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Report of the individual review of the annual submission of Hungary submitted in 2013*

* In the symbol for this document, 2013 refers to the year in which the inventory was submitted, and not to the year of publication.

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Contents

I. Introduction and summary

1. This report covers the review of the 2013 annual submission of Hungary, coordinated by the UNFCCC secretariat, in accordance with decision 22/CMP.1. The review took place from 23 to 28 September 2013 in Bonn, Germany, and was conducted by the following team of nominated experts from the UNFCCC roster of experts: generalists – Ms. Karin Kindbom (Sweden) and Mr. Newton Paciornik (Brazil); energy – Ms. Olia Glade (New Zealand), Mr. Ralph Harthan (Germany), Ms. Yuriko Hayabuchi (Japan) and Ms. Carmen Meneses Lopez (Venezuela (Bolivarian Republic of)); industrial processes and solvent and other product use – Mr. Predrag Novosel (Montenegro) and Mr. Jos Olivier (the Netherlands); agriculture – Mr. Bernard Hyde (Ireland), Mr. Jacques Kouazounde (Benin) and Mr. Asaye Ketema (Ethiopia); land use, land-use change and forestry (LULUCF) – Mr. Sandro Federici (San Marino) and Ms. Valentyna Slivinska (Ukraine); and waste – Ms. Maryna Bereznytska (Ukraine) and Ms. Violeta Hristova (Bulgaria). Mr. Federici and Ms. Kindbom were the lead reviewers. The review was coordinated by Mr. Roman Payo (UNFCCC secretariat).

2. In accordance with the "Guidelines for review under Article 8 of the Kyoto Protocol" (decision 22/CMP.1) (hereinafter referred to as the Article 8 review guidelines), a draft version of this report was communicated to the Government of Hungary, which provided comments that were considered and incorporated, as appropriate, into this final version of the report. All encouragements and recommendations in this report are for the next annual submission, unless otherwise specified. The expert review team (ERT) notes that the 2012 annual review report of Hungary was published after the submission of the 2013 annual submission.

3. In 2011, the main greenhouse gas (GHG) in Hungary was carbon dioxide (CO_2), accounting for 75.0 per cent of total GHG emissions[1] expressed in CO_2 equivalent (CO_2 eq), followed by methane (CH_4) (12.8 per cent) and nitrous oxide (N_2O) (10.2 per cent). Hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6) collectively accounted for 2.0 per cent of the overall GHG emissions in the country. The energy sector accounted for 71.5 per cent of total GHG emissions, followed by the agriculture sector (13.2 per cent), the industrial processes sector (9.5 per cent), the waste sector (5.3 per cent) and the solvent and other product use sector (0.5 per cent). Total GHG emissions amounted to 66,279.01 Gg CO_2 eq and decreased by 43.1 per cent between the base year[2] and 2011. The ERT concludes that the description in the national inventory report (NIR) of the trends for the different gases and sectors is reasonable given Hungary's transformation from a centralized economy to a market economy in the 1990s.

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

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

[2] "Base year" refers to the base year under the Kyoto Protocol, which is the average of the period 1985–1987 for CO_2, CH_4 and N_2O, and 1995 for HFCs, PFCs and SF_6. The base year emissions include emissions from sources included in Annex A to the Kyoto Protocol.

5. Additional background data on recalculations by Hungary in the 2013 annual submission, as well as information to be included in the compilation and accounting database, can be found in annex I to this report.

Table 1

Greenhouse gas emissions from Annex A sources and emissions/removals from activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, by gas, base year[a] to 2011

			Gg CO_2 eq							*Change (%)*
		Greenhouse gas	*Base year[a]*	*1990*	*1995*	*2000*	*2008*	*2009*	*2010*	*2011*	*Base year–2011*
Annex A sources		CO_2	85 430.19	73 155.17	62 478.24	59 468.97	56 527.97	51 055.84	51 609.07	49 740.71	–41.8
		CH_4	13 474.10	12 653.14	9 986.10	9 993.25	8 834.10	8 682.14	8 679.46	8 461.19	–37.2
		N_2O	17 128.40	12 814.87	7 472.26	8 359.82	7 000.72	6 541.40	6 464.30	6 774.46	–60.4
		HFCs	23.88	NA, NO	23.88	213.64	958.23	918.59	1 016.47	1 116.58	4 575.1
		PFCs	166.82	270.83	166.82	212.16	3.80	2.93	1.21	1.71	–99.0
		SF_6	169.59	87.62	169.59	195.26	275.50	220.55	234.94	184.37	8.7
KP-LULUCF	Article 3.3[b]	CO_2					–1 109.42	–1 060.71	–1 242.56	–1 184.62	
		CH_4					0.27	0.36	0.42	1.20	
		N_2O					0.28	0.30	0.29	0.38	
	Article 3.4[c]	CO_2	NA				–2 806.76	–1 914.00	–1 704.05	–1 560.13	NA
		CH_4	NA				20.64	20.13	22.09	33.70	NA
		N_2O	NA				2.10	2.04	2.24	3.42	NA

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

[a] "Base year" for Annex A sources refers to the base year under the Kyoto Protocol, which is the average of the period 1985–1987 for CO_2, CH_4 and N_2O, and 1995 for HFCs, PFCs and SF_6. The "base year" for cropland management, grazing land management and revegetation under Article 3, paragraph 4, of the Kyoto Protocol is the average of the period 1985–1987. For activities under Article 3, paragraph 3, of the Kyoto Protocol and forest management under Article 3, paragraph 4, only the inventory years of the commitment period must be reported.

[b] Activities under Article 3, paragraph 3, of the Kyoto Protocol, namely afforestation and reforestation, and deforestation.

[c] Elected activities under Article 3, paragraph 4, of the Kyoto Protocol, including forest management, cropland management, grazing land management and revegetation.

Table 2
Greenhouse gas emissions by sector and activity, base year[a] to 2011

			Gg CO_2 eq							*Change (%)*
		Sector	*Base year[a]*	*1990*	*1995*	*2000*	*2008*	*2009*	*2010*	*2011*	*Base year–2011*
Annex A		Energy	79 331.61	68 252.83	59 227.16	56 597.50	53 404.91	48 737.30	49 035.92	47 364.11	–40.3
		Industrial processes	14 657.17	11 573.67	7 878.06	8 160.47	6 851.48	6 012.91	6 490.17	6 323.65	–56.9
		Solvent and other product use	284.42	226.15	205.06	213.62	406.30	340.09	268.88	309.56	8.8
		Agriculture	19 043.88	15 477.47	9 296.02	9 533.77	9 113.38	8 577.52	8 531.30	8 758.65	–54.0
		Waste	3 075.90	3 451.50	3 690.61	3 937.75	3 824.26	3 753.62	3 679.17	3 523.04	14.5
		LULUCF	NA	–2 018.91	–5 575.21	–682.72	–4 824.47	–3 989.80	–4 084.71	–3 787.48	NA
		Total (with LULUCF)	**NA**	**96 962.72**	**74 721.70**	**77 760.39**	**68 775.86**	**63 431.65**	**63 920.74**	**62 491.53**	**NA**
		Total (without LULUCF)	**116 392.99**	**98 981.62**	**80 296.90**	**78 443.10**	**73 600.33**	**67 421.44**	**68 005.45**	**66 279.01**	**–43.1**
		Other[b]	NA	NA	NA	NA	NA	NA	NA	NA	NA
KP-LULUCF	Article 3.3[c]	Afforestation and reforestation					–1 155.59	–1 149.62	–1 290.39	–1 253.49	
		Deforestation					46.72	89.57	48.53	70.45	
		Total (3.3)					**–1 108.87**	**–1 060.06**	**–1 241.85**	**–1 183.04**	
	Article 3.4[d]	Forest management					–2 784.02	–1 891.82	–1 679.71	–1 523.02	
		Cropland management	NA				NA	NA	NA	NA	NA
		Grazing land management	NA				NA	NA	NA	NA	NA
		Revegetation	NA				NA	NA	NA	NA	NA
		Total (3.4)	**NA**				**–2 784.02**	**–1 891.82**	**–1 679.71**	**–1 523.02**	**NA**

Abbreviations: KP-LULUCF = LULUCF emissions and removals from activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, LULUCF = land use, land-use change and forestry, NA = not applicable.

[a] "Base year" for sources included in Annex A to the Kyoto Protocol refers to the base year under the Kyoto Protocol, which is the average of 1985–1987 for CO_2, CH_4 and N_2O, and 1995 for HFCs, PFCs and SF_6. The "base year" for cropland management, grazing land management and revegetation under Article 3, paragraph 4, of the Kyoto Protocol is the average of 1985–1987. For activities under Article 3, paragraph 3, of the Kyoto Protocol and forest management under Article 3, paragraph 4, only the inventory years of the commitment period must be reported.

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

[c] Activities under Article 3, paragraph 3, of the Kyoto Protocol, namely afforestation and reforestation, and deforestation.

[d] Elected activities under Article 3, paragraph 4, of the Kyoto Protocol, including forest management, cropland management, grazing land management and revegetation.

II. Technical assessment of the annual submission

A. Overview

1. Annual submission and other sources of information

6. The 2013 annual inventory submission was submitted on 15 April 2013; it contains a complete set of common reporting format (CRF) tables for the period 1985–2011 and an NIR. A revised NIR was submitted on 15 May 2013. Hungary also submitted the information required under Article 7, paragraph 1, of the Kyoto Protocol, including information on: activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, accounting of Kyoto Protocol units, changes in the national system and in the national registry, and the minimization of adverse impacts in accordance with Article 3, paragraph 14, of the Kyoto Protocol. The standard electronic format (SEF) tables were submitted on 10 April. Revised SEF tables were submitted on 15 May 2013. The annual submission was submitted in accordance with decision 15/CMP.1.

7. Hungary officially submitted revised emission estimates on 11 November 2013 in response to the list of potential problems and further questions raised by the ERT. The values used in this report are those submitted by Hungary on 11 November 2013.

8. The full list of materials used during the review is provided in annex II to this report.

2. Overall assessment of the inventory

9. Table 3 contains the ERT's overall assessment of the annual submission of Hungary. For recommendations for improvements related to cross-cutting issues for specific categories, please see the paragraphs cross-referenced in the table.

Table 3
The expert review team's overall assessment of the annual submission

		General findings and recommendations
The expert review team's (ERT's) findings on completeness of the 2013 annual submission		
Annex A sources[a]	Complete	Mandatory: None
		Non-mandatory: "NE" is reported for: N_2O emissions from wastewater handling for industrial wastewater and for domestic and commercial wastewater. HFC-365mfc is reported as blank
Land use, land-use change[a] and forestry	Not complete	Mandatory: "NE" is reported for: net CSC in DOM and mineral soils in cropland, grassland and settlements converted to forest land; net CSC in mineral soils in settlements converted to cropland; CSC in living biomass and mineral soils in settlements converted to grassland; CSC in living biomass and soils from wetlands converted to settlements; and CSC in soils from grassland converted to other land

		General findings and recommendations
		Non-mandatory: "NE" is reported for: CSC in all pools from wetlands remaining wetlands; CSC in all pools from settlements remaining settlements; CH_4 and N_2O emissions from drainage of soils and wetlands – wetlands; and CO_2 emissions from harvested wood products
KP-LULUCF	Complete	
The ERT's findings on recalculations and time-series consistency in the 2013 annual submission	Generally consistent	The ERT noted that several time series in the energy sector have been calculated using different methods and/or EFs for different years, which may lead to inconsistent time series (e.g. see paras. 42, 44, 45, 53, 54, 55, 59)
The ERT's findings on verification and quality assurance/quality control procedures in the 2013 annual submission	Sufficient	Consistency in information could be improved (e.g. see paras. 67, 88, 90, 95, 105 and 112)
The ERT's findings on the transparency of the 2013 annual submission	Generally sufficient	Some information is not completely transparent (e.g. see paras. 16, 17, 27, 32, 45, 49, 58, 63, 66, 68, 69, 70, 71, 82, 85, 94, 96, 98, 126)

Abbreviations: Annex A sources = sources included in Annex A to the Kyoto Protocol, CRF = common reporting format, CSC = carbon stock change, DOM = dead organic matter, EF = emission factor, KP-LULUCF = land use, land-use change and forestry emissions and removals from activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, NE= not estimated, NIR = national inventory report.

[a] The assessment of completeness by the ERT considers only the completeness of reporting of mandatory categories (i.e. categories for which methods and default emission factors are provided in the Intergovernmental Panel on Climate Change (IPCC) *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories*, the IPCC *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories*, or the IPCC *Good Practice Guidance for Land Use, Land-Use Change and Forestry)*.

3. Description of the institutional arrangements for inventory preparation, including the legal and procedural arrangements for inventory planning, preparation and management

Inventory planning

10. The NIR and additional information provided by the Party during the review described the national system for the preparation of the inventory. The Ministry of Rural Development (in agreement and cooperation with the Ministry of National Development) is the single national entity with overall responsibility for the national inventory. Other agencies and organizations are also involved in the preparation of the inventory. The inventory is approved by two ministers: the Minister of National Development and the Minister of Rural Development – the first approves the inventory submission before it is submitted to the European Commission; and the second approves it before it is ultimately submitted to the UNFCCC secretariat.

11. A GHG Inventory Division was established within the Hungarian Meteorological Service (OMSZ) for the preparation and development of the inventory. The Division is responsible for all inventory-related tasks, compiles the GHG inventory and other reports and supervises the maintenance of the national inventory system. In addition, it coordinates the work with other ministries, government agencies, universities, companies and consultants on a contractual basis. Since late 2009, following the entry into force of a

governmental decree, the Forestry Directorate of the National Food Chain Safety Office (NFCS, Forestry Directorate, formerly known as Central Agricultural Office) and the Forest Research Institute have been responsible for the part of the LULUCF sector inventory concerning forestry, including the supplementary reporting on activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, and for making recommendations to OMSZ.

12. Most parts of the inventory are prepared by the experts at the GHG Inventory Division of OMSZ. The calculations of emissions from the agriculture and LULUCF sectors (except forestry) are compiled by OMSZ with contributions from external experts on a contractual basis. In response to a question raised by the ERT during the review, Hungary explained that OMSZ does the actual compilations while the Karcag Research Institute of the University of Debrecen (Department of Soil Utilization and Rural Development) and the Research Institute for Animal Breeding and Nutrition, as well as the University of Gödöllő, are contracted for specified research projects in line with the annual development plan. The focus of the research tasks can vary between years. The ERT encourages Hungary to explain more transparently in the NIR the role of the contracted institutes as contributing to the research and development work rather than directly to the annual compilation of the inventory.

13. In the Hungarian quality assurance/quality control (QA/QC) plan it is stated that the sectoral experts are responsible for choices of methods, sometimes in cooperation with external experts. In response to a question raised by the ERT during the review, Hungary clarified that the sectoral experts consult with the head of the GHG Inventory Division on the choice of method. The ERT recommends that Hungary include this information in its NIR.

14. OMSZ has a quality management system, which also covers its GHG Inventory Division and the GHG inventory preparation process, certified by the International Organization for Standardization (ISO). Internal audits are conducted every year and the quality management system, including the activities of the GHG Inventory Division, is subject to regular external audits.

15. In response to a recommendation made in the previous review report, Hungary has included an English translation of its QA/QC-plan in annex 6 of the NIR. It includes a description of tasks and responsibilities and a description of the activities in the annual inventory cycle (including archiving routines, an inventory development plan and examples of QA/QC checklists used during the inventory preparation process). The ERT commends Hungary for its efforts in this regard.

16. In the QA/QC plan the ERT found that it was not clear what QA activities are performed in Hungary before submission of the inventory. In response to a question raised by the ERT during the review, Hungary explained that several activities considered as QA are performed. For example, experts from other ministries represented in the Committee for Interministerial Coordination for European Affairs have the opportunity to comment on the NIR, and also do so. For parts of the KP-LULUCF inventory it is a common practice that the experts from the Forestry Directorate of the National Food Chain Safety Office prepare the inventory and the experts from the Forest Research Institute perform QA checks. Peer reviews have also been carried out, most recently in 2010 for the energy and industrial processes sectors. Furthermore, it is usual practice in Hungary that emission forecasts are prepared by independent institutes or firms, who start their work by looking at the inventory and then extensive consultations occur with inventory staff at OMSZ. In addition, QA of inventory data is performed in cross-checks with the data from the National Accounting Matrix with Environmental Accounts (NAMEA) software of the Hungarian Statistical Office as well as by experts from several other agencies responsible for other international reporting obligations (e.g. experts responsible for reporting under the Nitrate Directive) who are required to check inventory data for comparison or before direct use. The ERT recommends that Hungary include, in the NIR, this information on the QA activities performed before its annual submission to increase transparency. The ERT also

recommends that Hungary develop templates or records for the documentation of these types of QA activities, as appropriate.

17. In response to a question raised by the ERT during the review on how the information from the different QA/QC checklists compiled are taken into account (especially those that need further action) Hungary clarified that QA/QC checklists are compiled by sectoral experts who are also responsible for inserting the issues that need further action into the annual Development Plan, which is approved by the head of the GHG Inventory Division. The ERT encourages Hungary to clarify these responsibilities in its QA/QC plan in the NIR.

18. In the summary table in the QA/QC plan, GHG Inventory Division meetings are mentioned and labelled as QC. In response to a question raised by the ERT during the review, Hungary explained that general issues and complicated sectoral problems (either regarding questions raised during a review or regarding planned improvements) are discussed during division meetings. The ERT considers that by including this clarification in the NIR the transparency would increase, and Hungary is therefore encouraged to do so.

Inventory preparation

19. Table 4 contains the ERT's assessment of Hungary's inventory preparation process. For improvements related to specific categories, please see the paragraphs cross-referenced in the table.

Table 4
Assessment of inventory preparation by Hungary

		General findings and recommendations
Key category analysis		
Was the key category analysis performed in accordance with the Intergovernmental Panel on Climate Change (IPCC) *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (hereinafter referred to as the IPCC good practice guidance) and the IPCC *Good Practice Guidance for Land Use, Land-Use Change and Forestry* (hereinafter referred to as the IPCC good practice guidance for LULUCF)?	Yes	A new more disaggregated tier 1 level and trend analysis for 2011 has been performed and reported in CRF table 7 and in the NIR. Furthermore, the more disaggregated tier 1 level assessment has not been performed for the base year (average of 1985–87) and the previous more aggregated key category analysis is reported in CRF table 7 (see para. 20)
Approach followed?	Tier 1 and tier 2	
Were additional key categories identified using a qualitative approach?	No	
Has the Party identified key categories for activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol following the guidance on establishing the relationship between the activities under the Kyoto Protocol and the associated key categories in the UNFCCC inventory?	Yes	
Does the Party use the key category analysis to prioritize inventory improvements?	Yes	

		General findings and recommendations
Are there any changes to the key category analysis in the latest submission?	Yes	A more disaggregated tier 1 key category analysis has been performed for 2010 and 2011. The disaggregated level and trend assessment for 2011 is reported in CRF table 7 and quantitatively in NIR Annex 1
Assessment of uncertainty analysis		
Approach followed?	Tier 1	
Was the uncertainty analysis carried out in accordance with the IPCC good practice guidance and the IPCC good practice guidance for LULUCF?	Yes	No reporting of quantitative uncertainty excluding LULUCF was provided. The ERT encourages Hungary to provide this
Quantitative uncertainty (including LULUCF)	Level = 20.2% Trend = 2.7%	
Quantitative uncertainty (excluding LULUCF)	Level = Not provided Trend = Not provided	

Abbreviations: CRF = common reporting format, LULUCF = land use, land-use change and forestry, NIR = national inventory report.

20. The ERT recommends that Hungary include in the NIR and CRF table 7 the results from the key category analysis performed excluding LULUCF, in addition to the results from the key category analysis including LULUCF. The ERT also recommends that Hungary report a disaggregated key category analysis for the base year in its NIR and CRF table 7.

Inventory management

21. Hungary has a centralized archiving system, which includes the archiving of disaggregated emission factors (EFs) and activity data (AD), and documentation on how these factors and data have been generated and aggregated for the preparation of the inventory. The archived information also includes internal documentation on QA/QC procedures, external and internal reviews, and documentation on annual key categories and key category identification and planned inventory improvements. Procedures for documenting and archiving are well described in the QA/QC plan in annex 6 in the NIR. The centralized archiving system is kept within the central register and IT networks of OMSZ, and an archiving coordinator is responsible for the maintenance of the archiving system. During the review, the ERT was provided with the requested additional archived information.

4. Follow-up to previous reviews

22. In response to recommendations made in previous review reports Hungary has provided a disaggregated key category analysis for 2011. Hungary has also included an English translation of its QA/QC plan in the NIR. The ERT notes that the 2012 annual review report of Hungary was published after the submission of the 2013 annual submission. Despite this, Hungary has implemented the recommendations for cross-cutting issues included in that report. Furthermore, in annex 8 of its NIR, Hungary lists recommendations from the 2012 European Union (EU) technical review and its responses

to questions raised in that review. The ERT commends Hungary for its efforts in following up on recommendations made in previous reviews.

23. Hungary has addressed the majority of previously raised issues, but the following pending issues were noted by the ERT:

(a) Ensure consistency of the time series for cement production and glass production (see para. 59 below);

(b) Determine whether import of N_2O for anaesthesia occurs and, if appropriate, collect data and report relevant estimates of N_2O emissions (see para. 64 below);

(c) Report estimates for the currently non-estimated carbon pools for which methodologies are provided in the Intergovernmental Panel on Climate Change (IPCC) *Good Practice Guidance for Land use, Land-Use Change and Forestry* (hereinafter referred to as the IPCC good practice guidance for LULUCF) (see paras. 82, 91 below);

(d) Increase the transparency of the figures in CRF table 5.A by disaggregating the area of the forest subcompartments and the "permanently" unstocked areas (see para. 85 below);

(e) Use the improvements made regarding estimates for cropland remaining cropland to move to a higher tier, as this is a key category (see para. 93 below);

(f) Clarify the assumptions of static management practices for grasslands (see para. 94 below);

(g) Explain the efforts made to separate and report emissions from managed peat lands in order to improve transparency (see para. 96 below);

(h) Use the notation key "NE" (not estimated) if emissions from lime application on grassland are negligible or "NO" (not occurring) if they do not occur, and provide this information in the documentation box of CRF table 5(IV) (see para. 98 below);

(i) Explain in more detail how the data for waste composition between 1950 and 1980 have been interpolated (see para. 101 below) and complete the time series on CH_4 recovery from solid waste disposal on land (see para. 102 below);

(j) Justify the use of default method from the *2006 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the 2006 IPCC Guidelines) to estimate CH_4 from wastewater handling (see para. 104 below);

(k) Improve the consistency of the information on the degradable organic component in the pulp and paper industry between the NIR and the CRF tables (see para. 105 below);

(l) Provide all necessary information on recalculations related to the KP-LULUCF activities in the NIR (see para. 109 below).

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

24. During the review, the ERT identified a number of areas for improvement, including some related to specific categories. These are listed in the relevant chapters of this report and in table 9.

B. Energy

1. Sector overview

25. The energy sector is the main sector in the GHG inventory of Hungary. In 2011, emissions from the energy sector amounted to 47,364.11 CO_2 eq, or 71.5 per cent of total GHG emissions. Since the base year, emissions have decreased by 40.3 per cent. The key drivers for the fall in emissions are: the economic transformation between 1987 and 1992 that reduced energy consumption; changes in the fuel matrix with the replacement of solid fuel by natural gas; and the impact of the financial crisis from 2008. Within the sector, 33.8 per cent of the emissions were from energy industries, followed by 29.2 from other sectors, 24.1 from transport and 8.0 from manufacturing industries and construction. Fugitive emissions from fuels accounted for 4.9 per cent of the sectoral emissions (4.89 per cent from oil and natural gas and 0.02 per cent from solid fuels).

2. Reference and sectoral approaches

26. Table 5 provides a review of the information reported under the reference approach and the sectoral approach, as well as comparisons with other sources of international data. Issues identified in table 5 are more fully elaborated in paragraphs 27–39 below.

Table 5
Review of reference and sectoral approaches

		Paragraph cross–references
Difference between the reference approach and the sectoral approach for 2011	Energy consumption: 13.04 PJ, 1.96% CO_2 emissions: 778.28 Gg CO_2 eq, 1.77%	
Are differences between the reference approach and the sector approach adequately explained in the NIR and the CRF tables?	Yes	
Are differences with international statistics adequately explained?	No	27–39
Is reporting of bunker fuels in accordance with the UNFCCC reporting guidelines?	No	37
Is reporting of feedstocks and non–energy use of fuels in accordance with the UNFCCC reporting guidelines?	Yes	

Abbreviations: CRF = common reporting format, NIR = national inventory report, UNFCCC reporting guidelines = "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual inventories".

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

27. The ERT notes that the apparent consumption in Hungary's reference approach for years in the period 1985–2011 corresponds within about 2 per cent to the International Energy Agency (IEA) data, except for 1994 (3 per cent). For 2011, the total apparent

consumption reported in the CRF tables is 1.0 per cent higher than that reported to the IEA. This is almost entirely due to the non-reporting (reported as "NA" (not applicable)) of jet kerosene consumption in international aviation bunkers in CRF table 1.A(b). The ERT noted that, if the value reported for bunker consumption of jet kerosene in table 1.C is taken into account, then the apparent consumption data would agree within 0.2 per cent. In response to a question raised by the ERT during the review, the Party acknowledged the wrongly reported international bunkers for jet kerosene. The ERT recommends that the Party make the correction to improve the transparency and consistency of the inventory.

28. The ERT noted that some data provided in the inventory are not consistent with the data from the IEA database. Fuels classifications also show some differences. For example, the classification for coals used by the Party (NIR table 3.5) is different from the classification in the IEA database and the IPCC *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (hereinafter referred to as the IPCC good practice guidance). This makes it difficult for the ERT to compare the reporting of consumption of coal types in the CRF tables with IEA statistics. In response to a question raised by the ERT during the review, the Party responded that the inventory uses data from the Hungarian Energy Statistical Yearbooks, and that the fuel categories in these yearbooks differ from those used by the IEA (especially in the case of liquid and solid fuels), and have changed many times since 1985. The Party also explained that, in the next annual submission, the data will be based on questionnaires similar to those used by the IEA and not from the Hungarian Statistics Yearbooks. The ERT acknowledges these planned improvements and recommends that the Party review the fuels classification used in the inventory and the data on coal consumption per coal type to improve transparency and comparability of the data from the IEA and CRF tables.

29. The ERT noted that the production of natural gas liquids reported in CRF table 1.A(b) is larger (ranging from 10 per cent to 130 per cent) than that reported to the IEA for the period 1985–2002. In response to a question raised by the ERT during the review, Hungary explained that, in the Hungarian Energy Statistical Yearbooks in this period, the produced natural gas liquids were accidentally reported together with coke oven gas and other products from coal processing. The Party also explained that there is a project in progress to correct this problem. The ERT commends the Party for the effort to improve transparency, and recommends that the Party report on the progress of this project and address this inconsistency.

30. The ERT noted for the period 1985–1989, other bituminous coal production is reported to the IEA under sub-bituminous coal. From 1990 onwards, it is included with lignite for the IEA. For the period 1985–2001, other bituminous coal imports in the CRF tables are reported to the IEA under sub-bituminous coal, while from 2002–2009, values for lignite imports in the CRF tables seem to be reported to the IEA under sub-bituminous coal. In response to a question raised by the ERT during the review, the Party explained that the Hungarian coal classification system is different as it is related more to the age of the coal than to its calorific value (see also section A.2.4.1 in the annexes of the NIR). For example, hard coal in the Hungarian statistics can refer to what the classification system of the IEA, or that of the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the Revised 1996 IPCC Guidelines), refers to as other bituminous coal or lignite. However, the Party indicated that it will try to use the coal classification system from the Revised 1996 IPCC Guidelines in its next annual submission. The ERT acknowledges this planned improvement and recommends that the Party use the coal classification from the Revised 1996 IPCC Guidelines to improve the comparability of the CRF tables and NIR data with the data reported by other Parties.

31. The ERT noted that naphtha imports are reported to the IEA from 1993 onwards but are not separately reported in the CRF tables. The ERT considers that naphtha imports may be included under gasoline imports in the CRF tables, as discrepancies between the IEA data and the CRF tables for these two categories are very similar, but of a different sign.

Similarly, imports of natural gas liquids are reported to the IEA from 2002 onwards but are not separately reported in the CRF tables. These appear to be included under liquefied petroleum gas (LPG) in the CRF tables. In response to a question raised by the ERT during the review, the Party explained that, in the Hungarian Energy Statistical Yearbooks, the balances and consumption of naphtha and gasoline were published together, so traditionally the Party reported them as gasoline in the CRF tables. Similarly, imports and exports of natural gas liquids were published as part of LPG. The Party indicated that it intends to report these in a manner that is more consistent with IEA data in its next annual submission. The ERT acknowledges this planned improvement and recommends that the Party continue the efforts to improve consistency in reporting consumption of naphtha and gasoline between the IEA data and the CRF tables.

32. The ERT noted that CRF table 1.A(b) shows exports of other oil from 1985 to 1992 but that these exports are not included in the IEA data. Conversely, exports of lubricants are reported to the IEA for all years but are not reported in the CRF table (for 1991 and 1992 these appear to have been included under other oil). In response to a question raised by the ERT during the review, Hungary explained that the Party follows the classification of the Hungarian Energy Statistical Yearbooks, and that other oil in the CRF tables includes lubricants and refinery feedstock. The Party indicated that it intends to report them separately in the next annual submission. The ERT acknowledges this planned improvement and recommends that the Party continue the efforts to increase transparency in reporting lubricants and refinery feedstock and provide further disaggregation.

33. The exports of gasoline in the CRF tables are generally 50–110 per cent higher than those reported to the IEA from 1993 to 2010. In response to a question raised by the ERT during the review, Hungary indicated that it will discuss this with the energy statistics provider. The ERT recommends that the Party report on this discussion and address this inconsistency.

34. The ERT noted that the IEA data on jet kerosene from 1985 to 1992 are included under other kerosene in the IEA data (Hungary has reported jet kerosene and other kerosene separately in CRF table 1.A(b)). In response to a question raised by the ERT during the review, the Party stated that it uses data from the Hungarian Energy Statistical Yearbooks to report jet kerosene and other kerosene together, and that it intends to disaggregate these data in the next submission. The ERT encourages the Party to make the disaggregation of jet kerosene and other kerosene, to improve the transparency and consistency of the inventory.

35. The exports of coking coal from 2004 to 2010 are reported in the IEA data but not in the CRF tables (except for a small quantity in 2008). In response to a question raised by the ERT during the review, Hungary recognized that the amount of coking coal is missing from the CRF tables and confirmed that it will correct this error in the next annual submission. The ERT recommends that the Party report the amount of coking coal in the CRF tables.

International bunker fuels

36. The ERT noted that there are differences in the fuel consumption by international aviation between the CRF tables and the IEA data, with discrepancies of up to 20.0 per cent between 2000 and 2006. In particular, the values for jet kerosene for international aviation in CRF table 1.A(b) are systematically lower than those reported to the IEA, with discrepancies of 2.0–5.2 per cent except for the years 2001 and 2004–2006, where discrepancies of 7.5–19.0 per cent occur. In response to a question raised by the ERT during the review, Hungary indicated that it will discuss this issue with the energy statistics provider. The ERT recommends that the Party report on this discussion.

37. The ERT noted that for jet kerosene there is a discrepancy in the data reported: international bunkers are reported as “NA” in CRF table 1.A(b) but estimates are reported in CRF table 1.C (for example, 9,660.00 TJ for 2011). In response to a question raised by

the ERT during the review, Hungary indicated that the value in CRF table 1.C is correct. The ERT recommends that the Party replace the notation key in CRF table 1.A(b) by the appropriate estimate.

38. The ERT noted that IEA data on fuel consumption in domestic navigation for 1985–1994 is higher than in the data reported in the CRF tables, due to a large amount of gasoline reported as "IE" (included elsewhere) in CRF table 1.A(a) and reported under road transportation. There is no estimation of consumption of gasoline in the IEA data after 1995, and no fuel consumption is reported to the IEA for 1999 and 2000. In response to a question raised by the ERT during the review, Hungary indicated that it will investigate this issue. The ERT recommends that the Party report its findings in its NIR and explain any recalculation.

Feedstocks and non-energy use of fuels

39. The ERT noted that stocks for liquid fuels show several discrepancies between the IEA data and the data reported in CRF table 1.A(b), mainly for crude oil (1988–1991), gas/diesel oil (1993–1997 and 2011), residual fuel oil (1990–1997) and gasoline (1999–2003). Refinery feedstocks and other oil show opposite but approximately equal disparities from 2004 to 2007. Stock changes for solid fuels (all years) and natural gas (from 2002 to 2004) also disagree. In response to a question raised by the ERT during the review, the Party stated that statistical differences and stock changes are handled together in the Hungarian Energy Statistical Yearbooks. The ERT recommends that the Party investigate the issue and report its findings in its NIR and explain any recalculations.

3. Key categories

Stationary combustion: all fuels – CO_2, CH_4 and N_2O[3]

40. For solid fuels use in public electricity and heat production, Hungary has reported a constant N_2O implied emission factor (IEF) (1.50 kg/TJ) for 1990–2004 and 2006–2009, but different values for 2005 and 2010–2011 (1.57 kg/TJ and 1.48 kg/TJ, respectively). In response to a question raised by the ERT during the review, the Party explained that, for 2010–2011, the increased use of coke oven gas, with a much lower EF, reduced somewhat the IEF. The Party also explained that it uses the default N_2O EF for coal from the 2006 IPCC Guidelines (i.e. 1.50 kg/TJ) for 1990–2004 and 2006–2009, which is higher than the default EF from the Revised 1996 IPCC Guidelines (i.e. 1.40 kg/TJ, table 1-8) but that might better reflect the current level of knowledge. With this choice, Hungary estimates N_2O emissions from solid fuel use conservatively. For 2010 and 2011, the Party calculated the emissions from the used coke oven gas with the N_2O EF also taken from the 2006 IPCC Guidelines (i.e. 0.1 kg/TJ, table 2-2). The ERT notes that the use of the EFs from the 2006 IPCC Guidelines needs to be justified. The ERT recommends that the Party review the N_2O EFs and, in the NIR, explain the source of these EFs and justify their selection, and ensure the time-series consistency of the estimates (including methodologies and EFs).

41. For biomass use in public electricity and heat production, Hungary has reported a constant CO_2 IEF (108.54 t/TJ) for 2003–2009, but the CO_2 IEF is lower for 2010 and 2011 (106.86 t/TJ and 106.84 t/TJ, respectively). A similar situation occurs for CH_4 and N_2O. In response to a question raised by the ERT during the review, Hungary responded that, for 2010 and 2011, biogas consumption was included in the estimations and that biogas has lower EFs that the other biomass fuels considered. The Party explained that emission

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

estimates for biomass combustion are being reviewed. The ERT recommends that the Party include more detailed information on biomass use, including fuels considered, AD and EFs, and explain any recalculation in its NIR.

42. For gaseous fuels use in petroleum refining, Hungary has reported a constant CO_2 IEF (55.82 t/TJ) for 1990–2008 and 2010–2011. The CO_2 IEF for 2009 (55.87 t/TJ) is different. In response to a question raised by the ERT during the review, the Party explained that the EF used for 2009 was based on data from the EU Emissions Trading System (EU ETS) and that the difference is quite small. The ERT recommends that the Party review the EFs used in this category to ensure the consistency of the time series (including the methodologies and the EFs) and explain any deviation.

43. For liquid fuel use in non-ferrous metals, Hungary has reported a constant CO_2 IEF (76.59 t/TJ) for 1985–2001, "NO" for 2002–2009 and 2011, and 69.41 t/TJ for 2010. In response to a question raised by the ERT during the review, the Party explained that, for 1985–2001, heavy fuel oil was used. In 2010, a very small amount of LPG and gasoil was included in the estimates (although in the IEA data there is no liquid fuel consumption for 2010). The ERT recommends that the Party include more detailed information on the use of liquid fuels in the non-ferrous metal industry, including fuels used, AD and EFs, and explain any recalculation in its NIR.

44. For biomass use in food processing, beverages and tobacco, the ERT noted that the CH_4 IEF for 2008 (7.31 kg/TJ) is the lowest in the time series, and considerable lower than the values reported for other years (20.39–30.00 kg/TJ). A similar situation also occurs for the N_2O IEF. In response to a question raised by the ERT during the review, Hungary stated that EU ETS data indicated a large amount of liquid biofuel use (fuel oil) for 2008, with a CH_4 EF lower by an order of magnitude than the EF of solid biomass. The ERT also noted that the Party used a tier 1 methodology with default EFs for the years 1992–1997, 2006–2007 and 2010–2011, reported emissions as "NO" for 1998–2005, and used a tier 2 methodology with country-specific and default EFs for 2008–2009. The ERT considers that there is a lack of consistency in the methods applied and recommends that the Party apply a consistent methodological approach and apply consistent EFs across the entire time series for this category. The ERT also recommends that the Party review the "NO" reported for emissions for 1998–2005 and confirm that these emissions do not occur and are not reported elsewhere.

45. For biomass use in other (manufacturing industries and construction), the ERT noted that the time series of CO_2 emissions is inconsistent. Specifically: "NA" is reported for 1985–1987 and 1990, 1998–2006 and 2009; CO_2 emissions are estimated for 1988–1989 and 1991–1997, but no information for EFs and methods is provided; CO_2 emissions are estimated for 2007–2008 and 2010–2011 and the method used is tier 2 with default EFs. In response to a question raised by the ERT during the review, Hungary responded that traditionally, the Hungarian inventory was based on fuel consumption data from the official Hungarian Energy Statistical Yearbooks. As regards biomass, these Yearbooks contained only firewood consumption data. For most years, there was no firewood consumption. However, the Party also indicated that some wood wastes and other solid wastes, partly containing mixed fossil and biogenic carbon, are co-incinerated and that, for the earlier years, further investigation is needed, taking into consideration the nature of the biomass incinerated (which is, at least partly, included in waste incinerated), the waste statistics and the energy statistics. The ERT recommends that the Party: apply a consistent methodology and EFs across the entire time series; follow the IPCC good practice guidance for EFs (i.e. default EFs should not be used if a tier 2 or 3 methodology is applied); apply the correct notation key ("IE" instead of "NA" when emissions are included elsewhere) and include transparent information, including references, on how these emissions are estimated.

46. For liquid fuels use in agriculture/forestry/fisheries, the CO_2 IEF for 2002 (75.99 t/TJ) is the highest (and substantially higher) in the entire time period (ranging from 72.31 t/TJ to 73.28 t/TJ). In response to a question raised by the ERT during the review, Hungary responded that CO_2 emissions in 2002 were overestimated. The ERT recommends that the Party review the CO_2 emissions and explain any recalculations.

47. For CO_2 emissions from biomass use in agriculture/forestry/fisheries, the ERT noted a –13.6 per cent inter-annual change of the CO_2 EF between 2009 (108.54 t/TJ) and 2010 (93.75 t/TJ). In response to a question raised by the ERT during the review, Hungary explained that up to 2009 solid biomass was the only biomass fuel used and therefore it applied the default CO_2 EF of 109.63 t CO_2/TJ from table 1-1 of the Revised 1996 IPCC Guidelines. For 2010 and 2011, as well as 421 TJ (2010) and 429 TJ (2011) of solid biomass being used, some 158 TJ (2010) and 130 TJ (2011) of biogas was also used, and the Party therefore used the default EF for biogas (54.63 t C/TJ) from the 2006 IPCC Guidelines. The ERT recommends that the Party include this information in its NIR.

48. For CH_4 and N_2O emissions from biomass use in agriculture/forestry/fisheries, the ERT noted that Hungary has reported constant CH_4 and N_2O IEF (300 kg/TJ and 4.00 kg/TJ, respectively) for 1990–2009, but variable for 2010 and 2011 (218 kg/TJ and 230 kg/TJ, respectively, for CH_4 and 2.94 kg/TJ and 3.09 kg/TJ, respectively, for N_2O). In response to a question raised by the ERT during the review, Hungary explained that for 1990–2009 the only biomass fuel was solid biomass and that it used default EFs from the Revised 1996 IPCC Guidelines (300 kg/TJ for CH_4 and 4 kg/TJ for N_2O, from tables 1-7 and 1-8). The Party also explained that biogas was used in 2010 and 2011 and, as the Revised 1996 IPCC Guidelines does not provide a default EF for non-CO_2 gases for biogas, the Party used the default EFs from the 2006 IPCC Guidelines (5 kg/TJ for CH_4 and 0.1 kg/TJ for N_2O from table 2.5) and that, for solid biomass, the Party kept the default EFs from the Revised 1996 IPCC Guidelines. The ERT recommends that the Party include information on how the CH_4 and N_2O EFs are estimated.

Civil aviation: liquid fuels – CO_2, CH_4 and N_2O[4]

49. For aviation gasoline, Hungary has reported AD and CO_2, CH_4 and N_2O emissions as "IE" in CRF table 1.A(a) for most of the years. In response to a question raised by the ERT during the review, Hungary responded that for all years for which no separate data are available, aviation gasoline consumption is reported together with gasoline use in road transportation. The ERT recommends that the Party report the emissions from gasoline use for civil aviation separately.

Railways: liquid fuels – CO_2

50. The ERT noted a decrease of CO_2 emissions from 267.93 Gg in 2010 to 141.67 Gg in 2011 (as reported in CRF table 1.A(a)), while there were no reported changes in the methodology for emission estimations. In response to a question raised by the ERT during the review, Hungary responded that IEA data also suggests a decrease in CO_2 emissions from diesel oil use in railways from 55 kt in 2010 to 46 kt in 2011, although the Party acknowledged that the difference was smaller than in the CRF tables. The Party also acknowledged that there is an allocation discrepancy of diesel oil between the national and IEA statistics for 2009 and 2010. The ERT noted that the AD for the category are similar in the CRF table and in the IEA data and that the CO_2 emissions for 2009 and 2010 may be overestimated. The ERT recommends that the Party review the AD for the category for 2009 and 2010 and explain any recalculation.

[4] Not all emissions related to all gases under this category are key categories, particularly CH_4 and N_2O emissions. However, since the calculation procedures for issues related to this category are discussed as a whole, the individual gases are not assessed in separate sections.

Oil and natural gas: gaseous fuels – CO_2 and CH_4[5]

51. Hungary has reported consumption of gaseous fuels for the category public electricity and heat production in CRF table 1.A(a). However, Hungary has reported CH_4 fugitive emissions for industrial plants and power stations as "NO" in CRF table 1.B.2 (reported under other leakage). In response to a question raised by the ERT during the review, Hungary indicated that no emission estimation methodologies are included either in the IPCC good practice guidance or in the 2006 IPCC Guidelines regarding other leakage (fugitive emissions from other leakage are also not included in table 2.15 for the major categories and subcategories in the oil and gas industry in the IPCC good practice guidance). However, the Party recognized that table 1–58 in the Revised 1996 IPCC Guidelines does contain EFs for other leakage. The Party indicated that it will investigate this issue, especially if the estimates for CH_4 fugitive emissions for other subcategories (based on methodologies and EFs from the IPCC good practice guidance) already include this leakage. The ERT encourages Hungary to investigate this issue and replace the notation key by "IE" (if the emissions are already reported under another category) or by the appropriate estimates (and explain any recalculations in its NIR).

52. For oil exploration, Hungary has reported AD and CO_2 and CH_4 emissions as "IE" in CRF table 1.B.2 and explained, in comments to the cells in the spreadsheet, that these estimates are reported under oil production. However, in response to a question raised by the ERT during the review, the Party explained that these estimates are actually reported under natural gas exploration and that it will correct this error in its next annual submission. The ERT recommends that the Party correct this error and clearly indicate where AD and emission estimates from oil exploration are reported.

4. Non-key categories

Road transportation: liquid fuels – CH_4 and N_2O

53. The ERT noted a large inter-annual change (59.1 per cent) of the CH_4 IEF for gasoline between 2004 (15.43 kg/TJ) and 2005 (24.55 kg/TJ). In response to a question raised by the ERT during the review, Hungary explained that it applied the COPERT model for the period 2005–2011 only and a tier 1 methodology for 1988–2004, and that it plans to improve the consistency of the time series in the next annual submission. The ERT recommends that the Party do so and explain any recalculations in its NIR.

54. The ERT noted a large inter-annual change (1,140.0 per cent) of the CH_4 IEF for LPG between 2009 (5.00 kg/TJ) and 2010 (62.00 kg/TJ). In response to a question raised by the ERT during the review, the Party explained that it used the same EF for 2010 and 2011 and that it is significantly higher than the default EF in table 1-45 of the Revised 1996 IPCC Guidelines (0.02 kg/TJ). The Party also explained that the EFs for the entire time series are higher that the default EF and, as a result, the emissions are not underestimated. The Party further explained that results from the COPERT model indicate lower CH_4 emissions from LPG use and therefore it is confident that emissions are not underestimated. The ERT considers that applying different EFs to different years in the time series without proper justification makes the series inconsistent. The ERT recommends that the Party review the time series of CH_4 emissions for LPG in road transportation, explain how the consistency of the time series is ensured and explain any recalculation in its NIR.

55. The ERT noted a large inter-annual change (–93.3 per cent) of the N_2O IEF for LPG between 2009 (3.00 kg/TJ) and 2010 (0.20 kg/TJ). In response to a question raised by the

[5] Not all emissions related to all gases under this category are key categories, particularly CO_2 emissions. However, since the calculation procedures for issues related to this category are discussed as a whole, the individual gases are not assessed in separate sections.

ERT during the review, Hungary indicated that it will consider using the same default N_2O EF from the 2006 IPCC Guidelines (0.20 kg/TJ from table 3.2.2 in the second volume) for the entire time series. The ERT considers that applying different N_2O EFs to different years in the time series without proper justification makes the series inconsistent. The ERT recommends that the Party review the time series of N_2O emissions for LPG in road transportation, explain how the consistency of the time series is ensured and explain any recalculation in its NIR.

Solid fuel transformation: CO_2 and CH_4

56. Hungary has reported AD and CH_4 emissions as "NO" but CO_2 emissions as "IE" in CRF table 1.B.1. The ERT strongly recommends that the Party review its use of notation keys for AD and CO_2 and CH_4 emissions for this category to ensure that all emissions are accurately estimated and reported. If "IE" is used, the ERT also recommends that the Party clearly explain under which category the AD or the emissions are reported.

C. Industrial processes and solvent and other product use

1. Sector overview

57. In 2011, emissions from the industrial processes sector amounted to 6,323.65 Gg CO_2 eq, or 9.5 per cent of total GHG emissions, and emissions from the solvent and other product use sector amounted to 309.56 Gg CO_2 eq, or 0.5 per cent of total GHG emissions. Since the base year, emissions have decreased by 56.9 per cent in the industrial processes sector, and increased by 8.8 per cent in the solvent and other product use sector. The key drivers for the decrease in emissions in the industrial processes sector are the decrease in industrial production due to the closure of factories and the modernization of the remaining factories. Within the industrial processes sector, 35.4 per cent of the emissions were from metal production (iron and steel production) followed by 20.6 from consumption of halocarbons and SF_6 and 19.5 per cent from mineral products. Other (industrial processes) accounted for 15.0 per cent and chemical industry for 9.4 per cent.

58. The ERT noted that transparency of the NIR has significantly improved by the inclusion of additional information on recalculations, methodological issues and any changes in industries leading to variations in trends and IEFs. In addition, the results of the QA/QC activities have been included into the subchapters "methodological issues" (for example for cement production and lime production), as recommended in the previous review report, except for consumption of halocarbons and SF_6. The ERT commends the Party for these improvements. The ERT considers that information provided on uncertainties was not completely transparent in the NIR (e.g. separate uncertainties of AD and EFs were reported in annex 7 to the NIR only and there was limited information provided on the source of the uncertainty values). In response to a question raised by the ERT during the review, Hungary explained that the uncertainty values are based on expert judgement unless otherwise stated in the NIR and that it is planned to gradually review and improve these values. The ERT reiterates the recommendation made in the previous review report that Hungary continue to improve the transparency of the information provided on QA/QC activities and category-specific uncertainties.

59. The ERT noted a recommendation made in the previous review report to ensure the consistency of the time series for categories, for example cement production and glass production, where emission estimates from 2005 are based on plant-specific data whereas, for previous years, Hungary used default methodologies from the IPCC good practice

guidance.[6] In response to a question raised by the ERT during the review, Hungary provided the ERT with additional information relating to the improvement of the consistency of the time series for cement production and glass production. For cement production, the ERT agrees with Hungary that use of an average CO_2 IEF for emission estimates before 2005 is the best solution. However, for glass production, the use of an average CO_2 IEF (t CO_2/t glass), where the CO_2 emissions are obtained from EU ETS data for the years before 2005 would not be completely appropriate (NIR page 95) because it does not consider the different carbonate contents of the raw materials necessary for the different glass types. In addition, the ERT noted that the NIR indicates a statistical change for emissions in 2008–2011 (NIR section 4.3.5.2, page 96). The ERT reiterates the recommendation made in the previous review report that the Party ensure the consistency of the time series, including for cement production and glass production, and report its findings and the explanations for all recalculations in its NIR.

60. For 1,1,1,3,3-pentafluorobutane (HFC-365mfc), the ERT noted that potential and actual emissions are reported as blank in CRF table 2(II). The ERT encourages Hungary to report these emissions.

2. Key categories

Ammonia production – CO_2

61. The ERT noted the significant difference in the CO_2 IEF for ammonia (NH_3) production throughout the time series (1.28–1.76 t CO_2 /t NH_3), as reported in NIR table 4.9. In response to a question raised by the ERT during the review, Hungary explained that the difference can be attributed to the constant decrease in the amount of natural gas used for NH_3 production due to improved efficiency, including better technology. Hungary provided the ERT with additional technical information. The ERT agrees that the information provided justifies the decreasing IEF and reiterates the recommendation made in the previous review report that the Party include this information in its NIR.

Consumption of halocarbons and SF_6 – HFCs, PFCs

62. For refrigeration and air-conditioning equipment, Hungary uses a top-down approach to estimate HFC and PFC emissions from operation. For emissions from assembly (manufacturing) and disposal, the Party uses a bottom-up approach with default parameters from the IPCC good practice guidance (NIR page 119). For the estimation of disposal emissions, Hungary assumed a recovery efficiency of 80.0 per cent from table 3.22 of the IPCC good practice guidance (NIR page 122). However, the ERT noted that the values shown in table 3.22 represent the best estimate (expert judgement) values and cannot be considered default values, and that the Revised 1996 IPCC Guidelines (reference manual, page 2.57) indicates that the charge remaining in the equipment upon retirement is normally vented (i.e. the recovery efficiency is equal to zero). The ERT considered that the value of 80.0 per cent recovery efficiency is neither an IPCC default value nor a justified country-specific value and therefore the estimates were not in line with the IPCC good practice guidance. Therefore, the ERT concluded that the HFC and PFC emissions from disposal of refrigeration and air-conditioning equipment were potentially underestimated. This issue was included in the list of potential problems and further questions raised by the ERT. In response to this list, Hungary submitted revised estimates assuming a zero per cent recovery efficiency. The ERT considers that the potential underestimation is resolved, but that the emissions are probably overestimated because there is evidence that some recovery occurred in the country, at least in 2010 and 2011. The ERT recommends that the Party

[6] See paragraph 60 of document FCCC/ARR/2012/HUN (available at <http://unfccc.int/resource/docs/2013/arr/hun.pdf>).

develop a country-specific value for recovery efficiency and include all the information related to the estimations of emissions from disposal.

3. Non-key categories

Soda ash production and use – CO_2

63. Hungary reported CO_2 emissions from soda ash use as "IE" in CRF table 2(I).A-G. Hungary indicated that these emissions are included under glass production reported under other (mineral products). However, the ERT considers that the NIR does not transparently indicate whether the estimates reported under glass production include only soda ash used in glass production or also include other uses of soda ash. The ERT notes that, according to the Revised 1996 IPCC Guidelines (reference manual, page 2.11, section 2.6.1) soda ash is used as a raw material in a large number of industries including glass manufacture, soap and detergents, pulp and paper production and water treatment. The ERT considered that it is very likely that soda ash is used in Hungary in industries other than glass production and, as it is not transparent whether the emissions reported under glass production include the soda ash used in other activities, the ERT considers that emissions from soda ash use were potentially underestimated. This issue was included in the list of potential problems and further questions raised by the ERT. In response to this list, Hungary submitted revised estimates where soda ash use other than glass production was estimated as the difference between imports and exports and the soda ash used in glass production (soda ash is not produced in the country). The ERT considers that the potential underestimation has been resolved and recommends that the Party explain these recalculations in its NIR.

Solvent and other product use – N_2O

64. Hungary used data obtained from the manufacturers to estimate N_2O emissions from the use of N_2O for anaesthesia. However, no data on imported products were available (as indicated in NIR section 5.3.1.2). The ERT reiterates the recommendation made in the previous review report that the Party determine whether the import of products into Hungary occurs and, if appropriate, collect appropriate data and report relevant estimates of N_2O emissions.

D. Agriculture

1. Sector overview

65. In 2011, emissions from the agriculture sector amounted to 8,758.65 Gg CO_2 eq, or 13.2 per cent of total GHG emissions. Since the base year, emissions have decreased by 54.0 per cent. The key driver for the fall in emissions is the economic and political transition which took place in the country during the 1990s, reducing agricultural production. Within the sector, 58.3 per cent of the emissions were from agricultural soils, followed by 24.5 per cent from manure management, 17.1 per cent from enteric fermentation and 0.1 per cent from rice cultivation.

66. The ERT considers that the transparency of the explanations on the recalculations is limited. For example, in the NIR (page 159), Hungary indicates that it has used a revised methane conversion rate (Ym) for dairy and non-dairy cattle in response to a recommendation made in the previous review report, but this was not transparently documented in the NIR. (In the 2012 annual submission, Hungary used the default value for non-dairy cattle but a country-specific for dairy cattle; in the 2013 annual submission, Hungary did the opposite – using a country-specific value for non-dairy cattle but the default value for dairy cattle.) The ERT recommends that the Party improve the explanation by clearly explaining the reason and logic behind the recalculations in its NIR to improve transparency.

67. The ERT noted that Hungary has used the tier 1 and tier 2 (Monte Carlo) approaches to estimate the uncertainty of the agriculture sector (NIR page 148–150). The ERT commends the Party for this improvement. However, the ERT noted that annex 7 to the NIR does not mention the tier 2 approach or its results, but indicates that the uncertainty analysis was done with the tier 1 approach. The ERT recommends that the Party address the inconsistency of this information.

2. Key categories

Enteric fermentation – CH_4

68. The NIR (page 158) reported that the net energy for dairy cattle is calculated using a country-specific model (WINLP software, the Hungarian nutrition optimization software for dairy cows). However, the ERT could not find any information in the NIR that explains the basis underlining the software used for the calculation. In response to a question raised by the ERT during the review, the Party provided a descriptive summary of the software. The ERT concludes that the documentation sufficiently supports use of the country-specific model, but recommends that the Party include this summary information, including the major underlying formulas used, in the NIR to improve transparency.

69. The NIR (page 159) reported that estimated body mass, based on expert judgement, has been used to calculate gross energy for non-dairy cattle. However, no reference was provided on what the underlying basis is for the expert judgement. In response to a question raised by the ERT during the review, Hungary provided information on the expert judgement, which was based on consultations with the Animal Husbandry Directorate of the Food Chain Safety Offices. The ERT recommends that the Party include this information in the NIR to improve transparency.

70. The ERT noted that, in NIR table 6.9 (page 155), Hungary reported that the population of non-dairy cattle in 2011 is 440,000. The same value is reported in CRF table 4.A. However, in NIR table 6.10 (page 156), the sum of the non-dairy population (cattle <1 year, cattle 1–2 years and non-dairy cattle >2 year) is 440,250, which is greater than the one reported in table 6.9 by 250. In response to a question raised by the ERT during the review on the difference in data between the two tables, Hungary explained that the Hungarian Central Statistical Office (HCSO) provides animal livestock data rounded for both the total non-dairy cattle and each subcategory. Thus, the sum livestock subcategories may not add up to the total due to rounding in the HCSO data. The ERT acknowledges the explanation and strongly recommends that the Party review the population values used to estimate emissions to ensure that all emissions are accurately estimated and reported, and include the information provided during the review in the NIR to improve transparency.

71. The ERT noted that there is a similar situation for poultry. In the NIR, table 6.9 (page 155), Hungary reported that the population of poultry in 2011 is 45,969,000. However, in table 6.10 (page 156) the sum of the poultry population (laying hens, chickens, hens, cocks, geese, ducks, turkeys and guinea fowl) is 45,970,000, greater than the one reported in NIR table 6.9 by 1,000. In response to a question raised by the ERT during the review, Hungary provided the same explanation as indicated in paragraph 70 above. The ERT acknowledges the explanation and strongly recommends that the Party review the population values used to estimate emissions to ensure that all emissions are accurately estimated and reported, and include the information provided during the review in the NIR to improve transparency.

Manure management – CH_4 and N_2O

72. In its 2013 annual submission Hungary has updated the AD for animal waste management systems (AWMS) according to HCSO's General Agricultural Census 2010 complemented with data from the NFCS nitrogen database because the coverage of the data

from the census was not sufficient (the NIR, page 165, explains that the data set is most representative for cattle and poultry covering about 80–90 per cent when compared with the others, which is 50–70 per cent for swine and sheep and 5–10 per cent for goats and horses). The ERT commends the Party for its effort to improve the AWMS data and encourages Hungary to increase the livestock coverage during the AWMS survey process to develop a more representative sample for livestock other than cattle and poultry.

Agricultural soils – N_2O

73. The ERT noted that, in the NIR (page 175), Hungary reported that the estimation of direct and indirect N_2O emissions was carried out on the basis of the tier 1b methodology of the IPCC good practice guidance (equation 4.29). However, the ERT noted that equation 4.29 is an equation only to calculate nitrogen (N) in crop residue returned to soils, and not to calculate both direct and indirect N_2O emissions from agricultural soils. In response to a question raised by the ERT during the review, Hungary confirmed that equation 4.29 is used only to estimate N in crop residue returned to soils and provided the equations from the IPCC good practice guidance that are used for the estimation of direct and indirect N_2O emissions. The ERT recommends that the Party include the correct equations with their respective explanation in the NIR.

74. Hungary has reported AD and N_2O emissions for cultivation of histosols as "NO" in CRF table 4.D, with no information in the documentation box. In response to a question raised by the ERT during the review, Hungary explained that histosols are protected in Hungary and are not cultivated, therefore this activity is reported as "NO". However, the ERT noted that FAOSTAT, the database of Food and Agriculture Organization of the United Nations, indicates that Hungary has an area of 229.20 kha of histosols under cultivation.[7] The ERT considers that if cultivation of histosols occurs in Hungary, not reporting the associated N_2O emissions is a potential underestimation of N_2O emissions and therefore this issue was included in the list of potential problems and further questions raised by the ERT. In response to this list, Hungary confirmed that histosols are not cultivated in Hungary and explained that the data on histosol cultivation in international soil databases refers to protected peat land that is not cultivated or to croplands and grasslands whose soils have lost most of their carbon content (ameliorated peat soils) and cannot be considered histosols. The Party also explained that it has started communicating with FAOSTAT to clarify the issue. The ERT considers that the potential underestimation has been resolved and recommends that the Party include this information in its NIR.

75. The ERT noted that, in the documentation boxes of CRF tables 4 and 4.B(b), Hungary has reported that for liquid manure management systems emissions and removals are included in CRF table 5.A. The ERT noted that CRF table 5.A refers to forest land in the LULUCF sector and that emissions from liquid systems are reported under either manure management (agriculture sector) or wastewater handling (waste sector), if the liquid system is treated as waste water. In response to a question raised by the ERT during the review, Hungary explained that all emissions from liquid systems are reported under manure management and that the comment in the documentation box is an error. The ERT agrees with the response and recommends that Hungary correct the error.

76. Hungary used country-specific data to estimate N_2O emissions from crop residues for sunflower and oilseed rape, but the NIR does not include a reference to the source of these data. In response to a question raised by the ERT during the review, Hungary clarified the data source of the values for residue to crop product ratio, dry matter fractions and N fractions of all crop residues (including the reference for sunflower and oilseed rape). In

[7] <http://faostat.fao.org/site/711/DesktopDefault.aspx?PageID=711#ancor> or <http://faostat3.fao.org/faostat-gateway/go/to/download/G1/GV/E>.

addition, Hungary indicated that the provided information will be included in the next annual submission. The ERT welcomes the information provided and recommends that Hungary include it in the NIR.

3. Non-key categories

Rice cultivation – CH_4

77. The NIR (page 173) indicates that rice is cultivated without organic amendments. However, in CRF table 4.C, Hungary has reported organic amendments added as "NE", which implies that organic amendment is used for rice cultivation but not estimated. In response to a question raised by the ERT during the review, Hungary explained that the notation key used in CRF table 4.C is wrong and should be replaced by "NO". The ERT recommends that Hungary use the corrected notation key.

Field burning of agricultural residues – CH_4

78. The ERT noted that Hungary has reported information on recalculations for prescribed burning of savannas in the section for recalculations for field burning of agricultural residues (NIR section 6.6.5, page 181). In response to a question raised by the ERT during the review, Hungary indicated that the information should be reported in the section for prescribed burning of savannas. The ERT recommends that the Party correct this issue.

79. The ERT noted that CH_4 and N_2O emissions from field burning of sugar cane are reported as "NA" in CRF table 4.F but the NIR (sections 6.6.1 and 6.6.2, page 181) indicates that field burning is assumed to not occur since 1990. The ERT considers that if burning of agricultural residues does not occur the notation key "NO" should be used instead of "NA" in CRF table 4.F for sugar cane. In response to a question raised by the ERT during the review, Hungary explained that the notation key should be "NO". The ERT recommends that Hungary correct the notation key.

80. Hungary has reported the change of emissions between the base year and 2011 for field burning of agricultural residues as 100 per cent in NIR table 6.2 (page 147). However, the ERT noted that this activity occurred during the base year (and emissions were reported) but does not occur since 1990, and therefore considers that this change should be reported as "NA". The ERT recommends that the Party correct this error.

E. Land use, land-use change and forestry

1. Sector overview

81. In 2011, net removals from the LULUCF sector amounted to 3,787.48 Gg CO_2 eq. Since 1985, net removals have increased by 45.7 per cent. The key drivers for the rise in removals are the abandonment of 554 kha cropland and the soil conservation tillage practices which increased the carbon stocks of cropland (NIR page 226; see also para. 93 below). Within the sector, 2,926.06 Gg CO_2 eq of removals were from forest land, followed by 1,238.32 Gg CO_2 eq from cropland. 198.33 Gg CO_2 eq of emissions were from grassland, followed by 175.56 Gg CO_2 eq from settlements and 3.02 Gg CO_2 eq from wetlands. Other land was reported as "NA", "NE" and "NO".

82. The ERT commends Hungary for providing for the first time estimates of emissions for grassland converted to wetlands, following the recommendations made in previous review reports (it was previously reported as "NE"). However, the ERT noted that the inventory is not complete (see table 3 above). The ERT reiterates the recommendation made in the previous review report that the Party report estimates of emissions for the currently not-estimated mandatory categories and carbon pools for which methodologies

are provided in the IPCC good practice guidance for LULUCF, to increase the completeness and transparency of its reporting. If no relevant methodologies are available, the ERT encourages the Party to evaluate the possibility of using methodologies from the 2006 IPCC Guidelines.

83. In response to a question raised by the ERT during the review concerning net carbon stock changes (CSCs) in soils for grassland converted to other land (reported as "NE" in CRF table 5.F), the Party explained that the conversion only happened on unmanaged land. The ERT recommends that Hungary include this information in its NIR. Hungary has reported emissions from wildfires on land converted to forest land as "NO", and it has reported AD of wildfires for forest land remaining forest land as "NE" in CRF table 5(V). However, the area of wildfires has been reported in the NIR as 8,548 ha for 2011 (NIR table 7.3.6, page 212). Hungary has stated in the NIR that it is not practicable to report non-CO_2 emissions on land converted to forest land separately because of its minor contribution to the overall emissions. The ERT recommends that the Party report in the CRF tables the area affected by wildfires for forest land remaining forest land and report the emissions from wildfires on land converted to forest land unless it can justify why they do not occur.

84. For wetlands converted to forest land, Hungary has reported net CSC in dead organic matter and in mineral and organic soils as "NO" in CRF table 5.A. However, the Party indicated in the NIR that a project has been initiated in the country to identify whether some forest land soils can be classified as organic soils in accordance with the IPCC good practice guidance for LULUCF. The ERT recommends that Hungary justify that net CSCs in dead organic matter and in mineral and organic soils are not occurring in wetlands converted to forest land or use the notation key "NE". The ERT also recommends that Hungary provide information on the status of the initiative on the identification of organic soils.

85. In sections 7.2.1 and 7.3 of the NIR, Hungary has provided a clarification of the definitions of forest and forest land, the latter including not only stocked and temporarily unstocked areas (referred to as "forest subcompartments" in the NIR) but also unstocked areas that will not revert to forest, including, for example, roads, openings, wildlife forage grounds, glades and buildings serving forest management purposes. For the years prior to 2009, Hungary reported only the stocked areas as the forest land area, but the value reported in the NIR and the CRF tables for 2011 corresponds to the total land under forest management (i.e. forest subcompartments, both stocked and temporarily unstocked, and unstocked areas), resulting in an increase of the estimated forest land area by 6.5 per cent (from 1,927.7 kha estimated as stocked or temporarily unstocked areas to the 2,050.7 kha value reported, according to NIR table 7.3.1). In response to a question raised by the ERT during the review, the Party clarified, however, that the changes in carbon stock were estimated only for the forest subcompartments. The ERT reiterates the recommendation made in the previous review report that the Party increase the transparency of the figures in CRF table 5.A by disaggregating the area of the forest subcompartments and the 'permanently' unstocked areas.

86. The ERT commends the Party its improvement in the uncertainty assessment by applying the IPCC tier 2 methodology (Monte Carlo simulation) for forest land. Hungary has applied the tier 1 methodology for other LULUCF categories. The ERT encourages the Party to apply the IPCC tier 2 methodology for other LULUCF categories and recommends that the Party also report the tier 1 uncertainty analysis for forest land in order to compare the results of the two tiers.

87. Hungary has reported that organic soils are not in use for agricultural purposes (NIR page 189). However, FAOSTAT shows data of cultivated organic soils from 1990 until 2011 and the organic soils area is constant and equal to 229.20 kha.[8] The ERT recommends

[8] <http://faostat3.fao.org/faostat-gateway/go/to/download/G1/GV/E>.

that Hungary further investigate the presence of management activities on organic soils in its territory.

2. Key categories

Forest land remaining forest land – CO_2

88. Hungary has reported the land-use matrices in the NIR (table 7.2.1), but at least some of the data do not correspond to the data reported in the CRF tables. For instance, the area of cropland converted to forest land for 1985 is 5.69 kha in CRF table 5.A, while the same area in table 7.2.1 is 11,166 ha (or 11.17 kha). The ERT also noted that table 7.2.1 in the NIR reports cumulative changes, but land-use matrices and land-use change matrices should report annual changes among land categories. The ERT recommends that Hungary correct the reporting of the land-use matrices in the NIR and make the information in the CRF tables and in the NIR consistent.

89. Hungary has reported that "the actually stocked area is calculated from that of the forest subcompartments by adjusting for gaps and overlaps in the canopy closure" (NIR page 199). The ERT recommends that Hungary provide numerical examples to better clarify the methodology applied and to report its impact on the accuracy of the calculation of carbon stocks.

Land converted to forest land – CO_2

90. Hungary has reported annual land-use changes in table A3-4.3 in its NIR, but at least some of the data do not correspond to the data reported in the CRF tables. For example, the sum of all the areas reported as cropland converted to forest land (including set-aside cropland) from 1985 to 2004 (197,363 ha) does not equal the area reported as cropland converted to forest land reported in CRF table 5A (120,942 ha). The ERT recommends that Hungary revise the data in these tables and make the information consistent between the NIR and the CRF tables.

91. Hungary has continued to report the net CSC in dead organic matter and soils for the conversions of cropland, grassland and settlements to forest land as "NE" in CRF table 5.A. In section 7.3.2.1 of the NIR, Hungary has provided information and references in support of the assumption that land conversion from abandoned cropland is the most frequent land conversion to forest land in the country (81.0 per cent of the area afforested between 1990 and 2009). The ERT noted that, for grassland converted to forest land, the Party has indicated in the NIR that it has assumed that the dead organic matter and soil pools are not a source according to a conservative approach (reported as "NE" or "NO" in CRF table 5.A). However, the NIR also indicates in the same section that the conversion of grassland to forest land may lead to net emissions from those pools and the ERT notes that for land conversion categories, the default methodology in the IPCC good practice guidance for LULUCF does not assume equilibrium. Since grassland conversion is the second most frequent conversion to forest land, the ERT reiterates the recommendation made in the previous review report that the Party provide estimates of changes in carbon stock in the soil and dead organic matter pools from conversion of grassland to forest land.

92. To estimate net CSC in biomass for land converted to forest land, Hungary used an empirical function built with data collected in young forests (for example, see NIR figure 7.3.4 on page 214). The ERT recommends that the Party periodically revise this function to ensure that estimates correspond to the actual level and dynamics of carbon stocks in land converted to forest land.

Cropland remaining cropland – CO_2

93. Hungary applied methodologies consistent with tier 1 and tier 2 methods from the IPCC good practice guidance for LULUCF to estimate emissions and removals for this

category, and stratified the area of cropland according to soil type, climate, management practice and fertilizer input, using a number of different country-specific data sources. The Party reported that conservation tillage practices (including reduced till, mulch till and crop residue management) were introduced in the country in 1998 and that initial research results assessing the impact of such practices on carbon in mineral soils are available (NIR, section 7.4.2.2, page 225). Domestic legislation does not allow the cultivation of organic soils. The ERT commends the Party for the revision of the no-till factor, as a result of a consultation with the soil expert, for the period 1998–2010. The ERT also commends the Party for the transparent information provided and its efforts to continuously improve the estimates for this subcategory.

Grassland remaining grassland – CO_2

94. Hungary has reported the CSCs in living biomass for grassland remaining grassland as "NO" in CRF table 5.C, explaining in section 7.5.2.1 of the NIR that the management practices of grassland remaining grassland could be considered static and therefore no change in carbon stock was estimated, following the tier 1 methodology from the IPCC good practice guidance for LULUCF. The ERT recommends that the Party use the notation key "NE" and report in the appropriate documentation box of the CRF table that a tier 1 methodology was used, assuming CSCs to be zero, in order to increase the transparency of the reporting.

95. The ERT noted an inconsistency in the NIR, in that the Party reported that the grassland-management practices could be considered to be static when discussing CSCs in living biomass (NIR section 7.5.2.1), but mentioned that those practices are changing when discussing CSCs in soils (NIR section 7.5.2.2). The ERT reiterates the recommendation made in the previous review report that the Party clarify the assumption of static management practices assumed for the entire time series.

3. Non-key categories

Wetlands remaining wetlands – CO_2

96. Hungary has reported the area of wetlands remaining wetlands (e.g. 253.11 kha for 2011), the largest subcategory under wetlands, but has reported the changes in carbon stock for all pools as "NE" in CRF table 5.D. The Party has reported that it is not possible to separate flooded lands from peat lands, owing to a lack of data. The ERT encourages the Party to explain the efforts being made to separate and report emissions from managed peat lands, in order to improve transparency.

Land converted to settlements – CO_2

97. For wetlands converted to settlements, Hungary has reported CSCs in living biomass and soils as "NE", and in dead organic matter as "NO", indicating that the data are not available. In response to a question raised by the ERT during the review, the Party recognized that wetlands converted to settlements could be a source of emissions that are currently not reported. The ERT noted that Hungary has made some headway regarding the improvement of completeness of its reporting. For example, data on the opening of new peat mines (land converted to peat extraction) have been received from the Hungarian Mining Authority, for the years from 1994 to 2010. The ERT strongly recommends that the Party estimate the missing CSCs in this subcategory.

CO_2 emissions from agricultural lime application

98. Hungary has reported CO_2 emissions from lime application to grassland as "NO" in CRF table 5(IV), indicating in section 7.5.2.2 of the NIR that they are negligible. In order to improve transparency, the ERT reiterates the recommendation made in the previous review report that Hungary use the notation key "NE" if emissions from lime application on

grassland are negligible, or "NO" if they do not occur, and provide this information in the documentation box of the CRF table.

F. Waste

1. Sector overview

99. In 2011, emissions from the waste sector amounted to 3,523.04 Gg CO_2 eq, or 5.3 per cent of total GHG emissions. Since the base year, emissions have increased by 14.5 per cent. The key driver for the rise in emissions is the increase in CH_4 emissions from solid waste disposal on land, which is due to the increase in the amount of waste sent to landfills. Within the sector, 79.3 per cent of the emissions were from solid waste disposal on land, followed by 17.1 per cent from wastewater handling and 2.8 per cent from waste incineration. The remaining 0.9 per cent were from other (waste).

2. Key categories

Solid waste disposal on land – CH_4

100. Hungary applied a tier 2 methodology (the first-order decay method (FOD)) to estimate CH_4 emissions from solid waste disposal on land. The Party has used default parameters from the 2006 IPCC Guidelines for methane correction factor (MCF), degradable organic carbon (DOC), fraction of DOC dissimilated, CH_4 generation rate constant, delay time and fraction of CH_4 in biogas, because parameters are more disaggregated by regions and types of waste compared to the parameters from the IPCC good practice guidance. In response to a question raised by the ERT during the review, Hungary provided the spreadsheets with the calculations used to apply the model. The ERT noted that the estimation of the amount of nappies deposited in landfills was incorrect for the period 1997–2004 due to an error in the formula in the spreadsheet and, as a result, the amount of nappies was underestimated and therefore the CH_4 emissions from managed waste disposal on land were underestimated. In response to a question raised by the ERT during the review, Hungary agreed with the ERT's finding. The ERT included this issue in the list of potential problems and further questions raised by the ERT. In response to this list, Hungary submitted revised estimates. The ERT agrees with the revised estimates and considers that the underestimation has been resolved, and recommends that the Party explain this recalculation in its NIR.

101. Hungary has country-specific data on waste composition for all years after 1980. For the period 1950–1979, the Party used the default data for waste composition for 1950 from the 2006 IPCC Guidelines and interpolated the data up to 1980. However, the ERT considers that the interpolation has not been completely explained in the NIR. In response to a question raised by the ERT during the review, the Party provided additional explanations. The ERT reiterates the recommendation made in the previous review report that Hungary explain in detail how the data for waste composition between 1950 and 1980 have been interpolated.

102. The ERT noted that, to estimate CH_4 emissions from managed landfills, Hungary has continued to apply the default oxidation factor (OX) of zero (reported as "NE" in the additional information of CRF table 6.A, C). The ERT also noted that the IPCC good practice guidance recommends a value of 0.1 for well-managed landfills. In response to a question raised by the ERT during the review, Hungary explained that only some of the landfills could be considered well managed before 2011, and that it plans to use an OX factor of 0.1 for some years and landfills in its next annual submission. In addition, the ERT noted that data on the amount of CH_4 recovered are incomplete because the CH_4 emissions that are recovered and flared without energy recovery are not included, and

therefore CH_4 emissions recovered are underestimated. The ERT considers that the zero OX value and the underestimation of CH_4 recovered result in an overestimation of CH_4 emissions from solid waste disposal on land. In response to a question raised by the ERT during the review, Hungary indicated that data on CH_4 recovered are being collected and the updated value of the OX is a planned improvement for the next annual submission. The ERT encourages Hungary to complete its data on CH_4 recovery. The ERT commends Hungary for the planned update of OX, and recommends that the Party continue to use zero as the value of the OX until the Party is able to appropriately apply the 0.1 IPCC default value.

Wastewater handling – CH_4

103. The ERT noted that Hungary has reported AD for sludge (both industrial and domestic and commercial) as "NE" in CRF table 6.B, but CH_4 emissions are reported as "IE" in the same table (emissions are reported under wastewater). The ERT recommends that the Party report disaggregated AD and CH_4 emissions for sludge in CRF table 6.B. If this is not possible, the ERT recommends that the Party report the AD as "IE".

104. Hungary used the default method from the 2006 IPCC Guidelines to estimate CH_4 emissions from industrial wastewater and domestic and commercial wastewater, without clear justification for this choice. In response to a question raised by the ERT during the review, the Party explained that its use of the default method from the 2006 IPCC Guidelines is not contrary to methodologies in the Revised 1996 IPCC Guidelines or the IPCC good practice guidance, but it has made this choice because the 2006 IPCC Guidelines provide default MCF values for different types of treatment and discharge pathway or system. The ERT reiterates the recommendation made in the previous review report that Hungary justify its use of the method included in the 2006 IPCC Guidelines in the NIR.

105. Hungary has reported that the degradable organic component in the pulp and paper industry has been changed from a default to a country-specific value (NIR page 282). However, the ERT noted that Hungary has reported the degradable organic component value for some years (e.g. for 2008) as the default value included in table 5.4 of the IPCC good practice guidance (9 kg chemical oxygen demand (COD)/m^3) in CRF table 6.B (additional information). The ERT recommends that the Party address this inconsistency and reiterates the recommendation made in the previous review report that the Party improve the consistency of the information between the NIR and the CRF tables.

106. The ERT noted that, in the additional information table for CRF table 6.B, the distribution of domestic wastewater and sludge between handling systems (aerobic and anaerobic) has been reported as "NE" and that of industrial wastewater and sludge as "NA". The ERT encourages Hungary to complete the parameters for handling systems in CRF table 6.B.

3. Non-key categories

Other (waste) – CH_4 and N_2O

107. The ERT noted that Hungary has reported CH_4 and N_2O emissions from composting for the first time, using the tier 1 methodology and the default parameters from the 2006 IPCC Guidelines. The ERT commends Hungary for this improvement.

G. Supplementary information required under Article 7, paragraph 1, of the Kyoto Protocol

1. Information on activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol

Overview

108. Table 6 provides an overview of the information reported and parameters selected by the Party under Article 3, paragraphs 3 and 4, of the Kyoto Protocol.

Table 6
Supplementary information reported under Article 3, paragraphs 3 and 4, of the Kyoto Protocol

		Findings and recommendations
Has the Party reported information in accordance with the requirements in paragraphs 5–9 of the annex to decision 15/CMP.1?	Sufficient	
Identify any elected activities under Article 3, paragraph 4, of the Kyoto Protocol	Activities elected: forest management Years reported: 2008–2011	
Identify the period of accounting	Annual accounting	
Assessment of the Party's ability to identify areas of land and areas of land-use change	Sufficient	There are forest areas named "found forests" that have been excluded from reporting under forest management even if these areas belong to the forest estate under forest management (see para. 113 below)

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

Afforestation and reforestation – CO_2

109. Hungary has conducted recalculations for afforestation and reforestation (units of land not harvested since the beginning of the commitment period) for 2008, 2009 and 2010. The estimates of net CO_2 removals increased by 3.9 per cent, 4 per cent and 2.6 per cent, respectively, compared with the 2012 annual submission. However, the Party has not provided all the necessary information on this recalculation in chapter 11 of the NIR. The ERT reiterates the recommendation made in the previous review report that the Party provide all of the necessary information on recalculations related to the KP-LULUCF activities in chapter 11 of the NIR.

110. Hungary has reported in the NIR (page 214) that: "[a]fforestation is deemed to have started when, after soil preparation, land has been "initially" planted, i.e. propagation material is planted on the area for the first time. (Subsequent beating up may be carried out depending of the success rate of this initial planting.)" The ERT notes that according to the IPCC good practice guidance for LULUCF the afforestation starts from the date of site preparation. In response to a question raised by the ERT during the review, the Party explained that site preparation precedes planting of the propagation material by one or two months. The ERT recommends that Hungary improve the description of afforestation in its NIR to set the beginning of the site preparation as the onset of the afforestation activity.

111. To estimate net CSC in biomass for afforestation and reforestation, Hungary used empirical yield tables and local (ground-based) field measurements by appropriate species

and site classes as a component of the national forest inventory (NIR, page 319). The ERT recommends that, over time, Hungary complement the methodology with data collected through the national forest inventory, when these data become available, to ensure that estimates correspond to the actual level and dynamic of carbon stocks in afforested and reforested lands instead of to the level and dynamic of the past.

Deforestation – CO_2

112. The ERT noted an inconsistency between the information reported in the CRF tables under the Kyoto Protocol and in the NIR for the year 2008. In CRF table 5(KP-I)A.2 the total net CO_2 emissions from biomass (above- and below-ground biomass) is 22.40 Gg while in NIR table 7.3.2 it is 27.1 Gg. The ERT recommends that the Party correct this inconsistency and improve its QC procedures to minimize inconsistencies.

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

Forest management – CO_2

113. Hungary is not accounting under forest management any area converted to forest land after 31 December 1989, which does not meet the definition of afforestation and reforestation. These areas are indicated in the NIR as "found forests". The ERT noted that these "found forests" are subject to forest management, as is any other forest land in Hungary. Indeed, on page 309 of the NIR, the Party defines forest management as any action envisaged in Article 7 of its Forest Act,[9] and therefore all forest land in Hungary can be considered to be subject to this legal act and subject to forest management under the Kyoto Protocol. In response to a question raised by the ERT during the review, the Party explain that the "found forests" are a net carbon sink during the commitment period; and therefore their exclusion from forest management results in an underestimation of CO_2 removals accounted under forest management. The ERT noted that the exclusion of "found forests" from forest management does not result in an underestimation of emissions or overestimation of removals, but the ERT also noted that such exclusion is inconsistent with decisions 16/CMP.1 and 15/CMP.1 and with the IPCC good practice guidance for LULUCF. Therefore, the ERT recommends that the Party include "found forests" in its reporting of forest management activities.

2. Information on Kyoto Protocol units

Standard electronic format and reports from the national registry

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

115. Information on the accounting of Kyoto Protocol units has been prepared and reported in accordance with decision 15/CMP.1, annex, chapter I.E, and reported in accordance with decision 14/CMP.1 using the SEF tables. This information is consistent

[9] Act XXXVII of 2009 on Forests, Protection of Forests and Forest Management. Article 7 reads "For the purposes of this Act, forest management shall be qualified as the entire range of activities aimed at maintaining, guarding and protecting forests, ensuring their public function, increasing forest assets, and exercising the forest usufructs in accordance with the provisions of Article 2".

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

with that contained in the national registry and with the records of the international transaction log (ITL) and the clean development mechanism registry and meets the requirements referred to in decision 22/CMP.1, annex, paragraph 88(a–j). The transactions of Kyoto Protocol units initiated by the national registry are in accordance with the requirements of the annex to decision 5/CMP.1 and the annex to decision 13/CMP.1. No discrepancy has been identified by the ITL and no non-replacement has occurred. The national registry has adequate procedures in place to minimize discrepancies.

Accounting of activities under Article 3, paragraph 3, of the Kyoto Protocol and any elected activities under Article 3, paragraph 4, of the Kyoto Protocol

116. Hungary has reported information on its accounting of KP-LULUCF in the accounting table, as included in the annex to decision 6/CMP.3. Information on the accounting of KP-LULUCF has been prepared and reported in accordance with decisions 16/CMP.1 and 6/CMP.3.

117. Table 7 shows the accounting quantities for KP-LULUCF as reported by the Party and the final values after the review.

Table 7
Accounting quantities for activities under Article 3, paragraph 3, and, if any, activities under Article 3, paragraph 4, of the Kyoto Protocol, in t CO_2 eq

	2013 submission[a]			*2010, 2011 and 2012 submissions*[b]	*Net accounting quantity*[c]
	As reported	*Revised estimates*	*Final*	*Final*	
Afforestation and reforestation	–4 849 093		–4 849 093	–3 479 636	–1 369 457
Non-harvested land	–4 559 618		–4 559 618	–3 323 289	–1 236 329
Harvested land	–289 476		–289 476	–156 347	–133 129
Deforestation	255 204	255 275	255 275	167 775	87 500
Forest management	–5 316 667		–5 316 667	–5 316 667	0
Article 3.3 offset[d]	0		0	0	0
Forest management cap[e]	–5 316 667		–5 316 667	–5 316 667	0
Cropland management					
Grazing land management					
Revegetation					

[a] The values included under the 2013 submission are the cumulative accounting values for 2008, 2009, 2010 and 2011, as reported in the accounting table of the KP-LULUCF CRF tables for the inventory year 2011.

[b] The values included under the 2010, 2011 and 2012 submissions are the final accounting values as a result of the 2012 review and are included in table 6 of the 2012 annual review report (FCCC/ARR/2012/HUN, page 38) in the column "2012 annual submission", "Final".

[c] The "net accounting quantity" is the quantity of Kyoto Protocol units that the Party shall issue or cancel under each activity under Article 3, paragraph 3, and paragraph 4, if relevant, based on the final accounting quantity in the 2013 submission and where the quantities issued or cancelled based on the 2012 annual review report have been subtracted ("net accounting quantity" = final 2013 – final 2012 annual review report).

[d] "Article 3.3 offset": For the first commitment period, a Party included in Annex I to the Convention that incurs a net source of emissions under the provisions of Article 3, paragraph 3, of the Kyoto Protocol may account for anthropogenic greenhouse gas emissions by sources and removals by sinks in areas under forest management under Article 3, paragraph 4, up to a level that is equal to the net source of emissions under the provisions of Article 3, paragraph 3, but not greater than 9.0 megatonnes of carbon times

five, if the total anthropogenic greenhouse gas emissions by sources and removals by sinks in the managed forest since 1990 is equal to, or larger than, the net source of emissions incurred under Article 3, paragraph 3.

[e] In accordance with decision 16/CMP.1, annex, paragraph 11, for the first commitment period only, additions to and subtractions from the assigned amount of a Party resulting from forest management under Article 3, paragraph 4, of the Kyoto Protocol after the application of decision 16/CMP.1, annex, paragraph 10, and resulting from forest management project activities undertaken under Article 6, shall not exceed the value inscribed in the appendix of the annex to decision 16/CMP.1, times five.

118. Based on the information provided in table 7 for the activity afforestation/reforestation, Hungary shall issue 1,369,457 removal units (RMUs) in its national registry.

119. Based on the information provided in table 7 for the activity deforestation, Hungary shall cancel 87,500 assigned amount units (AAUs), emission reduction units (ERUs), certified emission reduction units (CERs) and/or RMUs in its national registry.

120. Based on the information provided in table 7 for the activity forest management, Hungary shall neither cancel AAUs, ERUs, CERs and/or RMUs nor issue RMUs in its national registry.

Calculation of the commitment period reserve

121. Hungary has reported its commitment period reserve in its 2013 annual submission. Hungary reported its commitment period reserve to be 330,738,674 t CO_2 eq based on the national emissions in its most recently reviewed inventory (66,147.735 Gg CO_2 eq). The ERT notes that based on the submission of revised emissions estimates during the course of the review of the 2013 annual submission, the commitment period reserve for the Party changed, and the new commitment period reserve is reported as 331,395,070 t CO_2 eq. The ERT agrees with this figure.

3. Changes to the national system

122. Hungary reported that there are no notable changes in its national system since the previous annual submission. However, during the review, the Party indicated that the Central Agricultural Office, whose Forestry Directorate prepares the forestry-related parts of the Hungarian inventory, and the former Hungarian Food Safety Office were integrated into a new office establishing the National Food Chain Safety Office. The ERT concluded that the Party's national system continues to be in accordance with the requirements of national systems outlined in decision 19/CMP.1. The ERT recommends that the Party report in its next annual submission any changes in its national system in accordance with decision 15/CMP.1, annex, chapter I.F.

4. Changes to the national registry

123. Hungary reported that there are changes in its national registry since the previous annual submission. The Party described the changes, specifically due to the centralization of the EU ETS operations into a single EU registry operated by the European Commission called the Consolidated System of European Union Registries (CSEUR), in its NIR (pages 357–360).

124. The ERT noted that there were recommendations in the SIAR that had not been addressed related to the CSEUR, in particular recommendations related to reporting of test results, reporting a description of the changes in database structure and public availability of information on the website. In response to questions raised by the ERT during the review, Hungary provided further information on the changes to the national registry, including on reporting of test results, reporting a description of the changes in database structure and public availability of information on the website.

125. The ERT concluded that, taking into account the confirmed changes in the national registry, including additional information provided to the ERT during the review, Hungary's national registry continues to perform the functions set out in the annex to

decision 13/CMP.1 and the annex to decision 5/CMP.1 and continues to adhere to the technical standards for data exchange between registry systems in accordance with relevant decisions of the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol. With respect to the provision of information related to database structure specifically, the ERT encourages the Party to provide additional information in the NIR. The ERT recommends that the Party include all other additional information in response to the SIAR findings in its NIR in accordance with decision 15/CMP.1, annex, chapter I.G.

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

126. Hungary did not provide information on changes in its reporting of the minimization of adverse impacts in accordance with Article 3, paragraph 14, of the Kyoto Protocol in its annual submission. However, in response to a question raised by the ERT during the review, the Party confirmed that there had not been any changes in its reporting under Article 3, paragraph 14. The ERT concluded that the information provided is complete and transparent. The ERT recommends that the Party report any changes in the information provided under Article 3, paragraph 14, in accordance with decision 15/CMP.1, annex, chapter I.H.

127. Hungary has reported that it fully supports and implements the regulations established by the EU targeting the avoidance of adverse impacts and the fostering of sustainable development. In parallel, a policy framework has been put in place in Hungary and is laid down in Hungary's National Climate Change Strategy for the period 2008–2025. The policy framework ensures that climate policy is integrated into development policy, thereby ensuring that climate change-related projects will play an integral role in future development projects. At present, the Party does not participate in large-scale climate change projects.

III. Conclusions and recommendations

A. Conclusions

128. Table 8 summarizes the ERT's conclusions on the 2013 annual submission of Hungary, in accordance with the Article 8 review guidelines.

Table 8
Expert review team's conclusions on the 2013 annual submission of Hungary

		Paragraph cross-references
The ERT concludes that the inventory submission of Hungary is complete (categories, gases, years and geographical boundaries and contains both an NIR and CRF tables for 1990–2011)		
Annex A sources[a]	Complete	
LULUCF[a]	Not complete	82
KP-LULUCF	Complete	
The ERT concludes that the inventory submission of Hungary has been prepared and reported in accordance with the UNFCCC reporting guidelines	Yes	

		Paragraph cross-references
The submission of information required under Article 7, paragraph 1, of the Kyoto Protocol has been prepared and reported in accordance with decision 15/CMP.1	Yes	
The Party's inventory is in accordance with the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories*, the IPCC *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* and the IPCC *Good Practice Guidance for Land Use, Land-Use Change and Forestry*	Yes	
Hungary has reported information on Article 3, paragraphs 3 and 4, of the Kyoto Protocol	Yes	109–113
Hungary has reported information on its accounting of Kyoto Protocol units in accordance with decision 15/CMP.1, annex, chapter I.E, and used the required reporting format tables as specified by decision 14/CMP.1	Yes	
The national system continues to perform its required functions as set out in the annex to decision 19/CMP.1	Yes	
The national registry continues to perform the functions set out in the annex to decision 13/CMP.1 and the annex to decision 5/CMP.1 and continues to adhere to the technical standards for data exchange between registry systems in accordance with relevant CMP decisions	Yes	124, 125
Did Hungary provide information in the NIR on changes in its reporting of the minimization of adverse impacts in accordance with Article 3, paragraph 14, of the Kyoto Protocol?	No	126

Abbreviations: Annex A sources = sources included in Annex A to the Kyoto Protocol, CMP = Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol, CRF = common reporting format, IPCC = Intergovernmental Panel on Climate Change, KP-LULUCF = land use, land-use change and forestry emissions and removals from activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, LULUCF = land use, land-use change and forestry, NIR = national inventory report, UNFCCC reporting guidelines = "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual inventories".

[a] The assessment of completeness by the ERT considers only the completeness of reporting of mandatory categories (i.e. categories for which methods and default emission factors are provided in the Intergovernmental Panel on Climate Change (IPCC) *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories*, the IPCC *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories*, or the IPCC *Good Practice Guidance for Land Use, Land-Use Change and Forestry).*

B. Recommendations

129. The ERT identified the issues for improvement listed in table 9. All recommendations are for the next annual submission, unless otherwise specified.

Table 9
Recommendations identified by the expert review team

Sector	*Category*	*Recommendation*	*Paragraph cross-references*
Cross-cutting	Inventory planning	Explain in the NIR that the sectoral experts consult with the head of the GHG Inventory Division on the choice of method	13
		Improve the transparency of the information on the QA activities performed, including templates or records	16

Sector	*Category*	*Recommendation*	*Paragraph cross-references*
	Key category analysis	Include in the NIR and CRF table 7: the results from the key category analysis performed including and excluding LULUCF; and report a disaggregated key category analysis for the base year	20
Energy	Reference approach	Correct the bunker consumption for jet kerosene	27
	Comparison with international statistics	Review the fuels classification used in the inventory and the data on coal consumption per coal type	28
		Address the inconsistency in the reporting of natural gas liquids and report on the progress	29
		Use the coal classification from the Revised 1996 IPCC Guidelines	30
		Improve the consistency of the information on consumption of naphtha and gasoline	31
		Disaggregate the estimates for lubricants and refinery feedstock	32
		Improve the consistency of the information on exports of gasoline	33
		Report coking coal from 2004–2010 in the CRF tables	35
	International bunker fuels	Report on the discussion on fuel consumption by international aviation between the CRF tables and the IEA data	36
		For jet kerosene in international bunkers, replace the notation key in CRF table 1.A(b) by the appropriate estimate	37
		Report on the investigation into the discrepancies in fuel consumption in domestic navigation	38
	Feedstocks and non-energy use of fuels	Investigate the discrepancies for stocks for liquid fuels and report the findings in its NIR, and explain any recalculations	39
	Stationary combustion: all fuels – CO_2, CH_4 and N_2O	For solid fuels use in public electricity and heat production, review the N_2O EFs, and in the NIR, explain the source of these EFs and justify their selection, and ensure the time-series consistency of the estimates (including methodologies and EFs)	40
		For biomass use in public electricity and heat production, include more detailed information on biomass use, including fuels considered, AD and EFs, and explain any recalculation in its NIR	41
		For gaseous fuels use in petroleum refining, review the EFs used, to ensure the consistency of the time series (including the methodologies and the EFs) and explain any deviation	42
		For liquid fuel use in non-ferrous metals, include more detailed information on the use of liquid fuels in the non-ferrous metal industry, including fuels used, AD and EFs, and explain any recalculation in its NIR	43
		For biomass use in food processing, beverages and tobacco, apply a consistent methodological approach and apply consistent EFs across the entire time series, and review the “NO” reported for emissions for 1998–2005 and confirm that these emissions do not occur and are not reported elsewhere	44

Sector	*Category*	*Recommendation*	*Paragraph cross-references*
		For biomass use in other (manufacturing industries and construction): apply a consistent methodology and EFs across the entire time series; follow the IPCC good practice guidance for EFs (i.e. default EFs should not be used if a tier 2 or 3 methodology is applied); apply the correct notation key ("IE" instead of "NA" when emissions are included elsewhere) and include transparent information, including references, on how these emissions are estimated	45
		For liquid fuels use in agriculture/forestry/fisheries, address the overestimation of CO_2 emissions	46
		For CO_2 emissions from biomass use in agriculture/forestry/fisheries, report the information provided during the review	47
		For CH_4 and N_2O emissions from biomass use in agriculture/forestry/fisheries, explain how the CH_4 and N_2O EFs are estimated	48
	Civil aviation: liquid fuels – CO_2, CH_4, N_2O	Report the emissions from gasoline use for civil aviation separately	49
	Railways: liquid fuels – CO_2	Review the AD for the category for 2009 and 2010 and explain any recalculation	50
	Oil and natural gas: gaseous fuels – CO_2 and CH_4	For oil exploration, clearly indicate where AD and emission estimates are reported	52
	Road transportation: liquid fuels – CH_4, N_2O	Improve the consistency of the time series for CH_4 emissions from liquid fuels and explain any recalculations	53
		Review the time series of CH_4 and N_2O emissions for LPG, explain how the consistency of the time series is ensured and explain any recalculation	54, 55
	Solid fuel transformation: CO_2 and CH_4	Review the use of notation keys for AD and CO_2 and CH_4 emissions to ensure that all emissions are accurately estimated and reported. If "IE" is used, clearly explain under which category the AD or the emissions are reported	56
Industrial processes and solvent and other product use	General	Continue to improve the transparency of the information provided on QA/QC activities and category-specific uncertainties	58
	Time-series consistency	Ensure the consistency of the time series, including for cement production and glass production, and report the findings and the explanations for all recalculations	59
	Ammonia production – CO_2	Explain the decreasing trend of the CO_2 IEF	61
	Consumption of halocarbons and SF_6 – HFCs, PFCs	For refrigeration and air-conditioning equipment, develop a country-specific value for recovery efficiency and include all the information related to the estimations of emissions from disposal	62

Sector	*Category*	*Recommendation*	*Paragraph cross-references*
	Soda ash production and use – CO_2	Estimate the emissions from soda ash use in industries other than glass production and explain the recalculations	63
	Solvent and other product use – N_2O	Determine whether the import of products into Hungary occurs and, if appropriate, collect appropriate data and report relevant estimates of N_2O emissions	64
Agriculture	General	Improve the explanations on the recalculations; address the inconsistency of the information on the tier used in the uncertainty analysis	66, 67
	Enteric fermentation – CH_4	Explain how net energy for dairy cattle is calculated	68
		Improve the information on the expert judgement on body mass for non-dairy cattle	69
		Review the population data used in the inventory	70, 71
	Agricultural soils – N_2O	Correct the information on the method used to estimate direct and indirect N_2O emissions from agricultural soils	73
		Improve the transparency of the information on histosols	74
		Correct the information on liquid manure management	75
		Improve the information on N_2O emissions from crop residues	76
	Rice cultivation – CH_4	Correct the notation key for organic amendments	77
	Field burning of agricultural residues – CH_4	Report the information on recalculations in the right section of the NIR	78
		Correct the notation key for sugar cane	79
		Correct the value of the change in emissions between the base year and 2011	80
LULUCF	General	Report estimates of emissions for the currently not-estimated mandatory categories and carbon pools for which methodologies are provided in the IPCC good practice guidance for LULUCF	82
		Improve the information on: net CSCs in soils for grassland converted to other land; report the area affected by wildfires for forest land remaining forest land and report emissions from wildfires on land converted to forest land	83
		Justify that net CSCs in dead organic matter and in mineral and organic soils are not occurring in wetlands converted to forest land or use the notation key “NE”; provide information on the status of the initiative on the identification of organic soils	84
		Increase the transparency of the figures in CRF table 5.A by disaggregating the area of the forest subcompartments and the ‘permanently’ unstocked areas	85
		Report the tier 1 uncertainty analysis for forest land in order to compare the results of the two tiers	86
		Further investigate the presence of management activities on organic soils in its territory	87

Sector	*Category*	*Recommendation*	*Paragraph cross-references*
	Forest land remaining forest land – CO_2	Correct the reporting of the land-use matrices in the NIR and make the information in the CRF tables and in the NIR consistent	88
		Provide numerical examples to better clarify the methodology applied and to report its impact on the accuracy of the calculation of carbon stocks	89
	Land converted to forest land – CO_2	Improve the consistency of the land-use change areas reported	90
		Estimate changes in carbon stock in the soil and dead organic matter pools from conversion of grassland to forest land	91
		Periodically revise the function used for the estimates of net CSC in biomass for land converted to forest land	92
	Grassland remaining grassland – CO_2	Use the notation key "NE" for reporting of CSC for living biomass, and report in the appropriate documentation box of the CRF table that a tier 1 methodology was used, assuming CSCs to be zero	94
		Clarify the assumption of static management practices assumed for the entire time series	95
	Land converted to settlements – CO_2	For wetlands converted to settlements, estimate the CSC in soils and living biomass	97
	CO_2 emissions from agricultural lime application	Review the notation key for grassland	98
Waste	Solid waste disposal on land – CH_4	Explain the recalculation in its NIR	100
		Explain in detail how the data for waste composition between 1950 and 1980 have been interpolated	101
		Continue to use zero as the value of the oxidation factor until the Party is able to appropriately apply the 0.1	102
	Wastewater handling – CH_4	Report disaggregated AD and CH_4 emissions for sludge in CRF table 6.B	103
		Justify the use of the method included in the 2006 IPCC Guidelines in the NIR	104
		Address the inconsistency on the information on degradable organic component in the pulp and paper industry	105
KP-LULUCF	Afforestation and reforestation – CO_2	Provide all of the necessary information on recalculations	109
		Improve the description of afforestation in its NIR to set the beginning of the site preparation as the onset of the afforestation activity	110
		Over time, complement the methodology used in the estimates of CSC in biomass with data collected through the national forest inventory	111
	Deforestation – CO_2	Correct the inconsistency on the information on net CO_2 emission from biomass and improve its QC procedures to minimize inconsistencies.	112
	Forest management – CO_2	Include "found forest" in its reporting	113
National registry	General	Address the recommendations contained in the SIAR	114, 125

Sector	*Category*	*Recommendation*	*Paragraph cross-references*
National system	Changes in the national system	Report any changes in its national system in accordance with decision 15/CMP.1, annex, chapter I.F	122
Article 3, paragraph 14	Changes in the information provided	Report any changes in the information provided under Article 3, paragraph 14, in accordance with decision 15/CMP.1, annex, chapter I.H	126

Abbreviations: 2006 IPCC Guidelines = *2006 IPCC Guidelines for National Greenhouse Gas Inventories*, AD = activity data, CRF = common reporting format, CSC = carbon stock change, EF = emission factor, GHG = greenhouse gas, IE = included elsewhere, IPCC = Intergovernmental Panel on Climate Change, IPCC good practice guidance = IPCC *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories*, KP-LULUCF = LULUCF emissions and removals from activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, LULUCF = land use, land-use change and forestry, NIR = national inventory report, NA = not applicable, NE = not estimated, NO = not occurring, QA = quality assurance, QC = quality control, Revised 1996 IPCC Guidelines = *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories*, SIAR = standard independent assessment report.

IV. Questions of implementation

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

Annex I

Background data on recalculations and information to be included in the compilation and accounting database

Table 10
Recalculations in the 2013 annual submission for the base year and the most recent year

	1985–1987	*2010*	*1985–1987*	*2010*	
Greenhouse gas source and sink categories	*Value of recalculation (Gg CO_2 eq)*		*Per cent change*		*Reason for the recalculation*
1. Energy	520.15	–33.93	0.7	–0.1	Changed AD and EFs
A. Fuel combustion (sectoral approach)	490.75	–34.52	0.6	–0.1	
1. Energy industries	452.55	11.96	1.7	0.1	
2. Manufacturing industries and construction					
3. Transport	38.20	–46.48	0.5	–0.4	
4. Other sectors					
5. Other					
B. Fugitive emissions from fuels	29.40	0.59	1.0	0.02	
1. Solid fuels					
2. Oil and natural gas	29.40	0.59	1.5	0.03	
2. Industrial processes	0.96	–2.04	0.007	–0.03	Changed AD and EFs
A. Mineral products	0.96	0.65	0.03	0.05	
B. Chemical industry					
C. Metal production					
D. Other production					
E. Production of halocarbons and SF_6					
F. Consumption of halocarbons and SF_6		–2.69		–0.2	
G. Other					
3. Solvent and other product use	–0.12	–0.002	–0.04	–0.0006	Changed AD
4. Agriculture	1 097.51	264.55	6.1	3.2	Changed AD and EFs
A. Enteric fermentation	–72.41	–88.77	–2.0	–5.6	
B. Manure management	1,133.18	311.25	25.7	16.7	
C. Rice cultivation					
D. Agricultural soils	36.74	42.07	0.4	0.9	
E. Prescribed burning of savannas					
F. Field burning of agricultural residues					
G. Other					

Greenhouse gas source and sink categories	*1985–1987*	*2010*	*1985–1987*	*2010*	*Reason for the recalculation*
	Value of recalculation (Gg CO_2 eq)		*Per cent change*		
5. Land use, land-use change and forestry	–429.19	–712.61	19.8	21.1	Changed AD and EFs
A. Forest land	–122.94	–30.72	4.4	1.0	
B. Cropland	–162.38	–361.24	–44.2	39.2	
C. Grassland	–131.68	–278.91	–91.4	–62.7	
D. Wetlands					
E. Settlements	–15.61	–44.75	–18.6	–22.5	
F. Other land					
G. Other					
6. Waste	–0.39	–7.94	0.0	–0.2	Changed AD and EFs
A. Solid waste disposal on land		–8.72		–0.3	
B. Wastewater handling	–0.39	–25.41	0.0	–3.9	
C. Waste incineration					
D. Other		26.20		NA	
7. Other					
Total CO_2 equivalent without LULUCF	1 618.11	220.65	1.4	0.3	
Total CO_2 equivalent with LULUCF	1 188.92	–491.96	1.1	–0.8	

Abbreviations: AD = activity data, EF = emission factor, LULUCF = land use, land-use change and forestry, NA = not applicable.

Table 11
Information to be included in the compilation and accounting database in t CO_2 eq for 2011, including the commitment period reserve

	As reported	*Revised estimates*	*Adjustment*[a]	*Final*[b]
Commitment period reserve	330 738 674	331 395 070		331 395 070
Annex A emissions for 2011				
CO_2	49 740 010	49 740 711		49 740 711
CH_4	8 459 581	8 461 193		8 461 193
N_2O	6 774 461			6 774 461
HFCs	987 615	1 116 576		1 116 576
PFCs	1 701	1 707		1 707
SF_6	184 368			184 368
Total Annex A sources	**66 147 735**	**66 279 014**		**66 279 014**
Activities under Article 3, paragraph 3, for 2011				
3.3 Afforestation and reforestation on non-harvested land for 2011	–1 120 362			–1 120 362
3.3 Afforestation and reforestation on harvested land for 2011	–133 129			–133 129
3.3 Deforestation for 2011	70 420	70 453		70 453
Activities under Article 3, paragraph 4, for 2011[c]				
3.4 Forest management for 2011	–1 523 018			–1 523 018
3.4 Cropland management for 2011				
3.4 Cropland management for the base year				
3.4 Grazing land management for 2011				
3.4 Grazing land management for the base year				
3.4 Revegetation for 2011				
3.4 Revegetation in the base year				

Abbreviation: Annex A sources = sources included in Annex A to the Kyoto Protocol.
[a] "Adjustment" is relevant only for Parties for which the expert review team has calculated one or more adjustment(s).
[b] "Final" includes revised estimates, if any, and/or adjustments, if any.
[c] Activities under Article 3, paragraph 4, are relevant only for Parties that elected one or more such activities.

Table 12
Information to be included in the compilation and accounting database in t CO_2 eq for 2010

	As reported	*Revised estimates*	*Adjustment*[a]	*Final*[b]
Annex A emissions for 2010				
CO_2	51 608 422	51 609 074		51 609 074
CH_4	8 677 765	8 679 460		8 679 460
N_2O	6 464 303			6 464 303
HFCs	958 974	1 016 472		1 016 472
PFCs	1 010	1 206		1 206
SF_6	234 939			234 939
Total Annex A sources	**67 945 413**	**68 005 454**		**68 005 454**
Activities under Article 3, paragraph 3, for 2010				
3.3 Afforestation and reforestation on non-harvested land for 2010	–1 205 998			–1 205 998
3.3 Afforestation and reforestation on harvested land for 2010	–84 387			–84 387
3.3 Deforestation for 2010	48 524	48 534		48 534
Activities under Article 3, paragraph 4, for 2010[c]				
3.4 Forest management for 2010	–1 679 710			–1 679 710
3.4 Cropland management for 2010				
3.4 Cropland management for the base year				
3.4 Grazing land management for 2010				
3.4 Grazing land management for the base year				
3.4 Revegetation for 2010				
3.4 Revegetation in the base year				

Abbreviation: Annex A sources = sources included in Annex A to the Kyoto Protocol.

[a] "Adjustment" is relevant only for Parties for which the expert review team has calculated one or more adjustment(s).

[b] "Final" includes revised estimates, if any, and/or adjustments, if any.

[c] Activities under Article 3, paragraph 4, are relevant only for Parties that elected one or more such activities.

Table 13
Information to be included in the compilation and accounting database in t CO_2 eq for 2009

	As reported	*Revised estimates*	*Adjustment*[a]	*Final*[b]
Annex A emissions for 2009				
CO_2	51 055 297	51 055 836		51 055 836
CH_4	8 680 354	8 682 135		8 682 135
N_2O	6 541 399			6 541 399
HFCs	880 157	918 589		918 589
PFCs	2 907	2 930		2 930
SF_6	220 554			220 554
Total Annex A sources	**67 380 668**	**67 421 444**		**67 421 444**
Activities under Article 3, paragraph 3, for 2009				
3.3 Afforestation and reforestation on non-harvested land for 2009	–1 103 087			–1 103 087
3.3 Afforestation and reforestation on harvested land for 2009	–46 538			–46 538
3.3 Deforestation for 2009	89 553	89 568		89 568
Activities under Article 3, paragraph 4, for 2009[c]				
3.4 Forest management for 2009	–1 891 824			–1 891 824
3.4 Cropland management for 2009				
3.4 Cropland management for the base year				
3.4 Grazing land management for 2009				
3.4 Grazing land management for the base year				
3.4 Revegetation for 2009				
3.4 Revegetation in the base year				

Abbreviation: Annex A sources = sources included in Annex A to the Kyoto Protocol.
[a] "Adjustment" is relevant only for Parties for which the expert review team has calculated one or more adjustment(s).
[b] "Final" includes revised estimates, if any, and/or adjustments, if any.
[c] Activities under Article 3, paragraph 4, are relevant only for Parties that elected one or more such activities.

Table 14
Information to be included in the compilation and accounting database in t CO_2 eq for 2008

	As reported	*Revised estimates*	*Adjustment*[a]	*Final*[b]
Annex A emissions for 2008				
CO_2	56 527 298	56 527 974		56 527 974
CH_4	8 832 226	8 834 099		8 834 099
N_2O	7 000 722			7 000 722
HFCs	948 642	958 229		958 229
PFCs	3 798			3 798
SF_6	275 505			275 505
Total Annex A sources	**73 588 191**			**73 600 326**
Activities under Article 3, paragraph 3, for 2008				
3.3 Afforestation and reforestation on non-harvested land for 2008	–1 130 170			–1 130 170
3.3 Afforestation and reforestation on harvested land for 2008	–25 422			–25 422
3.3 Deforestation for 2008	46 708	46 720		46 720
Activities under Article 3, paragraph 4, for 2008[c]				
3.4 Forest management for 2008	–2 784 023			–2 784 023
3.4 Cropland management for 2008				
3.4 Cropland management for the base year				
3.4 Grazing land management for 2008				
3.4 Grazing land management for the base year				
3.4 Revegetation for 2008				
3.4 Revegetation in the base year				

Abbreviation: Annex A sources = sources included in Annex A to the Kyoto Protocol.
[a] "Adjustment" is relevant only for Parties for which the expert review team has calculated one or more adjustment(s).
[b] "Final" includes revised estimates, if any, and/or adjustments, if any.
[c] Activities under Article 3, paragraph 4, are relevant only for Parties that elected one or more such activities.

Annex II

Documents and information used during the review

A. Reference documents

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

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

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

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

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

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

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

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

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

Status report for Hungary 2013. Available at <http://unfccc.int/resource/docs/2013/asr/hun.pdf>.

Synthesis and assessment report on the greenhouse gas inventories submitted in 2013. Available at <http://unfccc.int/resource/webdocs/sai/2013.pdf>.

FCCC/ARR/2012/HUN. Report of the individual review of the annual submission of Hungary submitted in 2012. Available at <http://unfccc.int/resource/docs/2013/arr/hun.pdf>.

Standard independent assessment report, parts 1 and 2. Available at <http://unfccc.int/kyoto_protocol/registry_systems/independent_assessment_reports/items/4061.php>.

B. Additional information provided by the Party

Responses to questions during the review were received from Mr. Gábor Kis-Kovács (Greenhouse Gas Division, Hungarian Meteorological Service), including additional material on the methodology and assumptions used.

Annex III

Acronyms and abbreviations

AAU	assigned amount unit
AD	activity data
AWMS	animal waste management systems
CER	certified emission reduction unit
CH_4	methane
CMP	Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol
CO_2	carbon dioxide
CO_2 eq	carbon dioxide equivalent
CRF	common reporting format
CSC	carbon stock change
DOC	degradable organic carbon
EF	emission factor
ERT	expert review team
ERU	emission reduction unit
EU	European Union
EU ETS	European Union Emissions Trading System
FAOSTAT	database of the Food and Agriculture Organization of the United Nations
GHG	greenhouse gas; unless indicated otherwise, GHG emissions are the sum of CO_2, CH_4, N_2O, HFCs, PFCs and SF_6 without GHG emissions and removals from LULUCF
HFCs	hydrofluorocarbons
IE	included elsewhere
IEA	International Energy Agency
IEF	implied emission factor
IPCC	Intergovernmental Panel on Climate Change
ISO	International Organization for Standardization
ITL	international transaction log
kg	kilogram (1 kg = 1,000 grams)
kha	kilohectare
KP-LULUCF	land use, land-use change and forestry emissions and removals from activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol
LPG	liquefied petroleum gas
LULUCF	land use, land-use change and forestry
m^3	cubic metre
MCF	methane correction factor
N	nitrogen
N_2O	nitrous oxide
NA	not applicable
NE	not estimated
NH_3	ammonia
NIR	national inventory report
NO	not occurring
OX	oxidation factor
PFCs	perfluorocarbons
PJ	petajoule (1 PJ = 10^{15} joule)
QA/QC	quality assurance/quality control
RMU	removal unit
SEF	standard electronic format
SF_6	sulphur hexafluoride
SIAR	standard independent assessment report

TJ	terajoule (1 TJ = 10^{12} joule)
UNFCCC	United Nations Framework Convention on Climate Change
Ym	methane conversion rate