Provision of information on activity data and emission factors used (as for most sources these data have to be reported under other regulations (EPER) also);

(d) Use of a more detailed methodology for the consumption of halocarbons and SF_6 which is compatible with the IPCC Guidelines and which is better documented and more accurate;

(e) Provision of more detailed documentation on the country-specific emission factor for cement production;

(f) Inclusion of process emissions from iron and steel production under the sector industrial processes;

(g) Explanation in the NIR that N_2O emissions included under source category 2.G summarize emissions whose technologies are confidential, as mentioned for CH_4 Chemical industry.

(h) Linking of the information included in the EPER as well as the Emission Information System with monitoring and reporting requirements under the UNFCCC.

IV. AGRICULTURE

A. Sector overview

93. Total GHG emissions from agriculture have increased from 5,790 Gg CO_2 equivalent in the base year (5.9 per cent of total emissions) to 14,456 Gg CO_2 equivalent in 2000 (17 per cent of total emissions), owing mainly to a sudden increase in emissions in 1998. However, a proper assessment of the trend can hardly be made, given that the time series is not considered to be estimated consistently (see also overview section and paragraph 99). The key sources identified by Hungary agree with those identified by the secretariat in the draft 2002 S&A report.

1. Institutional arrangements

94. Estimates of emissions from agriculture are performed by IEM. The Central Statistical Office, the Animal Breeding and Feed Research Centre and experts from the Ministry of Agriculture provided the necessary activity data.

2. Record keeping and archiving

95. All IPCC worksheets are stored in spreadsheets in IEM. The calculation sheets, which are available in English, were available during the agriculture evaluation, but could not be considered owing to time constraints.

3. Completeness

96. The emission inventories from agriculture are almost complete for 1998–2000. The IEM notes that for other years (base year–1997), manure management (N_2O) and field burning of agricultural residues (N_2O and CH_4) would have to be quantified if relevant information is available. All CRF tables relating to agriculture were reported for 1998 to 2000.

4. Transparency

97. Generally, the NIR includes most of the necessary information concerning methods, activity data and emission factors required to follow the calculation of the emission estimates. The only exception is N_2O from organic soils (cultivation of histosols) for which the information in the NIR and the CRF is not sufficient to allow the emission estimates to be reconstructed, and was not in line with the corresponding information provided in the 3rd National Communication (NC3). However, this gap was addressed during the visit.

5. Methodology, emission factors and activity data

98. All methodologies used to estimate emissions followed the IPCC Guidelines (tier 1) except for manure management, for which a tier 2 method was used. Hungary used mainly default parameters and emission factors, and country-specific values where available, such as for rice cultivation and animal waste management. Most of the activity data come from the national agricultural statistic yearbook, others from expert judgement, such as in the case of manure management.

6. Recalculations and time series consistency

99. The ERT noted that no recalculations had been undertaken due to limited resources. Methodological modifications have not been done in a consistent way for the entire time series.

7. Verification and QA/QC

100. The agriculture inventory QA/QC system for Hungary is under development. There will be formal quality control procedures for the activity data that IEM officially collects from the Central Statistical Office. These activity data are also the basis for all agricultural statistics and calculations in Hungary, and are considered by national experts to be very reliable.

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

101. Hungary has followed the IPCC Guidelines. None of the default methodologies and emission factors have yet been updated to take account of the IPCC good practice guidance. In the case of the emission factors for CH_4 from enteric fermentation and manure management, Hungary has decided to use the Western Europe emission factors rather than the Eastern Europe values.

B. Key sources

1. Enteric fermentation – CH_4

102. CH_4 emissions from enteric fermentation decreased from 156.6 Gg CH_4 in the base year to 75.9 Gg in 2000. The main source categories are dairy cattle and non-dairy cattle, sheep and swine.

Completeness

103. Coverage of enteric fermentation is complete given the availability of data. The mules and asses population in Hungary is small but herding could in some respects be considered to be an anthropogenic activity. Hungary decided not to include this category in the inventory because of a lack of data.

Methodologies, emission factors and activity data

104. The IPCC tier 1 methodology was used for all animal species. The method is briefly explained and referenced in the NIR. For cattle, Hungary used emission factors for Western European countries.

105. Hungary has not yet applied the IPCC good practice guidance methodologies for estimating feed intake, nor a country-specific characterization of livestock. The ERT noted that Hungary uses a methodology which is based upon population numbers of animals which does not take into account changes in milk and meat production per animal or changes in feed intake per animal.

106. Statistics on animal livestock in the *Agricultural Yearbook 2001*, is available in Hungarian, with summaries and relevant tabular data in English.

107. According to the draft 2002 S&A report, for cattle, sheep, swine and horses, the national statistics and those of the Food and Agriculture Organization of the United Nations (FAO) showed some differences. The figures delivered in the national inventory are from the statistics yearbook of the Hungary Central Statistics Office, which are official data and considered to be more reliable, there was also help from the Animal Breeding and Feed Research Centre. Hungary believes that the difference between the data published by FAO and IEM is due to the different reference date taken (spring and autumn, respectively). In the review Hungary provided published data.

108. The following issues should be better addressed in future NIRs:

(a) From the data provided in the CRF it can be seen that the number of dairy cows decreased steadily over the period. Although this was not addressed in the NIR, it was explained during the visit that it had been an expert judgement based on the results from annual statistical information which shows that milk production per cow increased steadily over the period, sometimes reaching 6,700kg/head/yr. This might have resulted in cows becoming bigger, which is very similar to the situation in North America;

(b) The selected emission factor is lower than that of North America and higher than the proposed IPCC default value for Eastern Europe (table 4-3 of the IPCC Guidelines, Volume 2), because the yearly milk yield of Hungary is considered to also be between the two figures given for milk production.

Recalculations

109. Emission estimates from the entire time series seem to be calculated in a consistent way, although no recalculations have been undertaken. When Hungary performs recalculations, it has to be considered that the differences are in feed intake estimates, reflecting the new energy model introduced in the IPCC good practice guidance, and that an increase in the animal weight of cows has been taken into consideration. Animal population numbers do not fluctuate much during the time series.

Uncertainty

110. In the NIR, the uncertainty level for CH_4 emissions was estimated as medium, in accordance with information from the original statistics, although it is not clear whether this includes the uncertainty of the cattle feed intake estimates. The uncertainty of emission factors was estimated as 30 per cent, according to international experts.

2. Manure management – N_2O

111. N_2O emissions from manure management – including emissions in grazing/pasture – have increased steadily during recent years, from 1.6 Gg in 1998 to 2.5 Gg in 2000. The vast majority of emissions resulted from liquid systems and solid storage (94–95 per cent).

Completeness

112. The inventory for N_2O from manure management was considered complete.

Activity data, methodologies and emission factors

113. The total quantity of nitrogen from livestock has been estimated from annual average nitrogen excretion per head, with IPCC default values as determined by IEM and reported in the NIR. It appears that actual values are available for 1990 to 2000 and that interpolations and extrapolations have been done for the other years, based partly on expert judgement. Although these data were not reported in the CRF, Hungary made these data available during the visit.

114. N_2O emissions from manure management systems were estimated using the default methodology in the Revised IPCC Guidelines, country-specific N-excretion rates and manure management usage, and default emission factors based on table 4.12 of the IPCC good practice guidance and table 4-22 of the IPCC Guidelines (Volume 2).

115. In CRF table Summary 3, Hungary reports the method as tier 1 and the emission factors as country-specific/default. From the information available, however, Hungary should report the method as mixed tier 1/tier 2.

Uncertainty

116. The uncertainty for this source is estimated to be medium. The NIR did not provide any estimates of uncertainty levels for activity data and emission factors.

3. Agricultural soils: direct emissions – N_2O

117. Direct N_2O emissions from soils decreased continuously from the base year (4.56 Gg) to 1997 (1.67 Gg), but there was a sudden increase in the values (32.9 to 36.5 Gg) from 1998 to 2000. Hungary believes that this is due to revisions in the methodology when using the Revised IPCC Guidelines. But the ERT is of the opinion that this could also be due to a different definition of organic soils having been used as data input in table 4.D, which results in very high values for N_2O from agricultural soils. The most important source categories are the use of synthetic fertilizers and the cultivation of organic soils, while sludge spreading and N-fixing crops are minimal contributors.

Completeness

118. The estimate of N_2O emissions from agricultural soils is complete. However, for agricultural residues from certain vegetable crops (crop residues and N-fixing crops) N_2O emissions are reported to be 0.0007 and 0.0013 Gg N_2O, respectively. Particularly for crop residues this seems low compared to other reporting Parties given the low IEF of 0.00004 kg N_2O-N/ kg dm. [15]

[15] In table 4.D of the CRF, in the head of column B (N input to soils), the unit is specified as *kg N/yr*. However, entries for the sub-categories N fixing crops and crop residues are to be given in *kg dm/year*. This might have resulted in inconsistencies in reporting among Parties, as use of the latter gives a much smaller IEF value than use of the former.

Methodologies and emission factors

119. The country-specific volatilization factor for ammonia and NO_X from synthetic fertilizers is almost ten times lower than the IPCC default (0.1 kg NH_3-N +NO_X-N/kg N). This was justified and documented on the basis of expert information from IEM. The difference is attributed to the high acidity of Hungarian agricultural soils and a reduced use of urea and fertilizers, which are usually embedded deep into the soil (7–8 cm) during sowing operations. The emission factors were derived based on expert judgement by IEM.

120. The quantity of nitrogen added to the soil from nitrogen fixation and from crop residues was estimated according to the methodology proposed in equations 4.26 and 4.29 in the IPCC good practice guidance. Hungarian experts explained that a mix of IPCC default and country-specific factors had been applied. However, it is not clear which are default and which are country-specific, and there are no documentation references.

121. Hungary has used an emission factor of 2 kg N_2O-N/ha/a for N_2O from organic soils including all cultivated land, which is in the range of the updated value recommended in the IPCC good practice guidance (page 4.7).

Activity data

122. Nitrogen fertilizer data were available from the Agricultural Yearbook and from FAO. Both data sources show a decreasing trend. Hungary considers the data of its Agricultural Yearbook to be the more reliable.

123. Annual production data for both N-fixing and non-N-fixing crops also came from the yearbook. Information collected from FAO by the ERT revealed that Hungary had not considered certain vegetable and fruit crops. The inclusion of their residues as a nitrogen source in soils could possibly increase emissions of N_2O.

124. Apart from synthetic fertilizers, manure, crop residues and sewage sludge, Hungary stated that there was no significant use of other sources of nitrogen on agricultural soils. Forestry wastes were left in forests and industrial wastes were not applied to soils. Urban waste was used as fertilizer but in very negligible quantities.

125. The ERT has a different opinion regarding the area of cultivated organic soils, which might be a reason for the large jump in values after 1998. The area of cultivated organic soils should not be larger than the area of total arable land (table 4.D of the CRF and NC3). Due to a different definition used for organic soils which is inconsistent with the values for arable land area in the NC3, the activity data were not correctly presented and the ERT had to derive the data from descriptions in the NC3.

Uncertainty

126. The uncertainty for this source was estimated to be high; no uncertainty of emission factor or activity data was given.

C. Non-key sources

1. Manure management – CH_4

127. This source category shows a decrease in emissions from 48.1 Gg CH_4 in the base year to a minimum value of 30.8 Gg CH_4 in 1997. They increased in 1998 (34.5 Gg CH_4), finally decreasing to 32.5 Gg in 2000. Cattle (24 per cent) and swine (59 per cent) represent the biggest contributions to these emissions.

Completeness

128. The inventory for CH_4 from manure management was considered complete.

Transparency

129. Information is available in the submission to allow reconstruction of the estimates. The choice of the methane correction factor (MCF) value for liquid/slurry systems is not suitably documented.

Methodologies, emission factors and activity data

130. CH_4 emissions from manure management were calculated using the tier 2 method in accordance with the IPCC good practice guidance.

131. The activity data used are based on total manure produced, which was estimated from livestock using the methodology proposed by the IPCC good practice guidance.

Uncertainty

132. In the NIR, the uncertainty level was estimated as medium in accordance with information from the original statistics, although it is not clear whether this also includes the uncertainty of the cattle feed intake estimates. Uncertainty of emission factors and activity data was not given, although it is not clear whether this uncertainty already includes the newly available MCF values in the IPCC good practice guidance.

2. Field burning of agricultural residues – CH_4

133. This source category shows a decrease in emissions from 1.8 Gg CH_4 in 1998 to 1.3 Gg CH_4 in 2000.

Completeness

134. The emission inventory is considered to be complete because Hungary considers there is no field burning except for wheat and barley.

Transparency

135. All information is available in the submission to allow reconstruction of the estimates.

Methodologies, emission factors and activity data

136. CH_4 emissions from field burning of agricultural residues were calculated using the tier 1 method from the Revised IPCC Guidelines. There are no precise activity data concerning field burning in Hungary. This practice is not allowed in the country, but in some cases (such as infection of soil) it is, however, common. The annual crop production served as a basic (Hungary Central Statistical Office), and the IPCC Guidelines' values were used to derive the emission values.

137. The activity data used are based on fraction burned in fields, which is taken from the Revised 1996 IPCC Guidelines (Volume 3, table 4-17).

Uncertainty

138. In the NIR, the uncertainty level was estimated as high according to information from the original statistics, although it is not clear whether this also includes the uncertainty of fractions. Uncertainty of emission factors and activity data was not given, and it is not clear whether data for fraction of agricultural residue burned in the field are available.

3. Rice cultivation – CH_4

139. This source category shows a decrease in emissions from 3.7 Gg CH_4 in the base year to 0.6 Gg CH_4 in 2000 due to a decrease in the rice area.

Completeness

140. The emission inventory is considered complete. Hungary's rice area has been reducing since 1990.

Transparency

141. All information is available in the statistical yearbook to allow reconstruction of the estimates.

Methodologies, emission factors and activity data

142. CH_4 emissions from rice cultivation were calculated using the tier 1 method from the IPCC Guidelines, in accordance with IPCC good practice guidance. There are no country-specific emission factors. The lowest value of IPCC emission factor ($20g/m^2$) was selected, but this is only for non-organic fertilizer use. The use of data from Western Europe measurements ($40g/m^2$) is suggested by the ERT.

143. The activity data used are based on cultivated rice area, taken from the yearbook.

Uncertainty

144. In the NIR, the uncertainty level was estimated as medium.

4. Field burning of agricultural residues – N_2O

145. The figures for annual crop production served as a basis. The data from the Hungary Central Statistical Office and the Revised IPCC Guidelines' value were used to estimate emissions. Estimates were provided for 1998 to 2000 only.

146. The uncertainty is large. It should be improved in order to identify both activity data and country-specific emission factors, especially for the fraction of agricultural residue burned in the field.

D. Areas for further improvement

1. Planned or ongoing work by the Party

147. The resources required to produce the emission inventory and recalculate the inventory for 1985–1997 in a consistent manner are not available, primarily due to a lack of funding.

148. The statistical system in the 1990's was different from that required by the IPCC Guidelines, so that case estimation and expert judgement were often needed, which has in general lessened the reliability of the inventory. The new statistical system still needs several years to trickle down through the entire economy.

149. Improvement in capacity building through a UNITAR programme is expected. The recalculation of earlier years' inventories in line with the Revised IPCC Guidelines is planned. It would be preferable to determine the factor values for technologies unique to Hungary.

150. The national experts for agriculture consider that it might be better to use tier 2 methods, for which the data are available in Hungary, but more surveys are needed. This methodological shift is under consideration. Hungary also recognizes that expert opinion used in setting parameters should be improved by widening the range of experts.

151. Hungarian experts also consider that further research is needed on how better to estimate trends in peat-soil and other organic soils.

152. Hungary is considering crossing land-use change with soil types to improve the estimates of N_2O from organic soil cultivation.

2. Issues identified by the ERT

153. The ERT would recommend the following revisions to the agriculture sector:

(a) Burning of maize, rice, oats and rye are reported as NA in table 4.F of the CRF. Hungary explained that burning of maize and rice does not happen in Hungary, because the residues are rotated into the soil. The use of notation key NO would therefore be more appropriate. In the case of oats and rye, field burning may occur, though it is not usual, and therefore notation key NE would be more appropriate;

(b) N_2O and CH_4 from other crops, including soybean, are reported as NO (table 4.F) whereas this should be 0 or NE;[16]

(c) Notation keys in table 4.B(b) and additional information in 4.B(a) should be used in a consistent way;

(d) In table 4.D, the activity data of dry production of other crops should be consistent with the data in table 4.F;

(e) The data for volatized N from fertilizers and animal wastes (table 4.D) should be consistent with table 4.B(b);

(f) Hungary used an emission factor of 2 kg N_2O-N/ha/a for N_2O from organic soils. Inclusion of all cultivated land, which would be caused by different definitions of organic soils, would result in 7,715,500 ha (table 4.D). This is greater than the total area of arable land (100 ha/km^2 x 93,033 km^2 x 0.48). Consistency is needed.

154. The ERT suggests that Hungary incorporate all necessary information in the NIR in a way that easily allows reconstruction of the emission estimates.

155. Statistics for livestock, crop production and use of fertilizers should be cross-checked with international information (FAO, in particular) and discrepancies explained.

156. A better knowledge of the evolution of the abandonment of agricultural soils should be obtained.

157. Hungary should consider the use of more country-specific factors and tier 2 methods, at least for ruminant animals and animal waste.

158. The ERT suggests the establishment of an agricultural research project aimed at improving N_2O emission factors from mineral and organic soils.

159. The ERT agrees that capacity building for the agricultural sector requires a high priority, and that a new model should be developed incorporating ruminant animal and agricultural soil variations in a shorter timescale.

[16] It should be noted that in the revised UNFCCC reporting guidelines adopted by decision 18/CP.8, "0" is no longer considered a notation key. Parties should instead either report the emission estimate, if calculated, or use the notation key NE, even if emission estimates are considered to be negligible (see FCCC/CP/2002/8, page 9, para. 28 and footnote 7).

V. LAND-USE CHANGE AND FORESTRY

A. Sector overview

160. In Hungary the forested area covers 1,719 kha (evergreen species: 245 kha, deciduous species: 1,474 kha). Forest management follows the general requirements of sustainable yield resulting in harvest being lower than the annual increment.

161. The GHG balance of the Hungarian forest ecosystems results in a net sink, contributing between 3 per cent (in the base year) to ca. 6.2 per cent (in 1994 and 1995) of total emissions, with a decreasing trend during the past three years. The lowest sink was found for the base year (3,097 Gg CO_2) while the highest was for 1994 (4,819 Gg CO_2). In 2000, the sink amounted to 4,011 Gg CO_2. No visible increasing or decreasing trend was discernible in annual data for the sink during the period 1990–2000. However, care has to be taken in considering any trend in the LUCF emissions/removals estimates, given the general inconsistency identified in the forest and grassland conversion and CO_2 emissions and removals from soil categories (for details see paragraph 167), as well as possible inconsistencies resulting from the lack of recalculations.

1. Institutional arrangements and data collection

162. The land use and forestry GHG balance is based on extensive data sets collected by various institutions (for details see below). A portion of this data is reported to the Ministry for the Environment and the Ministry of Agriculture as well as to the Hungarian Central Statistical Office. The processed data are available through their statistical services. The institutions responsible for estimating GHG emissions/removals are, in some cases, identical to the institutions collecting data, as shown below:

(a) 5.A Changes in forest and other woody biomass stocks:

(i) Data collection/data source: National Forest Service;

(ii) Calculations: An expert subcontractor (from the Forest Research Institute) hired by IEM on an annual basis.

(b) 5.B Forest and grassland conversion:

(i) Data collection/data source: National Forest Service and Hungarian Central Statistical Office;

(ii) Calculations: An expert subcontractor (from the Forest Research Institute) hired by IEM on an annual basis.

(c) 5.D CO_2 emissions and removals from soil: Cultivation of mineral and organic soils:

(i) Data collection/data source: National Forest Service, Ministry of Agriculture, Research Institute for Soil Science and Agricultural Chemistry, St Stephan University, Plant Health and Soil Production Service, Hungarian Central Statistical Office and Research and Information Institute for Agricultural Economics.

(d) 5.D CO_2 emissions and removals from soil: Liming of agricultural soils

(i) Data collection/data source: Ministry of Agriculture, Plant Health and Soil Production Service and Hungarian Central Statistical Office. Generally, data for this category have not been collected in a systematic manner but originate from irregular data collection.

(e) Calculations for the entire soil category (5.D): IEM.

2. Completeness

163. The NIR and CRF include estimates of all gases and sources of emissions and removals from the LUCF sector, as recommended by the IPCC Guidelines. Annual estimates are available as follows:

(a) Changes in forest and other woody biomass stocks: CO_2 estimates are available for 1990–2000 and the base year (1985–1987);

(b) Forest and grassland conversion: CO_2 estimates are available for 1991–2000 but not for the period 1985–1990. CH_4 estimates were reported for the same years as those for CO_2, while for N_2O estimates, although emissions are very small, there is no continuous reporting of the time series. However, given that activity data used in this category were found to be inappropriate, the estimates provided do not approximate actual emissions, as explained in paragraph 167;

(c) Abandonment of managed lands: This activity does not occur in Hungary;

(d) CO_2 emissions and removals from soil: Estimates are available for 1998–2000 but not for the period 1985–1997.

164. According to the national experts, estimates on CO_2 emissions and removals from soil are in principle available until 1987, and thus the base year. For the following years (1988–1997) estimates may become available through the recalculation process. Hungary further explained that such estimates are available between 1965–1987, but that from 1987 onwards data availability is limited to individual input components.

3. Transparency

165. The information provided in the LUCF chapter of the NIR is not sufficiently detailed to enable full reconstruction of the inventory. However, the local experts assured the ERT that all the background information is available upon request. For example, data on wood resources in Hungarian forests were made available to the ERT during the visit (these data were compiled by the national expert using the National Forest Service publications). The submission requires a moderate improvement in transparency to enable a third party verification of the results; for example, an explanatory text accompanying the IPCC worksheets and references to the data collection and transformation to meet the UNFCCC reporting requirements is recommended by the ERT.

4. Methodologies, emission factors and activity data

166. Hungary used the methodology from the IPCC Guidelines to estimate all GHG emissions and removals from the LUCF sector. The ERT considers this methodology to be appropriate for Hungary.

5. Accuracy

167. The methodology is appropriately applied to estimate CO_2 emissions and removals from 5.A Changes in forest and other woody biomass stocks, resulting in reliable numerical values. However, the use of inappropriate activity data in forest and grassland conversion, changes in soil carbon for mineral soils, and carbon emissions from intensively managed organic soils might have resulted in a substantial bias in the estimated CO_2 emissions/removals. It seems that this resulted in estimates for forest and grassland conversions most likely being overestimated, but underestimated for changes in soil carbon for mineral soils. Therefore, the extent of error in the overall CO_2 balance for the LUCF sector introduced by the use of these activity data is difficult to estimate, but most likely large. The expected range of corrections to the annual CO_2 estimates may be in the order of the year-to-year variations based on the currently reported annual estimates, making any analysis of trends and time-series consistency practically impossible.

168. According to information provided by the national experts the appropriate activity data are available, so that these estimates could be revised during the recalculation process.

6. Recalculations and time-series consistency

169. No recalculations were undertaken by the Party. However, taking into account limitations resulting from the use of data based on past field surveys (such as yield tables), the ERT recommends recalculations whenever new data are available. The estimates for the category 5.A Changes in forest and other woody biomass stocks have been prepared by the same national expert for six to seven years and are calculated consistently (see also paragraph 175 below), and this category might, therefore, need only a minor recalculation reflecting the progress in knowledge. However, the recalculations required in the other categories of the LUCF sector (as described below under the section source and sink categories) will result in recalculation of the entire LUCF sector. Thus, an assessment of time-series consistency based on the current numerical values for the GHG balance in the LUCF sector is not practical.

7. Uncertainties

170. Hungary applies qualitative uncertainty estimates to its LUCF GHG balance, based on expert judgement. Uncertainties were assessed for the first time for the 2000 inventory.

171. Uncertainty of emissions/removals from category 5.A Changes in forest and other woody biomass stocks is critically dependent on the uncertainty inherent in the yield tables. The error inherent in the data in these tables is currently not known.

172. The assessment of uncertainties in emission/removal estimates for the other source/sink categories (5.B and 5.D) is impossible to verify due to the inappropriate activity data used.

173. In general, it seems that the expertise of the national experts should enable the use of Monte Carlo simulation for assessing uncertainties in future submissions. The necessary data for performing such simulation are in principle available.

8. Verification and QA/QC

174. Neither data verification nor QA/QC are performed at the national level within the LUCF sector. Estimates for categories 5.A and 5.B are supplied to IEM as final results in the form of final IPCC sheets and CRF. Consequently, the applicability of background data and correctness of the arithmetic used can not be verified by the IEM staff. All background information and calculations are archived only by the national expert at the Forest Research Institute. Estimates for the remaining categories are prepared within the IEM and thus the background data and calculations are in principle verifiable before submission to the UNFCCC secretariat.

B. Source and sink categories

1. Changes in forest and other woody biomass stocks – CO_2

175. Forest biomass stocks are divided between coniferous and deciduous species (90 per cent deciduous). Stock data are taken from the National Forest Inventory. The annual growth rate is calculated using current data provided by the National Forest Service and the data based on the yield tables developed by the Forest Research Institute. No estimates for non-forest trees are provided due to a lack of data (e.g. growth rates) but, taking into account their high uncertainty and low influence on the final balance, the procedure may be justified at this stage. Emissions from harvest, as presented in the IPCC sheets, cover all main sources of CO_2 emissions and the ERT has thus found the CO_2 balance input from changes in forest and other woody biomass stocks to be adequately covered. The following is noted with regard to the individual parameters used in the calculation of this category:

(a) Area of **forest stocks** (country-specific data): This is based on detailed information collected by the National Forest Service and is considered to contain negligible error.

(b) **Commercial harvest** (country-specific data): Data are taken from the National Forest Service. According to the national expert, 45 per cent of the harvested wood is for commercial use, 20 per cent remains as slash and 20 per cent is used as fuel.

(c) **Total traditional fuel wood consumed** (country-specific data): This is assessed as a fraction of commercial harvest. The national expert informed the ERT that the fraction was measured several times. The numbers applied are within reasonable ranges for this kind of data but their uncertainty is not known.

(d) **Absorption factors** (country-specific data): Annual growth rate is based on numerical data derived from the yield tables provided by the National Forest Service; however, in the opinion of the ERT the rate is rather high compared to other European data.

(e) **Emission factors** (country-specific data): The numerical values for the biomass conversion/expansion ratios are low when compared to the IPCC default values; however, they reflect the country-specific yield tables, which (according to the national expert) contain data not only about thick wood but also about thin wood and other minor parts of the above ground biomass of trees. Thus, the biomass expansion factors (BEFs) are not largely greater than the wood specific density. They should cover only the overbark volume/mass. According to the national expert, however, their numerical values are low and so it would be useful to perform a numerical check of all data used in the BEF calculation.

(f) **C fraction of dry matter** (default data): A value of 0.45 was applied, which is among those suggested in the Revised 1996 IPCC Guidelines.

2. Forest and grassland conversion – CO_2 from biomass

176. The data on area converted annually, biomass before conversion, biomass after conversion and others do not adequately represent the actual situation and therefore the CO_2 release estimated for this category is not appropriate. Hungary is aware of the need to revise this part of the activity data; such revision will be undertaken as part of the recalculation process (see also paragraph 169).

3. Emissions and removals from soil – CO_2

Change in soil carbon for mineral soils

177. The data on land area t and land area t -20 do not adequately represent the actual situation for the 1998 and 1999 inventories; the CO_2 release estimated within this category is thus not appropriate and requires recalculation.

Carbon emissions from intensively-managed organic soils

178. The data on land area do not adequately represent the actual situation for the 1998 and 1999 inventories; the carbon release estimated within this category is thus not appropriate and requires recalculation.

Carbon emissions from liming of agricultural soils

179. Data on limestone use are provided by the Ministry of Agriculture, the Plant Health and Soil Production Service and the Hungarian Central Statistical Office. The national expert responsible for the calculations was not available during the visit and therefore the ERT was not acquainted with the original data; however, the carbon emission estimate is within a reasonable range.

4. Forest and grassland conversion: on-site burning of forests and biomass burning – non-CO_2 gases

180. There is very little burning activity in Hungary. Data on non-CO_2 trace gases is limited and emissions are calculated using IPCC default values. However, activity data used in this category were

found to be inappropriate (as already referred to in the forest and grassland conversion - CO_2 section). Consequently, results of these calculations do not adequately reflect the actual situation with regard to the release of non-CO_2 gases from this source category.

C. Areas for further improvement

1. Issues identified by the Party

181. The LUCF section of the NIR makes no reference to identified or planned improvements specifically relating to LUCF; however, during the visit national experts indicated the following areas for improvement:

(a) The afforestation, reforestation and deforestation processes should be covered by the National Forest Inventory. To this end, the database from the Forest Service would require revision to allow data on afforestation/deforestation to be obtained separately;

(b) The availability of data (mainly relating to forestry) should be increased in order to improve transparency;

(c) An internal revision procedure should be introduced;

(d) The statistical errors inherent in the yield tables should be assessed and procedures introduced enabling updating of the tables' contents;

(e) Uncertainties should be estimated (for example, by applying Monte Carlo simulation);

(f) The fate of soil carbon during afforestation practices should be studied;

(g) The LUCF time series should be recalculated to correct for improper activity data used for some activities.

2. Issues identified by the ERT

182. The ERT would recommend the following improvements for the LUCF sector:

(a) The area of deforestation resulting from economic development of the country should be assessed, for example through usage of data stored by the institution issuing the land-use change permits (Forest Service), which might require some modification in the data system of these institutions;

(b) Internal verification and QA/QC procedures need to be defined and introduced into practice;

(c) Detailed references should be provided for all the data used;

(d) A safe system of archiving of the data and estimates at the country level should be introduced;

(e) The influence of bark volume and its specific density on the BEF values used in the inventory should be assessed numerically;

(f) Better communication should be established between the national forestry and soil experts to ensure consistency in the use of data between the various LUCF categories;

(g) Better communication should be established between the Ministry of Agriculture and the Ministry for the Environment;

(h) The necessary data for estimating forest and grassland conversion for the base year until 1990 should be collected, and the time series for soils from the base year until 1997 should be completed;

(i) Reporting in the CRF should be improved through the use of appropriate notation keys in the sector-relevant tables of the CRF, such as NO for abandonment of managed lands (in tables 5 and 10), and transcription errors in the CRF should be avoided (for instance by means of a checking procedure between national forestry expert and IEM).

VI. WASTE

A. Sector overview

183. The waste sector contributed approximately five per cent of CO_2 equivalent emissions in the year 2000. Consistent data are not available for more than one or two years and therefore a reliable trend cannot be determined or assessed.

1. Completeness

184. The CRF includes estimates of most gases and sources of emissions from the waste sector, as recommended by the IPCC Guidelines. Not included are N_2O from waste water and human sewage.

2. Transparency

185. The NIR alone is not detailed or transparent enough to allow independent verification. Information on the time series of the activity data, emission factors and emissions would be useful. More detailed explanation and documentation of the methodologies and underlying studies is important for an understanding of how the emissions were estimated.

3. Methodologies, emission factors and activity data

186. In general, the methodologies for the waste sector are in line with the IPCC Guidelines. However, the largest key source in this sector (solid waste disposal on land) is evaluated by a tier 1-type methodology, which is not in line with the IPCC good practice guidance. The methodology estimates emissions from waste deposited in that year only, assuming a steady state of emissions since the base year, but this is not likely to be the case; especially in the future. The other methodologies are in line with the choice of tier in the IPCC good practice guidance. The activity data for the waste sector are in general country-specific.

4. Recalculations and time-series consistency

187. All sources in the waste sector need to be recalculated in order to produce a consistent time series from the base year to the current inventory year. Data are reported for 1991–2000 only; 1990 and base-year estimates (1985–1987) are not available for any waste source.

5. Verification and QA/QC

188. QA/QC measures have not been applied to this sector in either a formal or an informal manner. The results have not been checked with the results from other methods or countries. The documentation on background materials needs to be improved in order to improve transparency and allow the ERT to investigate the applicability and accuracy of the methodology and parameters used.

B. Key sources

1. Solid waste disposal on land – CH_4

Completeness

189. CH_4 from unmanaged solid waste disposal sites is not estimated though the activity data are available and reported in the correct section of the CRF.

Methodology, emission factors and activity data

190. The methodology applied to this source is country specific but accounts only for annual emissions from the waste generated in the respective year.

191. The activity data are country specific but are available only for waste generation per year and not total waste in place in landfill sites. This information is incompatible with the methodology, which uses an emission factor that accounts only for the waste generated within the year. Additionally, the data include only the major landfill sites operated by communities and no landfill sites operated by industry. However, industrial landfill sites are usually a small source. Experts reported that the time series of data would be available for a recalculation. Experts reported that surveys are being expanded in the coming years.

192. The emission factor is not documented well enough to evaluate its appropriateness. The emission factor is an estimate of annual biogas per unit of waste deposited, which is based on a literature search. The background information is not well documented or known by the national experts. It is uncertain whether the literature used describes models, measurements or other estimation methodologies.

193. Since the methodology is based only on annual waste generation and annual biogas emission factors, then a recalculated trend would be adequate if the waste sector were in a steady state (i.e. it had not changed its characteristics for several years) but the overall estimate will be underestimated. This methodology will need to be revised in the near future in order to be applicable to Hungarian changes in the regulations regarding waste management.

194. Estimates were recently improved to account for CH_4 from all domestic waste, not just household waste.

195. Country experts noted that within the next two to three years a database of solid waste disposal sites will be available with an expanded level of detail.

2. Waste-water handling – CH_4

196. The methodology is in accordance with the 1996 IPCC Guidelines but data are not available on sludge. Using the IPCC good practice guidance simplifies the methodology and the sludge data are no longer needed.

197. The methodology uses country-specific BOD and COD values and output amounts but uses the default MCF values. More research into this factor is recommended, as recent publications imply that for most EIT countries the value would be closer to 0.15 than to one.

198. The activity data available on COD and output factors for industrial waste water are impressive. These data are not available in many countries and thus the industrial emissions estimates would be excellent if data were also available on MCF values.

C. Non-key sources

1. Solid waste disposal on land – CO_2

199. The inventory contains emission estimates for CO_2 from landfill gas. This CO_2 might be considered biogenic and thus not to be counted in the inventory. According to the IPCC good practice guidance, only CO_2 relating to direct waste combustion at a landfill site needs to be included.

2. Waste incineration – CO_2

200. The methodology applied is consistent with the IPCC good practice guidance if the emission factor can be verified and referenced, the waste stream composition has not changed, and data on the time series can be obtained.

201. The data on waste incineration are plant specific with only one incinerator in the country.

202. The emission factor and capacity assumptions are not well documented in the country or the NIR. Additionally, the emission factor assumes no change in the composition of the waste stream entering the incinerator. Depending on the availability of data regarding waste composition and capacity factor back to 1985, difficulty may occur in back-casting the emissions. Additionally, new regulations in Hungary may affect waste composition and for future inventories the emission factor may need to be re-evaluated.

203. A minor issue is the allocation of waste. Emissions associated with energy production from the incinerator need to be re-allocated to the energy sector.

204. The current methodology includes CO_2 from biogenic sources. The fraction of emissions from biogenic sources should be estimated based on the percentage of waste and emission factors. The biogenic portion of emissions should be excluded from the final estimate.

3. Waste incineration – N_2O

205. The emission factor is based on expert judgement and is not well documented in the country or the NIR. The emission factor is also kept constant, with an assumption of a stable composition of the waste stream. See also comments on CO_2.

D. Areas for further improvement

1. Issues identified by the ERT

206. The ERT would recommend the following improvements for solid waste disposal on land:

(a) The methodology should be revised in the near future to allow for accounting of changes in management and disposal practices. Use of a higher tier method is recommended to account for emissions over the lifetime of waste generated (~ 30years). It is suggested that the methodology should be revised once a new database is in place. If a new database is uncertain, revision based on the current level of data is suggested;

(b) Biogenic estimates of CO_2 from solid waste biogas should be removed;

(c) Estimates of CH_4 from unmanaged sites should be added;

(d) Data on flaring and/or recovery at landfill sites should be collected if possible (recovery data may be available from operators, communities, waste associations, and so on);

(e) It is suggested that data on flaring and/or recovery might be included in the revised survey for landfill sites;

(f) If no landfill-specific data are available, vendors may be open to providing data as outlined in the IPCC good practice guidance;

(g) If the present method is retained, the estimate of annual biogas per unit waste should be researched/documented;

(h) If the present method is retained, the applicability of steady state assumption should be researched/documented;

207. The ERT would recommend the following improvements for waste water:

(a) The IPCC good practice guidance methodology should be used, which simplifies the sludge component;

(b) The MCF value should be researched, as publications suggest much lower values for EIT countries;

(c) The human sewage N_2O component should be added, the IPCC default methodology is one option since this is not a key source. The activity data are available from FAO, if not available in the country.

208. The ERT would recommend the following improvements for waste incineration:

(a) The emission and capacity usage factors should be researched and documented;

(b) The biogenic fraction of CO_2 emissions should be excluded;

(c) Emissions relating to energy production should be re-allocated to the energy sector.

Annex

MATERIALS USED DURING THE REVIEW

A. Support materials on the CD-ROM and the UNFCCC web site for the review

2000, 2001 and 2002 *Inventory submissions of Hungary* including CRF and NIR [unpublished].
UNFCCC secretariat. *2000 Status reports for Hungary* [available *at* http://unfccc.int/program/mis/ghg/statrep00/lat00.pdf*]*.
UNFCCC secretariat. *2001 Status report for Hungary* [available at http://unfccc.int/program/mis/ghg/statrep01/lva01.pdf*]*.
UNFCCC secretariat. *2002 Status report for Hungary* [available at http://unfccc.int/program/mis/ghg/statrep02/lva02.pdf].
UNFCCC secretariat. *Synthesis and assessment report of the greenhouse gas inventories submitted in 2000,*. FCCC/WEB/SAI/2000 [available at http://unfccc.int/program/mis/ghg/sai2000.pdf].
UNFCCC secretariat. *Synthesis and assessment report of the greenhouse gas inventories submitted in 2001*, FCCC/WEB/SAI/2001 [available at http://unfccc.int/program/mis/ghg/sai2001.pdf].
UNFCCC secretariat. *Draft synthesis and assessment report of the greenhouse gas inventories submitted in 2002* (Part I and Part II – the section on Hungary) [unpublished].
Hungary's comments to the "Draft synthesis and assessment report of the greenhouse gas inventories submitted in 2002" [unpublished].
UNFCCC secretariat. *Key source analysis on the Hungarian inventory for the year 2000* [unpublished].
UNFCCC secretariat. *Handbook for review of national GHG inventories*. Draft 2002 [unpublished].
UNFCCC secretariat. *UNFCCC guidelines on reporting and review.* FCCC/CP/1999/7 [available at: http://www.unfccc.int/resource/docs/cop5/07.pdf].
IPCC. *IPCC good practice guidance and uncertainty management in national greenhouse gas inventories. 2000* [available at http://www.ipcc-nggip.iges.or.jp/public/gp/gpgaum.htm].
IPCC/OECD/IEA. *Revised 1996 IPCC Guidelines for national greenhouse gas inventory, volumes 1–3,* 1997 [available at: http://www.ipcc-nggip.iges.or.jp/public/gl/invs1.htm].

B. Additional materials provided by Hungary during the review

Worksheets from the Revised 1996 IPCC Guidelines for the 2000 inventory.
IPCC Input data sheets for the 2000 inventory.
Environmental Statistical Data of Hungary, 2000, Hungarian Central Statistical Office (KSH), Budapest 2002.
Data on Hungary's Environment, Ministry of the Environment, Budapest 2001 (including CD).
Energy Statistical Year book 2000, Energy Efficiency, Environment and Energy Information Agency Non-profit Co. (relevant tables for the energy sector only due to confidentiality).
Study on HFCs, PFCs and SF_6 from Ministry: Uveghazhatast okozo vegyuletek magyarorszagi felhasznalasa (HFC, PFC, SF_6), IEM, Budapest 1998 (in Hungarian).
Background data on HFCs, PFCs and SF_6 for 2000 and 2001, IEM (in Hungarian).
CORINAIR (SNAP code) for industrial processes (coverage of activities).
Comparison of emission data (CO_2, CH_4, N_2O, CO, NMVOc, NO_x and SO_2) according to the IPCC, CORINAIR and National Emission Database, IEM.
Deviations and reasons noticed while filling up the 1998 CORINAIR and IPCC database, IEM, Hungary, December 2000.
Figures on solid waste for 1980–1990 (in Hungarian), Euroconsult, January 1993.

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