United Nations FCCC/ARR/2011/UKR

Framework Convention on Climate Change

Distr.: General
13 January 2012

English only

Report of the individual review of the annual submission of Ukraine submitted in 2011*

* In the symbol for this document, 2011 refers to the year in which the inventory was submitted, and not to the year of publication.

Contents

I. Introduction and summary

1. This report covers the in-country review of the 2011 annual submission of Ukraine, coordinated by the UNFCCC secretariat, in accordance with decision 22/CMP.1. The review took place from 10 to 15 October 2011 in Kiev, Ukraine, and was conducted by the following team of nominated experts from the UNFCCC roster of experts: generalist – Ms. Helen Plume (New Zealand); energy – Mr. Joost Huurman (Netherlands); industrial processes – Ms. Maria-Jose Lopez (Belgium); agriculture – Ms. Savitri Garivait (Thailand); land use, land-use change and forestry (LULUCF) – Ms. Marina Vitullo (Italy); and waste – Mr. Philip Acquah (Ghana). Ms. Plume and Mr. Acquah were the lead reviewers. The review was coordinated by Ms. Ruta Bubniene and Ms. Astrid Olsson (UNFCCC secretariat).

2. In accordance with the "Guidelines for review under Article 8 of the Kyoto Protocol" (decision 22/CMP.1), a draft version of this report was communicated to the Government of Ukraine, which made no comment on it.

3. In 2009, the main greenhouse gas (GHG) in Ukraine was carbon dioxide (CO_2), accounting for 72.8 per cent of total GHG emissions[1] expressed in CO_2 eq, followed by methane (CH_4) (19.3 per cent) and nitrous oxide (N_2O) (7.8 per cent). Hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6) collectively accounted for 0.1 per cent of the overall GHG emissions in the country. The energy sector accounted for 70.1 per cent of total GHG emissions, followed by the industrial processes sector (18.3 per cent), the agriculture sector (8.9 per cent), the waste sector (2.6 per cent) and the solvent and other product use sector (0.1 per cent). Total GHG emissions amounted to 374,119.68 Gg CO_2 eq and decreased by 59.9 per cent between the base year[2] and 2009.

4. Tables 1 and 2 show GHG emissions from 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, 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.

5. Table 3 provides information on the most important emissions and removals and accounting parameters that will be included in the compilation and accounting database.

[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 1990 for all gases. The base year emissions include emissions from Annex A sources only.

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 to 2009[a]

			Gg CO_2 eq								*Change*
		Greenhouse gas	*Base year*[a]	*1990*	*1995*	*2000*	*2005*	*2007*	*2008*	*2009*	*Base year–2009 (%)*
Annex A sources		CO_2	721 308.11	721 308.11	376 682.96	295 786.27	327 212.72	343 317.63	327 785.07	277 756.57	–61.5
		CH_4	151 004.26	151 004.26	94 848.01	77 605.85	76 548.83	73 443.37	73 664.79	68 330.24	–54.7
		N_2O	60 767.78	60 767.78	39 889.30	26 694.41	26 566.71	27 898.25	30 208.15	27 591.17	–54.6
		HFCs	0.00	0.00	0.00	191.87	341.69	387.24	325.76	339.78	NA
		PFCs	203.23	203.23	153.45	113.15	143.78	155.59	173.62	69.83	–65.6
		SF_6	0.02	0.02	0.91	2.19	6.89	14.46	21.81	32.09	171 219.3
KP-LULUCF	Article 3.3[b]	CO_2							2 562.67	3 501.49	
		CH_4							0.03	0.02	
		N_2O							0.00	0.00	
	Article 3.4[c]	CO_2	NA						–53 348.40	–55 186.70	NA
		CH_4	NA						1.57	0.70	NA
		N_2O	NA						0.06	0.04	NA

Abbreviations: 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.

[a] "Base year" for Annex A sources refers to the base year under the Kyoto Protocol, which is 1990 for all gases. The "base year" for activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol is 1990.

[b] Activities under Article 3, paragraph 3, of the Kyoto Protocol, namely afforestation and reforestation, and deforestation. Only the inventory years of the commitment period must be reported.

[c] Elected activities under Article 3, paragraph 4, of the Kyoto Protocol, including forest management, cropland management, grazing land management and revegetation. For cropland management, grazing land management and revegetation the base year and the inventory years of the commitment period must be reported.

Table 2
Greenhouse gas emissions by sector and activity, base year[a] to 2009

			Gg CO_2 eq							*Change*
		Sector	*Base year[a]*	*1990*	*1995*	*2000*	*2005*	*2007*	*2008*	*2009*	*Base year–2009 (%)*
Annex A		Energy	695 478.29	695 478.29	379 336.90	282 160.16	306 476.44	307 318.80	300 906.51	262 222.70	–62.3
		Industrial processes	125 730.09	125 730.09	57 246.10	72 281.26	81 154.41	95 159.22	86 266.36	68 429.95	–45.6
		Solvent and other product use	376.80	376.80	372.11	354.89	340.38	336.35	334.73	333.42	–11.5
		Agriculture	103 269.97	103 269.97	66 071.04	36 912.79	33 598.86	32 923.79	35 056.50	33 393.74	–67.7
		Waste	8 428.24	8 428.24	8 548.48	8 684.65	9 250.52	9 478.39	9 615.11	9 739.87	15.6
		LULUCF	–69 922.08	–69 922.08	–48 322.94	–48 781.99	–36 239.23	–50 984.53	–17 245.92	–19 244.65	–75.3
		Total (with LULUCF)	**NA**	**863 361.32**	**463 251.70**	**351 611.75**	**394 581.39**	**394 232.01**	**414 933.28**	**354 875.03**	**NA**
		Total (without LULUCF)	**933 283.40**	**933 283.40**	**511 574.63**	**400 393.74**	**430 820.62**	**445 216.54**	**432 179.20**	**374 119.68**	**–59.9**
		Other[b]	NA	NA	NA	NA	NA	NA	NA	NA	NA
KP-LULUCF	Article 3.3[c]	Afforestation and reforestation							–2 010.89	–2 317.55	
		Deforestation							4 574.41	5 819.50	
		Total (3.3)							**3 380.30**	**4 619.17**	
	Article 3.4[d]	Forest management							–53 298.02	–55 158.76	
		Cropland management	NA						NA	NA	NA
		Grazing land management	NA						NA	NA	NA
		Revegetation	NA						NA	NA	NA
		Total (3.4)	**NA**						**–53 298.02**	**–55 158.76**	**NA**

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

[a] "Base year" for Annex A sources refers to the base year under the Kyoto Protocol, which is 1990 for all gases. The "base year" for activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol is 1990.

[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. Only the inventory years of the commitment period must be reported.

[d] Elected activities under Article 3, paragraph 4, of the Kyoto Protocol, including forest management, cropland management, grazing land management and revegetation. For cropland management, grazing land management and revegetation the base year and the inventory years of the commitment period must be reported.

Table 3
Information to be included in the compilation and accounting database in t CO_2 eq

	As reported	*Revised estimates*	*Adjustment*[a]	*Final*[b]	*Accounting quantity*[c]
Commitment period reserve	1 852 385 130	1 870 598 400		1 870 598 400	
Annex A emissions for current inventory year					
CO_2	274 130.38	277 756.57		277 756.57	
CH_4	68 317.66	68 330.24		68 330.24	
N_2O	27 587.28	27 591.17		27 591.17	
HFCs	339.78	339.78		339.78	
PFCs	69.83	69.83		69.83	
SF_6	32.09	32.09		32.09	
Total Annex A sources	373 978.07	374 119.68		374 119.68	
Activities under Article 3, paragraph 3, for current inventory year	–2 317.55			–2 317.55	
3.3 Afforestation and reforestation on non-harvested land for current year of commitment period as reported	–1 200.33			–1 200.33	
3.3 Afforestation and reforestation on harvested land for current year of commitment period as reported	–1 117.22			–1 117.22	
3.3 Deforestation for current year of commitment period as reported	5 819.50			5 819.50	
Activities under Article 3, paragraph 4, for current inventory year[d]	–55 158.76			–55 158.76	
3.4 Forest management for current year of commitment period	–55 158.76			–55 158.76	
3.4 Cropland management for current year of commitment period					
3.4 Cropland management for base year					
3.4 Grazing land management for current year of commitment period					
3.4 Grazing land management for base year					
3.4 Revegetation for current year of commitment period					
3.4 Revegetation in base year					

Abbreviations: NA = not applicable.

[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] "Accounting quantity" is included in this table only for Parties that chose annual accounting for activities under Article 3, paragraph 3, and elected activities under Article 3, paragraph 4, if any.

[d] Activities under Article 3, paragraph 4, are relevant only for Parties that elected one of these activities.

6. The Party's 2011 GHG inventory is generally in line with the Intergovernmental Panel on Climate Change (IPCC) *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the Revised 1996 IPCC Guidelines), the 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). Areas that are not completely in line with the Revised 1996 IPCC Guidelines, the IPCC good practice guidance and the IPCC good practice guidance for LULUCF include:

(a) The application of IPCC good practice guidance quality assurance/quality control (QA/QC) methods to ensure consistency between the data reported in the national inventory report (NIR) and in the common reporting format (CRF) tables (e.g. in the industrial processes, agriculture and waste sectors);

(b) General issues relating to transparency across all sectors;

(c) The allocation of some emissions within and between the energy and industrial processes sectors, and within the LULUCF sector.

7. The 2011 inventory submission covers all sectors and categories, showing significant improvement since the 2010 submission. However, during the review week the expert review team (ERT) identified potential underestimations in the industrial processes and energy sectors and requested Ukraine to provide emission estimates for military aviation and navigation (see para. 68 below); to revise the CO_2 emission estimates for ammonia production for the entire time series, including an updated net calorific value (NCV) of natural gas (see para. 85 below); to reallocate emissions from natural gas in ammonia production from the industrial processes sector to chemical industry in the energy sector and natural gas combustion in the residential sector (see paras. 58 and 59 below).

8. Ukraine acknowledged these findings at the time of the review and carried out major improvements to its GHG inventory during the review by providing estimates for the categories mentioned in paragraph 7 above and resubmitting the CRF tables and the commitment period reserve.

9. By submitting the revised inventories and supplying the additional information requested by the ERT, Ukraine has demonstrated sufficient capacity to comply with the "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual inventories" (hereinafter referred to as the UNFCCC reporting guidelines) and the IPCC good practice guidance.

10. Ukraine has submitted supplementary information required under Article 7, paragraph 1, of the Kyoto Protocol in accordance with chapter I of the annex to decision 15/CMP.1.

11. Ukraine has chosen to account for activities under Article 3, paragraph 3, of the Kyoto Protocol, and Article 3, paragraph 4, of the Kyoto Protocol (forest management) at the end of the commitment period. Ukraine has reported information on activities under Article 3, paragraph 3, of the Kyoto Protocol and elected activities under Article 3, paragraph 4, of the Kyoto Protocol in accordance with decisions 15/CMP.1, 16/CMP.1 and 6/CMP.3.

12. Ukraine has reported information on its accounting of Kyoto Protocol units in accordance with chapter I.E of the annex to decision 15/CMP.1, and has used the standard electronic format (SEF) tables as required by decision 14/CMP.1.

13. The national system performs its required functions as set out in the annex to decision 19/CMP.1 and demonstrates a considerable improvement since the last annual submission. The ERT commends Ukraine for its efforts in this regard and encourages it to continue to provide the necessary resources for a fully functioning national system. The ERT identified areas for further improvement, including the

timeliness of reporting and the identification of internal procedures that would increase the coordination between the different experts, agencies and organizations involved in the preparation of the national GHG inventory.

14. The national registry continues to perform the functions set out in the annex to decision 5/CMP.1 and the annex to decision 13/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 (CMP).

15. Ukraine has reported information on the minimization of adverse impacts in accordance with Article 3, paragraph 14, of the Kyoto Protocol, as requested in chapter I.H of the annex to decision 15/CMP.1, in its NIR. Ukraine submitted this information on 15 April 2011.

16. In the course of the review, the ERT formulated a number of recommendations relating to: transparency across all sectors (i.e. in the energy (see para. 45 below) and agriculture (see paras. 103, 104, 111 and 113 below) sectors); consistency between the NIR and the CRF tables in the industrial processes (see para. 79 below) and agriculture (see para. 101 below) sectors; the improvement of the accuracy of emission estimates (e.g. in the energy (see para. 61 below), industrial processes (see para. 82 below), agriculture (see para. 118 below), LULUCF (see para. 126 below) and waste (see para. 148 below) sectors); the completeness of the time series in the energy sector (see para. 68 below); time-series consistency in the industrial processes (see para. 89 below) and agriculture (see para. 106 below) sectors; the allocation of some emissions within and between the energy and industrial processes sectors (see paras. 48 and 86 below) and within the LULUCF sector (see para. 129 below); the enhancement of the archiving system for LULUCF data (see para. 128 below); and the application of the IPCC good practice guidance to assist with the methodological choice in the waste sector (see para. 153 below).

II. Technical assessment of the annual submission

A. Overview

1. Annual submission and other sources of information

17. The 2011 annual inventory submission was submitted on 15 April 2011; it contains a complete set of CRF tables for the period 1990–2009 and an NIR. Ukraine resubmitted the NIR and the CRF tables on 25 May 2011 and 8 June 2011, respectively. The Party also submitted 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 under Article 3, paragraph 14, of the Kyoto Protocol. The SEF tables were submitted on 14 April 2011.

18. Ukraine officially submitted revised emission estimates on 14 October 2011 in response to questions raised by the ERT during the review. The ERT notes that Ukraine did not complete its first submission until 25 May 2011 and, although this was within the six-week period before any consequences resulting from a late submission come into effect, the ERT recommends that Ukraine submit its next inventory (a complete NIR and set of CRF tables) by 15 April 2012 as required by decision 15/CMP.1. Further, the ERT recommends that Ukraine review the elements

of its national inventory system that would enable the timely submission of its complete NIR. The values used in this report are based on the values contained in the submission of 14 October 2011.

19. The ERT also used previous years' submissions during the review. In addition, the ERT used the standard independent assessment report (SIAR), parts I and II, to review information on the accounting of Kyoto Protocol units (including the SEF tables and their comparison report) and on the national registry.[3]

20. During the review, Ukraine provided the ERT with additional information. The documents concerned are not part of the annual submission but are in many cases referenced in the NIR. The full list of materials used during the review is provided in annex I to this report.

Completeness of inventory

21. The inventory covers all source and sink categories for the period 1990–2009 and is complete in terms of years and geographical coverage.

2. A description of the institutional arrangements for inventory preparation, including the legal and procedural arrangements for inventory planning, preparation and management

Overview

22. The ERT concluded that the national system performs its required functions. Ukraine has put in place the mandatory requirements for a national system under Article 5, paragraph 1, of the Kyoto Protocol and the national system is generally prepared in accordance with the "Guidelines for national systems under Article 5, paragraph 1, of the Kyoto Protocol" (decision 19/CMP.1). The ERT recognizes, however, that parts of the national system relating to the LULUCF sector of the inventory and reporting of activities under KP-LULUCF need to be further improved. The ERT therefore recommends that Ukraine fully describe in its next annual submission how the parts of the national system relating to the LULUCF sector and KP-LULUCF activities are prepared and how they fit into the overall national system.

23. Ukraine described the changes to the national system since the previous annual submission and these changes (relating to an ongoing process of administrative reform in Ukraine) are discussed in paragraph 178 of this report.

Inventory planning

24. During the review week, Ukraine described the national system for the preparation of the inventory. The State Environmental Investment Agency (SEIA) has overall responsibility for the national inventory. Other agencies involved in the preparation of the inventory include, in particular, the Ministry of Ecology and Natural Resources of Ukraine (MEP), the Ukrainian Hydrometeorological Research Institute (UHRI), the Ukrainian Scientific and Research Institute of Forestry and

[3] The SIAR, parts I and II, is prepared by an independent assessor in line with decision 16/CP.10 (paras. 5(a), 6(c) and 6(k)), under the auspices of the international transaction log (ITL) administrator using procedures agreed in the Registry System Administrators Forum. Part I is a completeness check of the submitted information relating to the accounting of Kyoto Protocol units (including the SEF tables and their comparison report) and to national registries. Part II contains a substantive assessment of the submitted information and identifies any potential problem regarding information on the accounting of Kyoto Protocol units and the national registry.

Forest Melioration, the Institute of Agriculture and the Cherkassky State Research Institute of Technological and Economic Information in the Chemical Industry. The main data providers include the State Statistics Committee of Ukraine, the Ministry of Fuel and Energy of Ukraine, the Ministry of Industrial Policy of Ukraine, the Ministry of Agricultural Policy and Food, the Ministry of Construction, Architecture, Housing and Communal Services of Ukraine, the State Committee of Ukraine for Water Management and industrial enterprises.

25. MEP (under Decree No. 1239/2005 of the President of Ukraine) is responsible for policy and regulatory framework development, submission approval and research funding. SEIA (under Decree No. 1085/2010) is directed and coordinated by the Cabinet of Ministers of Ukraine via the Minister of Ecology and Natural Resources. SEIA is the designated national inventory entity responsible for inventory planning, organizing the preparation of the inventory (data collection, QA/QC, internal and public review), inventory management (including archiving and the organization of reviews) and the official submission of the inventory to the UNFCCC secretariat. UHRI, under a long-term contract, is responsible for the estimation of GHG emissions, conducting the key category analysis, the estimation of inventory uncertainty, the implementation of general inventory QA/QC procedures and the compilation of the inventory (draft NIR and CRF tables).

26. The functioning of the national system was well demonstrated by Ukraine during the review week; the Party was able to respond to questions as they arose, retrieving information from the archiving system, providing estimates for missing categories and making a revised CRF submission before the end of the review week. However, during the review week, the ERT formed the view that, given the large number of experts, agencies and organizations involved in the preparation of the inventory, Ukraine's national system could benefit from greater coordination. This would further strengthen the national system, providing an opportunity for cross-sectoral understanding, including of the linkages and overlaps between sectors. The ERT encourages Ukraine to study the internal procedures that would increase the coordination between the different experts, agencies and organizations involved in the preparation of the national GHG inventory.

Inventory preparation

Key categories

27. Ukraine has reported a key category tier 1 analysis, both level and trend assessment, as part of its 2011 submission. The key category analysis performed by the Party and that performed by the secretariat[4] produced similar results. Ukraine has included the LULUCF sector in its key category analysis, which was performed in accordance with the IPCC good practice guidance and the IPCC good practice guidance for LULUCF. Ukraine uses the key category analysis to prioritize inventory improvement activities, with many key categories included in its inventory improvement plan for 2012 (e.g. the development of a methodology for the

[4] The secretariat identified, for each Party, the categories that are key categories in terms of their absolute level of emissions, applying the tier 1 level assessment as described in the IPCC good practice guidance for LULUCF. Key categories according to the tier 1 trend assessment were also identified for Parties that provided a full set of CRF tables for the base year or period. Where the Party performed a key category analysis, the key categories presented in this report follow the Party's analysis. However, they are presented at the level of aggregation corresponding to a tier 1 key category assessment conducted by the secretariat.

calculation and determination of N_2O emissions from agricultural soils and the development and application of a higher-tier method for road transportation).

28. The activities afforestation/reforestation and forest management have been identified by the Party as key categories, in line with the IPCC good practice guidance for LULUCF.

Uncertainties

29. Ukraine has provided a tier 1 uncertainty analysis in the NIR. The results of this analysis are presented both at the summary level and at the individual category level. In 2009, the total inventory level uncertainty is 4.9 per cent (a reduction of 0.1 per cent compared to 2008) and the total uncertainty in the trend is 1.2 per cent (a reduction of 0.4 per cent compared to 2008) excluding LULUCF and 5.1 per cent (compared to 6.3 per cent for 2008) and 1.2 per cent (compared to 2.3 per cent for 2008) including LULUCF. The information provided on uncertainties is generally appropriate and as required by the UNFCCC reporting guidelines and the IPCC good practice guidance. Ukraine informed the ERT during the review week that it uses the results of the uncertainty analysis to prioritize inventory improvements, in particular regarding N_2O emissions from soils. The ERT recommends that Ukraine continue to improve its uncertainty estimates, both at the sectoral level and at the combined level, taking into account the introduction of new methodologies and emission factors (EFs) as appropriate. Sector-specific recommendations regarding uncertainties can be found in the sections of this report on the agriculture (see para. 105 below) and waste (see para. 153 below) sectors.

Recalculations and time-series consistency

30. Recalculations have been performed and reported in accordance with the IPCC good practice guidance. The ERT noted that recalculations reported by the Party of the time series 1990–2008 have been undertaken to take into account changes in EFs, activity data (AD) and methodologies. The major changes include: CO_2 emissions from energy industries (reflecting the use of country-specific or plant-specific coal data and the carbon content of natural gas); N_2O emissions from transport (as a result of new information on the export/import of diesel fuel); and CO_2 emissions/removals in the LULUCF sector (as a result of clarifying land classification and sources of AD). The major changes, and the magnitude of the impact, include: an increase in estimated total GHG emissions in 1990 (0.36 per cent) and a decrease in 2008 (0.34 per cent). The rationale for these recalculations is provided in CRF table 8(b) and in the NIR but the clarity of the explanations could be improved, in particular for the LULUCF, agriculture and industrial processes sectors. The recalculations have resulted in concrete improvements to the inventory. The ERT recommends that Ukraine continue to improve the explanations of future recalculations. More information on the recalculations can be found in the relevant sector-specific chapters of this report.

Verification and quality assurance/quality control approaches

31. Ukraine has developed a QA/QC plan in accordance with the IPCC good practice guidance. The QA/QC plan includes all mandatory elements as set out in the IPCC good practice guidance and decision 19/CMP.1. The NIR clearly explains that QA/QC procedures are conducted on categories containing confidential information but there is no explicit mention of confidential information in the QA/QC plan. The ERT recommends that Ukraine more strictly apply the IPCC good practice guidance QA/QC methods to improve the consistency between the data reported in the NIR and

in the CRF tables. The ERT further recommends that Ukraine provide more explicit information on the QA/QC procedures for the sectors that include confidential information.

Transparency

32. The 2011 NIR provides much of the information necessary to assess the inventory and the ERT was provided with full access to confidential information during the review. However, the provision of additional information could improve the transparency and accessibility of the information in the NIR, such as specific information in one section of the NIR on how the recommendations from previous reviews have been addressed. The ERT recommends that Ukraine continue to increase transparency across all aspects of the NIR and consider using tabular formats to streamline the presentation of information where appropriate. More information on ways of increasing transparency can be found in the sector-specific chapters of this report.

Inventory management

33. Ukraine has a centralized archiving system, which is kept at SEIA. The system includes calculation sheets and their history, and CRF Reporter and reference material (which, where necessary, is scanned into the system). Confidential information is not stored in the system, but a record exists of where it can be located. The archiving system has user guidelines and individual accounts for registered users and is backed up to an external server. Ukraine was able to provide the archived documents requested by the ERT during the review, including confidential data in accordance with national procedures. The ERT commends Ukraine for its archiving system, which was well demonstrated during the review. When developing the archiving system for LULUCF data, the ERT recommends that Ukraine continue working on linking the two archiving systems.

3. Follow-up to previous reviews

34. With the 2011 submission, Ukraine has demonstrated its responsiveness to the recommendations from the previous review and has been able to make a large number of changes over the past year. The Party has made changes to its national system, giving it high priority and the necessary resources; these changes are reflected in the completeness of the reporting, including the reporting for categories that had previously not been estimated, and in improvements required for LULUCF and KP-LULUCF reporting. The ERT commends Ukraine for its hard work over the last year and encourages it to continue improving the accuracy, transparency and completeness of its inventory.

4. Areas for further improvement

Identified by the Party

35. The ERT noted the planned improvements reported under each sector of the 2011 NIR. In addition, during the review, Ukraine presented a consolidated GHG inventory improvement plan for the year 2012. These improvements include:

(a) The use of a tier 3 country-specific model for the calculation of emissions from landfills;

(b) Research into CH_4 and N_2O emissions from wastewater treatment to determine country-specific EFs;

(c) The development of methodologies and/or country-specific EFs for: CH_4 emissions from coal mines; CO_2 emissions from cement production; limestone and dolomite use; chemical production; iron and steel and ferroalloys; and N_2O emissions from agricultural soils;

(d) The implementation and completion of stage 2 of the development of a methodology for the calculation and determination of GHG emissions from mobile sources;

(e) The implementation and completion of stage 2 of the development of a methodology for the calculation and determination of HFCs, PFCs and SF_6 emissions from industrial processes;

(f) The implementation and completion of stage 2 of the development and maintenance of a global information system (GIS) database aimed at providing AD on afforestation and reforestation, deforestation and forest management;

(g) The implementation and completion of stage 2 of the collection of additional data to identify carbon accumulation in forest pools (living and dead biomass, litter and soil) in the context of Ukraine's climatic zones.

Identified by the expert review team

36. The ERT recommends that Ukraine include a consolidated inventory improvement plan (covering all sectors) as an annex to the next and subsequent annual submissions, with the plan encompassing improvements beyond one year. The overall inventory improvement plan should be updated on an annual basis. During the review week the ERT identified cross-cutting issues for improvement. These are listed in paragraph 194 below. Recommended improvements relating to specific categories are presented in the relevant sector chapters of this report.

B. Energy

1. Sector overview

37. The energy sector is the main sector in the GHG inventory of Ukraine. In 2009, emissions from the energy sector amounted to 262,222.70 CO_2 eq, or 70.1 per cent of total GHG emissions. Since 1990, emissions have decreased by 62.3 per cent. The key driver for the fall in emissions is the economic crisis during the transformation of the country to a market economy. Other key drivers include the fuel switch from liquid fuels to gaseous fuels and, more recently, the economic crisis in 2008–2009, which resulted in a decrease in emissions of 12.9 per cent. The most significant decrease was in manufacturing industries and construction with a 31.0 per cent reduction.

38. Within the sector, 37.0 per cent of the emissions were from energy industries, followed by 17.0 per cent from other sectors, 15.0 per cent from transport and 12.3 per cent from manufacturing industries and construction. The category other (energy) accounted for 0.4 per cent. The remaining 18.4 per cent were from fugitive emissions from fuels. The most important GHG was CO_2, which accounted for 81.0 per cent of total GHG emissions in the energy sector, followed by CH_4 (18.4 per cent) and N_2O (0.5 per cent).

39. Ukraine is a large producer and consumer of coal, both for electricity and for heat and coke production. Significant quantities of natural gas are transported through Ukraine from the Russian Federation to several countries of the European Union.

These circumstances cause the relatively high percentage of CH_4 emissions in the Party's inventory.

40. In the 2011 annual submission, Ukraine has provided an energy balance for the years 2008 and 2009 for most fuels. Data on fuel production and consumption are collected by the State Statistical Service, while international trade statistics are used to reference import and export data. For natural gas, however, the physical transborder flows are used since they are considered more reliable. Ukraine has signed a memorandum of understanding on the exchange of information and is providing annual information to the International Energy Agency (IEA). The ERT commends Ukraine for the improvements that have been made so far to improve the energy balance and recommends that the Party work closely with the IEA to further improve the quality of the energy balance. In addition, the ERT recommends that Ukraine improve the working relationship between the national inventory team and other organizations involved in the preparation of the inventory, such as the State Statistical Service, especially regarding QA/QC procedures.

41. To improve the transparency of the emission estimates for solid fuels, mostly in the energy industries and the iron and steel categories, Ukraine followed up on the recommendations in previous review reports to provide a coal and a coke balance in the NIR. The ERT commends Ukraine for this effort and encourages the Party to continue improving the transparency of the NIR by providing (access to) relevant background data on, for example, the production of blast furnace gas and oxygen steel furnace gas.

42. The Party has included some trend explanations in its 2011 NIR. However, these were based on a high level of aggregation and mainly focused on the trend compared to the base year. The ERT recommends that Ukraine include in its next annual submission:

(a) Information on short-term trends, both for AD and emissions. The assessment should be mostly focused on the changes since the previous year;

(b) Information on significant changes in implied EFs (e.g. changes in the fuel mix).

43. The ERT noted that Ukraine has included information in the NIR on all CO_2 EFs used as well as on some CH_4 and N_2O EFs. The ERT recommends that Ukraine include in its next annual submission information on all EFs used, preferably in a tabular format and with reference to the source of the EF.

44. Following up on a recommendation made in previous review reports, Ukraine has improved the time-series consistency by splicing the energy consumption for the years 1991–1997 using the IPCC splicing technique. The Party has used the same AD sources and EFs for the whole time series. The ERT commends Ukraine for the efforts made to improve the completeness of the time series.

45. In comparison with the 2010 submission, the size of the Party's NIR and its annexes has grown substantially, especially for the energy sector. The ERT commends Ukraine for the inclusion of the additional information on energy balances, fuel losses and EFs. The ERT encourages the Party to reconsider the content required for the NIR and its annexes and the way in which the information is presented in order to improve transparency.

46. The ERT noted that, in the CRF tables, most of the categories for the energy sector have been estimated. However, the following data were reported as not estimated ("NE"):

(a) Some subcategories of fugitive emissions for which no methodology is available in the Revised 1996 IPCC Guidelines and/or the IPCC good practice guidance (e.g. CO_2 emissions from post-mining activities, CO_2 and N_2O emissions from oil refining and storage and CO_2 and CH_4 emissions from the distribution of oil products);

(b) The time series for the period 1991–1997 for the whole reference approach (CRF tables 1.A(b) and 1.A(d)) as well as the subcategories lubricant use in bunkers and refinery feedstocks. Although these data were reported as "NE", they have no effect on the reported estimated emissions using the sectoral approach;

(c) The AD on solid fuel production; according to the explanation provided by Ukraine to the ERT, there is no relation between the AD and the reported emissions;

(d) Emissions from military aviation and navigation for the years 1990–2007. In response to questions raised by the ERT during the review week, Ukraine submitted CO_2, CH_4 and N_2O emission estimates for military aviation and navigation for the years 2008 and 2009. Data for the years 1990–2007 were not available in the short time frame available.

47. The data reported as "NE" do not have an effect on the 2009 emission estimates. The ERT recommends that Ukraine use the notation key not applicable ("NA") for the reporting of AD on solid fuel production and that it estimate CO_2, CH_4 and N_2O emissions from military aviation and navigation for the years 1990–2007. The ERT encourages Ukraine to provide emission estimates for the categories for which there are no default methodologies in the Revised 1996 IPCC Guidelines and/or the IPCC good practice guidance. Furthermore, the ERT encourages the Party to complete the CRF tables for the reference approach.

48. The ERT noted prior to and during the review week that the allocation of emissions from off-road vehicles was incorrect. Emissions from agricultural off-road vehicles are reported in the category other transportation, as were emissions from other off-road vehicles. The ERT recommends that Ukraine report emissions from agricultural off-road vehicles under the category agriculture/forestry/fisheries and emissions from other off-road vehicles under the relevant subcategories in manufacturing industries and construction with the exception of emissions from ground activities in airports and harbours which have to be reported under other transportation.

49. Emissions from stationary combustion are based on International Standard Industrial Classification (ISIC) sectors 61–67[5] and are reported under the category other (energy). The ERT recommends that Ukraine report these emissions under the category commercial/institutional with the exception of stationary combustion emissions in pipeline transport which have to be reported under the category other transportation in order to be in line with the Revised 1996 IPCC Guidelines.

50. The Party has made recalculations for the energy sector between the 2010 and 2011 submissions in response to recommendations from the 2010 annual review report. The impact of these recalculations on the energy sector is a decrease in emissions of 0.8 per cent for 2008. The main recalculations took place in the following categories:

[5] United Nations Statistics Division. 2011. *International Standard Industrial Classification of All Economic Activities, Rev.3.1*. See the sections on transport, storage and communications, and financial intermediation. Available at <http://unstats.un.org/unsd/cr/registry/regcst.asp?Cl=17>.

(a) CO_2 emissions from stationary combustion of solid fuels in thermal power plants due to the introduction of country-specific EFs and oxidation factors;

(b) CO_2 emissions from the combustion of gaseous fuels due to the introduction of a country-specific EF;

(c) N_2O emissions from liquid fuels in road transportation due to the use of a different EF.

51. In response to questions raised by the ERT during the review week, Ukraine submitted revised emission estimates for military aviation and navigation (see para. 68 below) and reallocated emissions from natural gas combustion in ammonia production from the industrial processes sector to chemical industry in the energy sector and natural gas combustion in the residential sector (see paras. 58 and 59 below). The total emissions from the energy sector increased by 3.6 per cent for 2009 due to these revised estimates.

2. Reference and sectoral approaches

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

52. Ukraine has provided a comparison of the reference approach with the sectoral approach for 1990 and for the time series 1998–2009 with differences in total emissions ranging from –1.5 per cent in 2009 to 7.0 per cent in 2003. The ERT recommends that Ukraine improve the quality of the reference approach by increasing the accuracy of the energy balance, where possible. Furthermore, the ERT noted that the reporting of carbon stored is not in line with the Revised 1996 IPCC Guidelines and is generally focused on reducing the difference between the reference approach and the sectoral approach instead of providing an independent check of the sectoral approach. The ERT recommends that Ukraine estimate the amount of carbon stored following the Revised 1996 IPCC Guidelines and provide an explanation in its next annual submission for the reasons for the differences between the reference approach and the sectoral approach (see also para. 56 below).

53. Apparent consumption data are not available in the CRF tables for the years 1991–1997. For the years where data are available, the apparent consumption reported by Ukraine in the CRF tables shows differences of up to 10 per cent compared to the IEA data for all the years of the time series, with the data corresponding more closely from 2006 onwards. In response to questions raised by the ERT during the review week, Ukraine explained that it is continuing its efforts to reduce discrepancies between the CRF tables and the IEA data. SEIA, as the state body responsible for preparing the inventory, is currently holding consultations with the State Statistical Service aimed at developing a common approach to the submission of reporting data to international organizations.

International bunker fuels

54. Ukraine estimates fuel consumption for international and civil aviation using the European Monitoring and Evaluation Programme core inventory of air emissions (EMEP/CORINAIR) methodology, and uses IPCC default EFs for CO_2 and N_2O emissions from international bunker fuels and the EMEP/CORINAIR approach to estimate CH_4 emissions from international bunker fuels. The approach applied to the division of GHG emissions between domestic and international aviation is in line with the approach described in the Revised 1996 IPCC Guidelines.

55. The national statistics do not contain any data on international marine bunkers. In this regard, an indirect method is used to calculate CO_2 and N_2O emissions, based on data on total fuel consumption by maritime transport collected by the State Statistical Service; data on the freight turnover of maritime transport in coastal waters and data on international shipping. This method is in line with a recommendation in the IPCC good practice guidance whereby cargo tonnage data are mentioned as a possible source of proxy data that may be used to split the fuel use data.

Feedstocks and non-energy use of fuels

56. Ukraine reports not only non-energy use in CRF table 1.A(d), but also inputs for coke production, natural gas losses and coke oven gas flares during coke production. In addition, the carbon storage fractions used are all equal to 1 except for lubricants. The ERT noted that Ukraine uses this approach to ensure consistency between the sectoral approach and the reference approach. Since this is not in line with the Revised 1996 IPCC Guidelines and also results in a dysfunctional reference approach (see para. 52 above), the ERT recommends that Ukraine report, in its next annual submission, the feedstock and non-energy use table following the Revised 1996 IPCC Guidelines.

3. Key categories

Stationary combustion: gaseous fuels – all gases

57. In response to recommendations in previous review reports, Ukraine has developed a country-specific CO_2 EF for natural gas using data from more than 1,500 measurements of emissions from natural gas pipeline transport on the borders of the country. This has resulted in an EF ranging from 15.11 kg C/GJ in 2009 to 15.18 kg C/GJ in 2006. Ukraine plans to improve the accuracy of the EF by also taking into account natural gas which is produced domestically. The ERT commends Ukraine for the improvement that has been made and encourages the Party to continue the research on the amount of natural gas that is produced domestically.

58. During the review week, the ERT noted that Ukraine reported all emissions from ammonia production, both from fuel use and from feedstock use, in the industrial processes sector. Since this resulted in an underestimation of CH_4 and N_2O emissions from fuel combustion, the Party submitted revised estimates during the review week, reallocating the natural gas used for combustion purposes to the energy sector, and estimated emissions for all gases. The data obtained from three of the six ammonia-producing companies were used to differentiate between feedstock and fuel use. The ERT commends Ukraine for this improvement. The impact of the revised estimates for 2009 is a 10.0 per cent increase in emissions from manufacturing industries and construction.

59. The ERT also noted that not all fuel combustion from natural gas in the residential sector was included in the inventory. In response to questions raised by the ERT during the review, Ukraine provided revised emission estimates. The impact of the revised emission estimates for 2009 is an increase of 8.7 per cent in the residential sector. The ERT notes that the revised emission estimates include all fuel combusted from natural gas in the residential sector. However, the ERT encourages the Party to improve the transparency of reporting of data on natural gas consumption in order to improve the quality of the emission estimates for gas consumption for all categories.

Stationary combustion: solid fuels – CO_2

60. In response to recommendations in previous review reports, Ukraine developed a country-specific EF as well as a country-specific oxidation factor for coal used in thermal power plants (TPPs). Over 270 measurements have been taken from 2001 to 2009 resulting in EFs for the different coal grades ranging from 28.0 kg C/GJ for anthracite to 24.8 kg C/GJ for bituminous coal. An oxidation factor of 0.963 was estimated based on data covering all major TPPs in Ukraine. The ERT commends the Party for this improvement. Two national circumstances were important in the calculation of the oxidation factor:

(a) The NVC of raw coal in Ukraine is relatively low due to the high (>30) ash percentage. This explanation was not included in the NIR. The ERT recommends that Ukraine include this explanation in its next annual submission;

(b) The oxidation factor for coal combustion in TPPs in Ukraine is lower than in other countries due to the age of the average TPP.

Road transportation: liquid fuels – all gases[6]

61. In response to a recommendation in the previous review report, Ukraine has started using the medium-range IPCC default EF (10.5 g N_2O/GJ) for both gasoline and diesel consumption for 1990–2009, which the ERT considers to be an improvement.

62. An improvement programme has been conducted during the period May–October 2011 by the State Road Transport Research Institute in order to advance to a tier 3 methodology for the calculation of emissions from road transportation. During the review week, the preliminary results were presented to the ERT and the implementation of the new methodology is planned for the 2012 annual submission. The ERT commends Ukraine for the efforts made to improve the accuracy of the data and recommends that the Party use this study to improve the quality of the 2012 annual submission.

63. Since the IPCC default CO_2 EF for gasoline (18.9 t/TJ) used by Ukraine is among the lowest compared to other reporting Parties (ranging from 18.9 t/TJ to 20.2 t/TJ) and as CO_2 emissions from road transportation are a key category, the ERT recommends that Ukraine undertake research in order to establish a country-specific CO_2 EF for liquid fuels or provide documentation to prove that the IPCC default EF is appropriate to the national circumstances.

Oil and natural gas – all gases

64. The gas transmission system (GTS) of Ukraine is the second largest in Europe. It comprises 39,800 km of gas pipelines, 13 underground gas storage locations, a developed gas distribution system and gas metering stations. The GTS intake throughput is 290 billion m^3/year and its output is 175 billion m^3/year, including 140 billion m^3/year for European countries. Research documentation and consultations with experts from the Ukrainian gas transportation system operator Ukrtransgaz and the Gas Institute of National Academy of Sciences of Ukraine were used to determine CH_4 emissions from the national gas transport system. This results in an EF of 3,000 kg/m/year, which is slightly higher than the medium-range value in the IPCC good

[6] 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 and issues related to this category are discussed as a whole, the individual gases are not assessed in separate sections.

practice guidance (2,000 m^3/m/year, which is approximately 1,550 kg/m/year). The ERT agreed with this approach and the EF used.

65. The national gas distribution networks have been rapidly developing over the last decade. The length of the gas distribution network increased from 90,000 km in 1990 to 364,900 km in 2009. Based on research from the oil and gas industry relating to the length of the gas distribution networks, the average specific EF for CH_4 has been estimated at $8.2*10^{-4}$ Gg/km^3/year. This value is used to calculate CH_4 emissions from gas distribution networks. The ERT agrees with this methodology and the EFs used.

66. Fugitive CH_4 emissions from natural gas leakage from end-users were calculated using the approach stipulated by the Revised 1996 IPCC Guidelines. The CH_4 EFs were equal to the average values of the proposed range "by default" as presented in table 1-58 of Volume III of the Revised 1996 IPCC Guidelines for the countries of the former Soviet Union. Since this is an important part of the key category oil and natural gas, the ERT encourages Ukraine to conduct research on country-specific CH_4 EFs, as indicated in the Party's inventory improvement plan.

67. Following a recommendation in the previous review report, Ukraine included background data on losses of natural gas in the industrial sector reported to the State Statistical Service. As a result of the provision of this background information, the ERT was able to verify that these losses were included in the emissions reported in the subcategory natural gas ((other leakage) (1.B.2.b.v)).

4. Non-key categories

Other (energy): liquid fuels – all gases

68. During the review week, the ERT noted that emissions from military fuel use were only partially reported. Emissions from military vehicles were included in road transportation, as were emissions from diesel use in military ships (the latter being the result of the balance methodology used by Ukraine). However, emissions from military aviation were not reported. In response to questions raised by the ERT during the review week, Ukraine submitted revised estimates for the years 2008 and 2009 based on data provided by the Ministry of Defence and reported emissions of CO_2, CH_4 and N_2O as "NE" for the remaining years of the time series. The revision resulted in an increase in emissions from the category other of 3.1 per cent or 27.92 Gg for 2009. The ERT recommends that Ukraine estimate emissions from military aviation and navigation for the complete time series and report all military emissions under the category other (energy) in its next annual submission.

5. Areas for further improvement

Identified by the Party

69. Ukraine reported on the following planned improvements in its NIR:

(a) Switching to a higher-tier methodology for the determination of N_2O emissions from road transportation, which is based on data on the vehicle fleet, the vehicle mileage and the specific fuel combustion for each vehicle type, as well as the presence of catalysts using COPERT IV;

(b) Improving the accuracy of the estimation of the carbon content in natural gas, by determining the specific carbon content in the domestically produced natural gas;

(c) Studying CH_4 emissions from abandoned coal mines and clarifying emissions from active mines on the basis of detailed studies using the data on direct measurements of CH_4 emissions;

(d) Establishing country-specific EFs for fugitive CH_4 emissions from natural gas leakage from end-users.

Identified by the expert review team

70. The ERT identified the following issues for improvement:

(a) The improvement of the working relationship between the national inventory team and other organizations involved in the preparation of the inventory, such as the State Statistical Service, especially regarding QA/QC procedures;

(b) The inclusion in the next annual submission of all EFs used, preferably in a tabular format and with reference to the source of the EFs;

(c) The improvement of the allocation of emissions from off-road vehicles and emissions from stationary combustion based on ISIC sectors 61–67;

(d) The completion of the reference approach and the CRF table on feedstock/non-energy use of fuels in accordance with the Revised 1996 IPCC Guidelines;

(e) The improvement of the data coverage on natural gas consumption in order to improve the quality of the emission estimates for gas consumption for all sectors;

(f) The undertaking of research in order to establish a country-specific CO_2 EF for liquid fuels or provide documentation to prove that the IPCC default EF is appropriate to the national circumstances;

(g) The estimation of emissions from military aviation and navigation for the complete time series and the reporting of all military emissions under the category other (energy) in the next annual submission.

C. Industrial processes and solvent and other product use

1. Sector overview

71. In 2009, emissions from the industrial processes sector amounted to 68,429.95 Gg CO_2 eq, or 18.3 per cent of total GHG emissions (mostly from iron and steel production, mineral products and ammonia production). Since the base year, emissions have decreased by 45.6 per cent in the industrial processes sector. The key driver for the fall in emissions is the general decrease in industrial production activities (mainly due to the reduction in iron and steel production) as a result of the economic recession in the country following the transition to a market economy in the early 1990s and the global economic crisis in 2008–2009. Within the industrial processes sector, 74.2 per cent of the emissions were from metal production, followed by 16.6 per cent from mineral products and 8.6 per cent from chemical industry. The remaining 0.6 per cent were from consumption of halocarbons and SF_6.

72. In 2009, emissions from the solvent and other product use sector amounted to 333.42 Gg CO_2 eq, or 0.1 per cent of total GHG emissions. Since the base year, emissions have decreased by 11.5 per cent in the solvent and other product use sector. In this sector, Ukraine estimated only emissions of N_2O used for anaesthesia and emissions of non-methane volatile organic compounds (NMVOCs) from paint

application, degreasing and dry cleaning, and the manufacture and processing of chemical products. The remaining categories are reported as "NE" and "NO" (not occurring).

73. Indirect GHG emissions have been reported in the NIR, including NMVOC emissions both from industrial processes and from solvent and other product use.

74. Ukraine has made recalculations for the industrial processes sector between the 2010 and 2011 submissions in response to the 2010 annual review report and in order to improve the accuracy of estimates in the categories where adjustments had been applied during the previous review, rectify identified errors, refine AD and EFs, improve estimation methods and the accuracy of the estimates and reallocate confidential data. These recalculations were made for all years of the time series in accordance with the IPCC good practice guidance. The impact of the recalculations includes a decrease of 2.3 per cent in the national total GHG emissions in 1990 and a decrease of 4.8 per cent in 2008. The rationale for these recalculations is provided in the industrial processes chapter of the NIR and in CRF table 8(b). The ERT appreciates the transparent reporting of recalculations performed by Ukraine before the in-country review and encourages the Party to further enhance transparency by including an explanation for all revisions estimates (e.g. ammonia production).

75. According to the "Law of Ukraine on State Statistics, with amendments and additions introduced by Law of Ukraine of 13 July 2000 No. 1922-III" (2006), which relates to the confidentiality of state statistics, information on production values from industrial activities with fewer than three plants remains confidential. Due to this law, a large amount of confidential data are aggregated in Ukraine's inventory, thus decreasing the comparability of the estimates and the transparency of the inventory. Although the number of categories reported as "C" (confidential) has decreased since the previous submission and the allocation of confidential data has been improved, the ERT recommends that Ukraine continue to decrease the number of categories reported as "C" where possible as well as improve the allocation of confidential data (e.g. asphalt roofing emissions are currently aggregated in the chemical industry category and could instead be aggregated in the mineral products category with, for example, emissions from road paving with asphalt).

76. The ERT noted that Ukraine followed most of the recommendations made by the previous ERT, which has improved the completeness and accuracy of the inventory. The ERT commends Ukraine for its efforts, particularly regarding the estimation of emissions from categories that were previously reported as "NE" or "NO", the refinement of AD and EFs and the provision of more detailed information in the NIR.

77. The ERT further noted that, for some categories (and especially for categories where estimates were recalculated), there are inconsistencies between the NIR values and the CRF tables (e.g. for cement production, lime production and iron and steel production) and the methods used (especially for the categories reported as "C") are not always clearly, accurately and transparently described (e.g. limestone and dolomite use and ferroalloys production). The ERT recommends that Ukraine check and correct any inconsistencies between the NIR and the CRF tables and elaborate in the NIR on the methods and background parameters used. The ERT also recommends that Ukraine report in the NIR all relevant information that could facilitate understanding if the AD and related parameters continue to be classed as confidential (e.g. indexed information relative to the base year and the methodology for one year with no real values).

78. The general QA/QC approach of the Party with regard to the industrial processes sector is to collect data from different sources, where possible (e.g. directly from enterprises, from the State Statistical Service and from the Ministry of Industrial Policy) and compare the AD between them, to compare emission estimates with those of previous years and to compare country-specific EFs to IPCC default values and the country-specific EFs of other countries. Expert judgement (e.g. from external experts and/or research organizations) is also used in some categories (e.g. consumption of fluorinated gases, nitric acid production, adipic acid production and ferroalloys production). However, the QA/QC activities in this sector can be improved by, for example, including peer reviews of all inventory estimates, at least for the key categories, conducted by external experts not involved in the inventory.

2. Key categories

Cement production – CO_2

79. Ukraine uses plant-specific data to calculate CO_2 emissions from cement production, in accordance with the IPCC good practice guidance. The ERT noted that the CO_2 emissions reported in NIR table 4.3 are not consistent with the emissions reported in the CRF tables for the period 2004–2008 and that the AD for 2009 are incorrect in the NIR. The reason for this inconsistency is that the emissions that decreased as a result of a joint implementation (JI) project undertaken in one plant were subtracted for the period 2004–2009 in the CRF tables, whereas the NIR presents the baseline emissions.

80. During the review, the ERT identified that the EFs and the correction factor for cement kiln dust were derived in 2001 from the weighted average of 10 plants in the country (from 12 plants before 2001) and applied to the period 2001–2009. Ukraine explained its plans to undertake new research in the near future in order to update these country-specific EFs. To increase the accuracy of the emission estimates, the ERT recommends that the Party implement the planned improvement to update the country-specific EFs. The ERT recommends that Ukraine present, in its next annual submission, the actual emission estimates (and not the emissions according to the baseline scenario) as well as the actual EFs, the source and the values of the emission reductions resulting from the JI project as well as additional information on the types of cement produced in the country or on the composition of cement and clinker or the raw materials, in order to increase transparency.

Lime production – CO_2

81. The ERT noted that the AD reported in previous submissions did not subtract the water content of lime. When reviewing the NIR and the CRF tables, incorrect or out-of-date values were identified. For example, the ERT identified that, when subtracting the water content for all years of the 2011 submission, the following mistakes were introduced: the AD were wrongly reported for 2003 in the CRF tables; in the NIR, CO_2 emissions were wrongly reported for 2003 and for total lime production for 2004. The ERT recommends that Ukraine improve its QC procedures by increasing consistency between the CRF tables and the NIR in its next annual submission.

82. During the review, the ERT noted that the calculations are performed following the IPCC default assumptions. To increase the accuracy of the emission estimates, the ERT encourages Ukraine to obtain updated country-specific information on the different types of lime produced in the country (i.e. calcium oxide

and magnesium oxide content, high-calcium quicklime and dolomitic quicklime and the water content of slaked lime).

Ammonia production – CO_2

83. The ERT noted that CO_2 emissions from natural gas combustion in ammonia production are reported under ammonia production together with CO_2 emissions from natural gas used as feedstock. Recalculations have been undertaken to take into account an updated carbon content in natural gas. As the AD are collected directly from six plants and half of them measure the amounts of natural gas from both the energy use and the feedstock consumption, the ERT considered that the energy and non-energy use of natural gas could have been separated. In addition, the Party used an oxidation factor (0.995) for the whole amount of natural gas (for energy use and as feedstock) to estimate emissions from ammonia production in the industrial processes sector, which is not in line with the Revised 1996 IPCC Guidelines.

84. The inclusion of the oxidation factor in the calculations led to the underestimation of CO_2 emissions from ammonia production. During the review week, in order to increase the accuracy and comparability of the CO_2 emission estimates, as well as to be in line with the Revised 1996 IPCC Guidelines, the ERT requested Ukraine to report CO_2 emissions from natural gas used for energy purposes under the energy sector and to recalculate CO_2 emissions from natural gas used as feedstock under the industrial processes sector without applying an oxidation factor.

85. In response to questions raised by the ERT during the review, Ukraine revised the CO_2 emission estimates for ammonia production for the entire time series, including an updated NCV of natural gas. This revision led to a reduction in CO_2 emissions from ammonia production of 45.0 per cent in the base year (from 11,895.6 Gg CO_2 as originally reported to 6,542.44 Gg CO_2) and of 44.4 per cent in 2009 (from 6,465.26 Gg CO_2 as originally reported to 3,592.36 Gg CO_2).

86. The ERT commends the Party for solving this issue during the review week and recommends that Ukraine include further explanations on the allocation of CO_2 emissions from ammonia production in its next annual submission.

Iron and steel production – CO_2

87. The ERT noted that CO_2 emissions from coke used as fuel and feedstock are reported under iron and steel production. Recalculations in this category were performed due to an error in the estimation of emissions from electric arc furnaces (EAFs), the revision of data on the carbon content in coke and the revision of CO_2 EFs for the use of carbon electrodes in the production of EAF steel. The NIR presents the EFs but not the underlying parameters used to estimate them. For this category, Ukraine plans to continue updating the data on carbon content in coke used for the production of pig iron. As iron and steel production is a key category and the major source of emissions in the industrial processes sector, the ERT recommends that the Party collect additional relevant information directly from the pig iron production plants and elaborate on the methodology used to estimate the EFs in its next annual submission.

88. According to the Revised 1996 IPCC Guidelines, CO_2 emissions from fuel combustion in industrial processes have to be reported under the energy sector. The ERT reiterates the recommendation in the previous review report that Ukraine report CO_2 emissions from coke combusted in iron and steel production under the energy sector. The ERT encourages Ukraine to provide a carbon mass balance of the coke used in the blast furnaces, including the background parameters (reducing agents,

carbon stored, steel produced in basic oxygen furnaces, open hearth furnaces and EAFs, electrodes) and assumptions used for the estimation of the EFs in addition to the corresponding EFs in its next annual submission.

3. Non-key categories

Other mineral products – CO_2

89. Ukraine has reported CO_2 emissions from glass production under this category. These estimates are reported separately for the first time – they were previously combined with emissions from limestone and dolomite use. The ERT noted that some of the AD (the production of glass jars and bottles) are not available for the entire time series and are limited to the data for 1995, 2000, 2005, 2008 and 2009. To ensure the conservative estimation of CO_2 emissions, Ukraine uses the production of jars and bottles from the most recent year (i.e. the production for 2008 is also used for the years 2006–2007). The ERT commends the Party for the improvement in the disaggregation of the estimates from glass production and for the use of additional emission sources for this category. However, the ERT recommends that Ukraine obtain actual data or improve the interpolation methods used in this category in order to increase accuracy and time-series consistency.

Ferroalloys production – CO_2

90. Recalculations were conducted in order to reflect a revision of the coefficients of CO_2 emissions in ferroalloys production (by making conservative assumptions about a 0.5 per cent carbon content in the ore). During the review, the ERT had the opportunity to review the methodology and concluded that it is consistent with the Revised 1996 IPCC Guidelines. In addition, Ukraine plans to continue updating the data on the composition of the reducing agents used in the production of ferroalloys, as well as the carbon content in the ore, slag-forming materials and waste. In order to increase transparency, the ERT recommends that Ukraine provide, in the NIR, more detailed information on the background parameters (production of ferroalloys, used mass of ore, reducing agent, slag-forming materials and waste, as well as their carbon content) used to estimate the CO_2 emissions from ferroalloys production and encourages the Party to continue updating national data on the carbon content in the materials used in ferroalloys production.

Consumption of halocarbons and SF_6 – HFCs, PFCs and SF_6

91. Following the recommendation of the previous ERT and the adjustments applied during the previous review, Ukraine estimated and reported in the 2011 submission for the first time PFC emissions from stationary and mobile air-conditioning equipment, HFC emissions from foam blowing and aerosols/metered dose inhalers and HFC and PFC emissions from fire extinguishers.

92. The ERT noted that the Party reported approximate estimates of emissions from foam blowing and from fire extinguishers (using data from reporting countries with similar national circumstances). Ukraine, however, plans to collect the national AD and fully recalculate the emissions for these subcategories in future annual submissions.

93. Ukraine confirmed during the review that the following information could be refined in order to improve the accuracy of the emission estimates: the output of refrigerators that use HFC-134a; the number of stationary air conditioners that use HFC-410a; the number of cars with air-conditioning equipment in total sales; the number of asthmatic patients who use metered dose inhalers containing HFC-134a;

and SF_6 switchgear maintenance, refilling and removal from service. Ukraine also presented its plans to: collect additional information on the output of refrigerators that use HFC-134a as a coolant, on the use of HFCs in imported refrigerators and on the HFC-134a disposal system; revise the data on the initial filling and HFC-134a annual leakage EFs; estimate HFC emissions from chillers, trucks and buses; obtain more accurate data as well as estimate HFC emissions from general-purpose aerosols; and improve the accuracy of the AD and the emissions of SF_6.

94. The ERT commends Ukraine for the significant improvements to the completeness and accuracy of its reporting on consumption of halocarbons and SF_6 since the previous submission and notes the planned improvements to refine the AD and EFs (by obtaining national data on foam blowing and fire extinguishers and by improving data on: the output of refrigerators, filling and leakage EFs, the output of stationary and mobile air-conditioning equipment, the output of aerosols and the output of electrical equipment that uses SF_6). The ERT recommends that Ukraine introduce the planned improvements in its next annual submission.

Solvent and other product use – NMVOCs and N_2O

95. To estimate NMVOCs from the production and processing of chemical products, Ukraine used the EF by industry type in Belarus (assuming that the technologies of its chemical industry are similar to those of Ukraine). Ukraine intends to determine national country-specific NMVOC EFs for this category by industry type and report thereon in future annual submissions.

96. To estimate N_2O emissions from the use of anaesthesia, Ukraine used the national population and the average value of the use of N_2O for anaesthesia per capita in Belarus as the EF. Although there are currently no statistics on the consumption of N_2O by medical care facilities, Ukraine intends to determine a national country-specific EF on the use of N_2O for anaesthesia and report thereon in future annual submissions.

97. The ERT commends the Party for the planned improvements in the solvent and other product use sector and encourages Ukraine to introduce them in future annual submissions.

4. Areas for further improvement

Identified by the Party

98. Ukraine has identified in the NIR and during the review week the following areas for improvement:

(a) Improving emission estimates for consumption of halocarbons and SF_6 by refining the AD and EFs (national data on foam blowing and fire extinguishers, the output of refrigerators, filling and leakage EFs, the output of stationary and mobile air-conditioning equipment, the output of aerosols and the output of electrical equipment that uses SF_6);

(b) Updating the country-specific EFs in cement production using data from recent years;

(c) Collecting national data on NMVOC emissions from the production and processing of chemical products and on the use of N_2O for anaesthesia in the solvent and other product use sector.

Identified by the expert review team

99. In addition to the improvements identified and planned by Ukraine, the ERT identified the following additional areas for improvement:

(a) Obtaining basic parameters to use in the calculation of emissions from the production of iron and steel directly from the industrial plants and including this information in the NIR together with a carbon mass balance of the coke consumed in blast furnaces;

(b) Undertaking studies to collect the relevant national basic parameters in order to avoid using IPCC default ratios and assumptions for the key categories (e.g. lime production and limestone and dolomite use);

(c) Updating country-specific EFs for the key categories (e.g. cement production, iron and steel production and ammonia production);

(d) Improving transparency and documentation on the AD, parameters, emission estimates and trends, and referencing them appropriately in the NIR;

(e) Providing more focused and precise methodological descriptions in the NIR consistent with the AD used in the CRF tables, in particular for country-specific methods and EFs.

D. Agriculture

1. Sector overview

100. In 2009, emissions from the agriculture sector amounted to 33,393.74 Gg CO_2 eq, or 8.9 per cent of total GHG emissions. Since the base year, emissions have decreased by 67.7 per cent. The key drivers for the fall in emissions are the decreases in the amount of fertilizer applied to soils, the area of harvested crops and the number of livestock in agricultural enterprises, as well as the changes to animal manure management. Within the sector, 56.8 per cent of the emissions were from agricultural soils, followed by 27.6 per cent from enteric fermentation, 13.6 per cent from manure management and 0.3 per cent from rice cultivation. The remaining 1.8 per cent were from manure management, which is identified as the category other and which Ukraine has added since the 2010 submission.

101. Prescribed burning of savannas does not occur in the country because there is no land classified as savannas in Ukraine, and was reported as "NO" in CRF table 4.E but as "NA" in other CRF tables. Field burning of agricultural residues is prohibited by law in Ukraine; this category was reported as "NO" in CRF table 4.F but as "NA, NO" in other CRF tables. The ERT recommends that Ukraine consistently use the notation keys in CRF tables 4.E and 4.F.

102. To calculate its emission estimates, Ukraine has used country-specific methodologies or higher-tier methods for the key categories, using a combination of country-specific EFs estimated from country-specific parameters and IPCC default EFs in accordance with the IPCC good practice guidance. The key categories include CH_4 emissions from enteric fermentation, CH_4 and N_2O emissions from manure management, and direct and indirect N_2O emissions from agricultural soils. The estimate of emissions from rice cultivation was performed using a tier 1 methodology from the Revised 1996 IPCC Guidelines. The ERT noted the great effort made by Ukraine to make the agriculture sector of the inventory as complete as possible (e.g. by including an additional category on indirect N_2O emissions from manure management since the 2010 submission).

103. In general, the descriptions of the AD, methodologies and EFs used for the estimates were detailed and sufficiently transparent in the NIR. Ukraine has implemented most of the recommendations from the previous review report. Additional information on the livestock population and crop residues was provided in annex 3.1 to the NIR in order to enhance the description of the methodologies used to estimate country-specific EFs and parameters (e.g. $Frac_{GASF}$), following the recommendations of the previous review report regarding transparency. Although Ukraine provided explanations of country-specific methodologies and data, the ERT noted that it was difficult to distil from these the theoretical basis or source of data and other information. The ERT therefore recommends that Ukraine provide supporting documentation in the form of summary tables and graphs to highlight this information in its next annual submission. This would enable both an easier understanding of the information and a simpler and faster data QA/QC check (e.g. the possibility of justifying any observed fluctuations of emissions in the time series due to any temporal variation of AD).

104. To improve the transparency of the inventory for the agriculture sector for the next annual submission, the ERT also encourages Ukraine to improve the content of the documentation boxes in the CRF tables for all categories, by indicating the corresponding paragraphs and pages in the NIR, and to clearly highlight the relevance of country-specific methodologies, EFs and/or parameters involved in the country-specific EF estimations, or data sources, whenever applicable. In addition, the ERT recommends that the Party provide a table summarizing its improvement plans and the status of implemented or planned projects, in order to emphasize the accomplishments to date and improve the completeness of the reporting on the agriculture sector.

105. Uncertainty estimates and an uncertainty analysis were conducted using the tier 1 method provided in the IPCC good practice guidance based on the error propagation methodology for all categories. All data from the State Statistical Service are assumed to have an uncertainty of 5.0 per cent, as per the documentation from the data provider. Descriptive information was provided on the uncertainty calculations of estimates using country-specific methodologies, which was aimed at following up on recommendations of the previous review. Nevertheless, it is still unclear to the ERT whether this related to the emissions from enteric fermentation, from manure management or from agricultural soils. The ERT therefore recommends that Ukraine improve the documentation of the corresponding uncertainty estimates in the next annual submission, by providing the formula used for the calculations and a table summarizing the input data along with their sources.

106. The analysis of the total emissions time-series consistency was provided for all categories of the sector, thereby complying with the IPCC good practice guidance. However, the ERT noted that the time-series consistency analysis of the AD, country-specific EFs and parameters used, which would help identify any gaps in the data used and hence the final calculations, is still missing from the NIR. The ERT recommends that, for the next annual submission, Ukraine include the time-series consistency analysis of the data used (i.e. the AD and country-specific EFs/parameters used in the form of graphs).

107. The description of the QA/QC procedures undertaken in each category was provided in the NIR. In general, the QA/QC procedures were carried out on a category-by-category basis. The QC was performed by inventory team members by cross-checking between interrelated categories (e.g. within LULUCF). The QA was conducted using expert approval and cross-checking with international referenced data. However, because there is no sector-specific QA/QC plan in place, the ERT

encourages Ukraine to add the description of the sector-specific QA/QC plans in the NIR, by systematically following the IPCC good practice guidance on QA/QC and by providing workflow diagrams along with tables summarizing the QA and QC plans.

108. Ukraine has made recalculations between the 2010 and 2011 submissions in order to reflect changes in AD and EFs, consistent with the new data and/or methods used. The main recalculations took place in the following categories:

(a) CH_4 emissions from enteric fermentation;

(b) CH_4 and N_2O emissions from manure management;

(c) Direct and indirect N_2O emissions from agricultural soils.

109. The recalculations were conducted taking into account the updated AD for all livestock, whether with an enhanced or basic characterization, cultivated and harvested areas, the amount of organic and chemical fertilizer applied to soils, the areas of organic soils, the geographical distribution of animal waste management systems (AWMS) and the fraction of manure allocated to each AWMS, especially for livestock with an enhanced characterization, including cattle, sheep, swine and poultry. The recalculations led to a decrease in emissions from the agriculture sector of 1.4 per cent in 1990 and an increase of 1.2 per cent in 2008, compared to the 2010 submission.

110. Overall, Ukraine implemented most of the recommendations from the previous review report. In order to improve the presentation of the results of the recalculations for the agriculture sector, the ERT encourages Ukraine to include graphs with markers indicating the changes compared to the previous submission along with tables summarizing the data involved in the recalculations, whether for the category, for the sector or for the impact on the national total GHG emissions.

111. During the review week, Ukraine provided the ERT with clarifications and information on data collection and documentation, data management and archiving, country-specific methodologies and parameters and improvement plans. The Party provided much of this information in a tabular format and the ERT encourages Ukraine to provide this information in the next annual submission using a similar presentation to facilitate its review.

2. Key categories

Enteric fermentation – CH_4

112. Ukraine used an enhanced livestock characterization to estimate emissions related to cattle, sheep, swine and poultry. The animal population data were updated for all types of animals using annual averaged data from the State Statistical Service. CH_4 emissions from poultry enteric fermentation were not estimated since no methodology is provided in the Revised 1996 IPCC Guidelines. The ERT noted that the CH_4 emissions from poultry are reported as "NA", although they should be reported as "NE". Ukraine employed a country-specific methodology to estimate CH_4 emissions for dairy cattle, non-dairy cattle and sheep, based on the estimation of gross energy in feed intake using the amount, chemical composition and structure of the feed.

113. Following the recommendations in the previous review report, Ukraine made corrections and updates to the country-specific data used in the estimations, in particular using expert judgement. Additional information on the livestock population was provided in annex 3.1 to the NIR, as well as associated references. In response to a request made by the ERT during the review week, Ukraine provided a table

summarizing the primary data sources used (including the date of publication) in the development of the country-specific methodology and EFs. In order to improve transparency, the ERT recommends that Ukraine provide such a table in the next NIR.

114. The ERT welcomes Ukraine's efforts to develop country-specific EFs and parameters for the estimation of emissions from enteric fermentation, including for animals for which default EFs are not defined in the Revised 1996 IPCC Guidelines or the IPCC good practice guidance (e.g. rabbits and fur animals), by establishing assumptions on the similarities of their digestive systems in order to enable the calculation of EFs using the methodology described in the *2006 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the 2006 IPCC Guidelines). Overall, Ukraine has addressed most of the recommendations in the previous review report related to this category. As a follow-up to the continuing inventory improvement process, the ERT encourages Ukraine to undertake a peer review of country-specific EFs by, for example, submitting papers describing the country-specific methodologies and results to international scientific peer-reviewed journals.

Manure management – CH_4 and N_2O

115. Ukraine used a tier 2 method to estimate CH_4 emissions for cattle, swine and poultry and the tier 1 method for sheep, goats, horses, donkeys and mules, rabbits and fur-bearing animals, following the IPCC good practice guidance. The Party provided descriptions of the allocation of manure to different AWMS based on expert judgement. A sharp reduction in emissions, by more than 92 per cent, was observed in this category during the reporting period 1990–2009. The key drivers of this decrease were the fall in the numbers of animals due to the economic crisis in Ukraine following the collapse of the former Soviet Union and the changes in manure management practices.

116. Most of the recommendations from the previous review report have been implemented by Ukraine. However, the documentation and information provided were not sufficiently clearly presented. Therefore, the ERT reiterates its recommendation that the Party include summary tables and graphs where necessary in order to improve transparency and facilitate understanding and review. For this category, the ERT recommends that Ukraine follow the same approach recommended in paragraph 113 above, by providing a table summarizing the primary data sources used. Also, the ERT encourages Ukraine to provide better rationale for the choice of methodology for each type of livestock (e.g. for sheep a higher tier is used for emissions from enteric fermentation but a tier 1 method is used for this category).

Direct emissions from agricultural soils – N_2O

117. Ukraine calculated the estimates of direct N_2O emissions from agricultural soils based on the tier 1a method provided in the IPCC good practice guidance, using country-specific methods to develop the parameters used in the calculations. The AD, including synthetic fertilizer application, organic fertilizer application, crop residues returned to soil incorporating nitrogen (N) fixation, cultivation of histosols, and pasture/range and paddock manure, were described and additional information on crop residues was presented in annex 3.1 to the NIR. The conversion of primary data collected from the State Statistical Service (e.g. harvested area, crop yields, etc.) was provided to enhance the documentation of the country-specific methodologies used, in response to the recommendations from the previous review. This contributed to the avoidance of double counting and the improvement of the completeness of the inventory.

118. During the review week, Ukraine provided the ERT with information on the content and details of the different forms used for data collection by the State Statistical Service (e.g. Reporting Form #9-b-sh), thereby enabling the ERT to understand the level of disaggregation with which the Party can calculate emission estimates. In addition, Ukraine explained how the data were re-aggregated for the final calculations. In order to improve the accuracy of the inventory for the next annual submission, the ERT recommends that Ukraine use disaggregated data on harvested cropland areas for the estimation of emissions, which should help to reduce the uncertainties related to N input through the application of organic fertilizers and the incorporation of crop residues to soil.

119. To improve transparency in and facilitate the understanding and review of this category, the ERT recommends that Ukraine follow the same approach outlined in paragraph 113 above, by providing a table summarizing the primary data sources used.

3. Areas for further improvement

Identified by the Party

120. The Party identified in the NIR and during the review the following areas for improvement:

(a) Conducting research to determine the CH_4 and N_2O EFs for manure management of livestock and poultry based on a tier 3 approach;

(b) Conducting further studies on national EFs for the application of N to soils using synthetic and organic fertilizers, as well as crop residue mineralization under direct soil emissions.

Identified by the expert review team

121. In addition to the improvements identified and planned by the Party, the ERT identified the following additional areas for improvement of transparency:

(a) Providing more information on the time-series consistency analysis;

(b) Providing more information on country-specific methodologies and data;

(c) Providing a summary of the improvement plan for the agriculture sector;

(d) Improving the documentation on the uncertainty assessment.

E. Land use, land-use change and forestry

1. Sector overview

122. In 2009, net removals from the LULUCF sector amounted to 19,244.65 Gg CO_2 eq. Since 1990, net removals have decreased by 72.3 per cent. The key driver for the fall in removals is the growth in emissions from soils in cropland (cropland soils were responsible for the removal of 3,555.90 Gg CO_2 in 1990, while in 2009 the emissions from cropland soils were equal to 9,400.45 Gg CO_2, not taking into account liming). Within the sector, net removals from forest land amounted to 57,533.12 Gg CO_2 eq, followed by emissions from cropland amounting to 29,986.60 Gg CO_2 eq, 3,284.70 Gg CO_2 eq from grassland, 390.25 Gg CO_2 eq from wetlands and 4,079.94 Gg CO_2 eq from settlements. The remaining 490.16 Gg CO_2 eq were emissions from

other land. Within the sector, 60.4 per cent of the emissions/removals[7] were from forest land, followed by 31.5 per cent from cropland and 4.3 per cent from settlements. Grassland accounted for 3.5 per cent and wetlands accounted for the remaining 0.4 per cent of the emissions/removals.

123. Ukraine has made recalculations for the LULUCF sector between the 2010 and 2011 submissions in response to the 2010 annual review report. The recalculations resulted from changes in land representation (and consequently affecting each land-use category) and changes in the EFs and parameters used to estimate CO_2 emissions from cropland and grassland soils. The impact of these recalculations on the LULUCF sector is an increase in removals of 3.98 per cent for 2008. The main recalculations took place in the following categories:

(a) Forest land (the average recalculation in the period 1990–2008 results in an increase in removals equal to 0.65 per cent);

(b) Cropland (the average recalculation in the period 1990–2008 results in a decrease in emissions equal to 26.44 per cent);

(c) Grassland (the average recalculation in the period 1990–2008 results in an increase in emissions equal to 103.64 per cent);

(d) Wetlands (the average recalculation in the period 1990–2008 results in an increase in emissions equal to 223.15 per cent);

(e) Settlements (the average recalculation in the period 1990–2008 results in an increase in emissions equal to 3,696.19 per cent).

124. The ERT noted a significant improvement in the quality of reporting of the LULUCF sector under the Convention when compared with the 2010 annual submission. The ERT also noted a remarkable improvement in the data collection and in the general transparency of the NIR and an improvement in the QA/QC procedures undertaken by the Party, resulting in a considerable decrease in the number of discrepancies between the CRF tables and the NIR. The ERT found that the inventory for the LULUCF sector has been prepared in accordance with the IPCC good practice guidance for LULUCF.

125. Ukraine collected data on areas of land use and land-use change, developing land-use change matrices in order to identify the land-use changes and including the land-use change matrices in the NIR. In addition, the Party is going to compile a GIS database related to forestry activities aimed at supplying AD for the KP-LULUCF reporting. The ERT recommends that Ukraine use the GIS database in its assessment of land uses and land-use changes in its 2014 submission at the latest and encourages Ukraine to apply it earlier, thereby ensuring consistency between different data sources and coherence of the reported data.

126. In response to questions raised by the ERT during the review, Ukraine provided detailed information on the different data sources used to classify the land areas in accordance with the IPCC land-use categories in the 2011 submission. Additionally, the ERT noted the ongoing work to collect additional data on the land areas, which the Party is planning to include in the next annual submission. The ERT encourages Ukraine to include the above-mentioned detailed explanations and a clear

[7] The percentage of the sectoral emissions/removals for each category was calculated by comparing the net emissions/removals expressed as an absolute value with the sum of the absolute values for the categories forest land, cropland, grassland, wetlands, settlements, other land and other.

description of the land use and land-use change assessment in the next annual submission.

127. The ERT recommends that Ukraine increase the transparency of its next NIR by including information, in a tabular format, on how the IPCC land-use categories match the areas identified in the national statistical form 6-zem and by including a table specifying the data sources used (including their main content and the land-use category (if any) under which these data have been used). In addition, the ERT recommends that Ukraine increase the transparency of the reporting in the NIR by including in the next annual submission, in a tabular format, the status of surveys and monitoring projects on forestry activities carried out in the country, detailing if and how the outcomes have been used for reporting purposes.

128. The ERT notes that Ukraine's archiving system includes, for the LULUCF sector, calculation sheets referring to the different inventory submission years and reference material. The ERT encourages Ukraine to further enhance the archiving system by including in the centralized archiving system a direct link to different LULUCF data sources (e.g. the GIS database, the forest management database, etc.).

2. Key categories

Forest land remaining forest land – CO_2

129. The ERT noted a significant improvement in the forest land remaining forest land category and a consistent land area representation. Ukraine used outcomes from the forest management database as the main data source for the forest land area assessment, together with data from the national statistical form 6-zem. Ukraine is going to compile a GIS database related to forestry activities aimed at supplying AD for the KP-LULUCF reporting. In the NIR, Ukraine refers to the above-mentioned GIS database as the main data source used to deduce the forest land area. Nevertheless, during the review week, the ERT noted that the GIS database had not been used for the preparation of the 2011 submission. The ERT recommends that Ukraine use, in its 2014 submission at the latest, the GIS database to assess the forest land area and encourages Ukraine to do so earlier. Furthermore, the ERT recommends that Ukraine provide detailed and clear explanations of the methodology used in ensuring consistency between the areas reported in the forest land category and the area reported for activities under Article 3, paragraph 4, of the Kyoto Protocol.

130. Ukraine estimated the carbon stock changes from forest land remaining forest land using national statistical data and country-specific parameters. The country-specific data on the biomass increment and root-to-shoot ratio are reported for major forest types and natural zones. The ERT noted that Ukraine, following recommendations from the previous review, increased the transparency of its NIR by reporting details on the methodology and parameters used to estimate carbon stock changes. The ERT encourages Ukraine to improve the transparency of the NIR by referencing the EFs and parameters used in the estimation process.

Land converted to forest land – CO_2

131. The ERT noted an improvement in the assessment of land area converted to forest land due to the use of the forest management database as the main driver to detect the land converted to forest land. The above-mentioned land has been further subdivided into the different land-use categories, on the basis of the ratio indicated by the land-use change matrix developed from the statistical form 6-zem data. The ERT encourages Ukraine to consider using the GIS database related to forestry activities as the main data source in its next annual submission and to ensure consistency between

the areas reported in the category land converted to forest land and the area reported for activities under Article 3, paragraph 3, of the Kyoto Protocol.

Cropland remaining cropland – CO_2

132. The ERT noted an increasing trend in the total emissions in cropland remaining cropland over the period 1990–2009, not taking into account liming. In 1990, the category was reported as a removal of 13,307.48 Gg CO_2, while emissions of 29,473.36 Gg CO_2 were reported for 2009 (essentially related to the increase of emissions in the soil pool: soil removals were equal to 3,555.90 Gg CO_2 in 1990, while in 2009 the emissions from soils were equal to 9,400.45 Gg CO_2), resulting in a decrease in total removals of 325.4 per cent. The ERT also noted that, during the period 1990–2009, the Party reported a decrease of 2.3 per cent in cropland area. Ukraine used a country-specific approach, based on the balance of N fluxes, to estimate emissions and removals from soils. In the NIR, Ukraine explained that this significant change was a consequence of the variation of several factors, such as the volume of harvested crops, the amount of added organic residues and fertilizers and the dynamics of garden planting. The ERT noted that this change is mainly occurring in mineral soils.

133. Following a recommendation in the previous review report, Ukraine carried out a comparison between the country-specific methodology to estimate CO_2 emissions and removals by soils and the tier 2 approach in the IPCC good practice guidance for LULUCF; the comparison, reported in the NIR, resulted in large differences in terms of emissions (the average difference for the period 1990–2009 is 78.5 per cent). In response to questions raised by the ERT during the review, Ukraine provided a detailed explanation of the country-specific coefficients and parameters used to estimate the carbon content in soils, using the N inputs and outputs (e.g. the input from dead organic substance humification, the input from organic fertilizer humification and the crop N mineralized). Ukraine also stated that the time considered for net N accumulation is equal to three years, according to national literature.

134. The ERT noted that the country-specific methodology is able to detect the variation in the organic content in soils, but to estimate CO_2 emissions and removals it is necessary to take into account the value of the soil organic content in the first year of the application of the methodology. Therefore, the ERT strongly recommends that Ukraine modify the country-specific methodology for the estimation of CO_2 emissions and removals from soils, taking into account the soil organic content in the first year of the application of the methodology, and provide transparent and detailed information on all the coefficients and parameters used to estimate the carbon content in soils in its next annual submission.

Grassland remaining grassland – CO_2

135. The ERT noted a decreasing trend in total removals in grassland remaining grassland: in 1990 the category was reported as a removal of 103.72 Gg CO_2, while a removal of 2,906.92 Gg CO_2 was reported for 2009, due to the increase of removals in the soil pool. The ERT also noted that, in the period 1990–2009, Ukraine reported an increase of 9.2 per cent in the grassland area. Ukraine used a country-specific approach, based on the balance of N fluxes, to estimate emissions and removals from soils. During the review week, Ukraine explained that this change was a consequence of the variation of several factors, such as changes in management practices. The ERT noted that this change is mainly occurring in mineral soils.

136. In response to questions raised by the ERT during the review week, Ukraine provided a detailed explanation of the country-specific coefficients and parameters used to estimate the carbon content in soils, using the N inputs and outputs (e.g. the input from dead organic substance humification, the input from organic fertilizer humification and the crop N mineralized). Ukraine also stated that the time considered for net N accumulation is equal to three years (the same as for cropland), according to national literature. The recommendation in paragraph 134 above also applies to the category grassland remaining grassland.

Land converted to settlements – CO_2

137. In its 2011 annual submission, Ukraine assumed that the initial land use for land converted to settlements is forest land, on the basis of the available information and the preliminary results of the implementation of the GIS database. The ERT recommends that Ukraine verify the assumption made, taking into account the final outcomes of the GIS database and any relevant additional information.

3. Areas for further improvement

Identified by the Party

138. The 2011 NIR identifies several areas for improvement in the LULUCF sector. The improvements identified by the Party include:

(a) The collection of additional data sources to obtain a more detailed system of factors for the carbon accumulation in forest pools, taking into account the different Ukrainian climatic zones, the age of woody plants and forest litter and dead biomass data;

(b) The full compilation of the GIS database related to forestry activities aimed at supplying AD for the KP-LULUCF reporting;

(c) The undertaking of studies to deduce the N EFs to be used in the estimation of CO_2 emissions and removals from cropland and grassland.

Identified by the expert review team

139. During the in-country review, the ERT identified the following areas for improvement:

(a) The further enhancement of the archiving system by including a direct link to different LULUCF data sources (e.g. the GIS database, the forest management database, etc.) in the centralized archiving system;

(b) The correction of the country-specific methodology for the estimation of CO_2 emissions and removals from cropland and grassland soils, taking into account the soil organic content in the first year of the application of the methodology.

F. Waste

1. Sector overview

140. In 2009, emissions from the waste sector amounted to 9,739.87 Gg CO_2 eq, representing 2.6 per cent of total GHG emissions. Since the base year, emissions have increased by 15.6 per cent. The key drivers for the rise in the emissions are the increased waste generation per capita (by 52.0 per cent between 1990 and 2009) and

the improvement in the efficiency of waste collection and disposal on land during the period. The impact of these drivers was offset by the influence of the population decline (by 12.0 per cent during the period 1990–2009), the drop in the organic content of solid waste and the reduction in GHG emissions from wastewater handling (by 19.9 per cent during the period 1990–2009). The waste sector thus remains the only sector with continuously growing emissions.

141. Within the sector, 74.0 per cent of the emissions were from solid waste disposal on land, followed by 26.0 per cent from wastewater handling. The total emissions from waste incineration are reported in the energy sector in accordance with the IPCC good practice guidance. The incineration of non-hazardous waste in Ukraine is harnessed for energy generation. The ERT notes that waste composting practice is emerging in the country and encourages Ukraine to estimate and report CH_4 emissions from composting in its future annual submissions.

142. The ERT acknowledges and commends Ukraine for the completed research on, and the development and validation of, a country-specific first-order decay (FOD) model based on national circumstances, which was presented as additional information during the review. Ukraine intends to apply the results of the research to the recalculations and reporting of emissions from solid waste disposal on land in its next annual submission.

143. Ukraine improved the completeness and transparency of its reporting on the sector by disaggregating emissions from waste incineration into emissions from biogenic and non-biogenic waste streams. The emissions from the non-biogenic fraction of waste were reported under the energy sector and those from the biogenic fraction were accounted for under biomass emissions as memo items following the recommendations in the previous review report.

144. The ERT notes that transparency has been increased through the improved reporting of the key parameters for the estimation of emissions reported in the CRF documentation boxes and by adequately referencing these key parameters in the NIR. The ERT recommends that Ukraine further improve the transparency of the NIR by providing the key AD, EFs and other parameters used in the form of tables and charts in the NIR of its next annual submission. The ERT further recommends that Ukraine improve the consistency between the NIR and the CRF tables by enhancing sectoral QC procedures. The ERT also recommends that Ukraine further improve the use of notation keys by reporting as "NE" the EFs for N_2O emissions from wastewater. The ERT notes that it is acceptable to report categories as "NE" where there are no methodologies provided in the IPCC good practice guidance. Ukraine may wish, however, to justify the use of and apply the methodology presented in the 2006 IPCC Guidelines to estimate N_2O emissions from wastewater.

145. The ERT commends Ukraine for the completion of its methodological improvement plan for the estimation of emissions from solid waste disposal on land, following a recommendation of the previous ERT that urged Ukraine to enhance its efforts to develop and use country-specific parameters and EFs for this key category (see paras. 147 and 148 below).

2. Key categories

Solid waste disposal on land – CH_4

146. In 2009, CH_4 emissions from solid waste disposal on land is a key category by level and trend and amounted to 7,212.78 Gg CO_2 eq, representing 1.9 per cent of the national total GHG emissions and 74.0 per cent of the GHG emissions from waste.

Ukraine applied the IPCC FOD method and IPCC default EFs and parameters to estimate CH_4 emissions from solid waste disposal on land in accordance with the IPCC good practice guidance.

147. The results of Ukraine's research, presented during the review, based on temperature and precipitation distribution, and waste characteristics in four regions provides the country-specific parameters for the application of the IPCC good practice guidance relevant to the national circumstances. The ERT recommends that Ukraine apply the national FOD model and the country-specific EFs developed (namely k-values ranging from 0.048 to 0.11 and landfill gas (LFG) generation potential ranging from 69 to 214 m^3/t) for the estimation of CH_4 emissions from solid waste disposal on land in its next annual submission. The ERT encourages Ukraine to compare the results of the national FOD model and the 2011 estimates and provide adequate explanation in the NIR for any significant differences observed.

148. Ukraine used an average country-specific density of 250 kg per m^3 for the estimation of waste mass disposed on land in the 2010 submission. This value had been considered one of the lowest by the previous ERTs in comparison with other reporting Parties. In its 2011 submission, Ukraine began using weighed quantities of disposed municipal solid waste based on AD from the State Statistical Service which reflect real disposed waste quantities in line with the IPCC good practice guidance, in response to a recommendation in the previous review report. The ERT commends Ukraine for this improvement.

149. The ERT noted that Ukraine has used the measurements of significant LFG steady flow rates from three active solid waste disposal sites (SWDS) in 1959, 1967 and 1995 and determined the LFG recovery potential of 18.0 m^3/h, 20.6 m^3/h and 43.9 m^3/h, respectively. The measurements will facilitate the development of projects for CH_4 capture and utilization from landfills, foreseen in the framework of the Renewable Energy Programme of Ukraine. The ERT encourages the Party to use the results of the measurements to further improve the accuracy of the CH_4 emission estimates for solid waste disposal on land.

150. The ERT further noted that the national FOD model development study has provided field estimates of the compacted density of waste in Ukraine in three SWDS of 274–490 kg/m^3. Generally, truck-compacted waste has a density range of 210–237 kg/m^3. On the basis of these values, the ERT considers that the previous country-specific solid waste average bulk density of 250kg/m^3 is acceptable. However, the ERT recommends that Ukraine periodically revise the bulk density to reflect potential waste composition changes as waste legislation in the country is enforced.

Wastewater handling – CH_4 and N_2O

151. In 2009, total emissions from wastewater handling amounted to 2,527.69 Gg CO_2 eq made up of 59 per cent of CH_4 emissions and 41 per cent of N_2O emissions. The total emissions from wastewater handling have decreased by 19.9 per cent between the base year and 2009. The CH_4 emissions dropped by 6.5 per cent over the period mainly due to a reduction of industrial wastewater streams due to the economic downturn and the decommissioning of all 126 anaerobic digesters in Ukraine by 2009. The N_2O emissions from human waste, on the other hand, have decreased by 33.7 per cent as a result of the 12 per cent decline in the population since 1990 and the drastic reduction in per capita protein consumption by 25 per cent since 1990: from 105 g/person/day in 1990 to 78.9 g/person/day in 2009.

152. Ukraine identified CH_4 emissions from wastewater handling as a key category in 2009 by trend analysis. Ukraine estimates CH_4 emissions from domestic

wastewater handling using the IPCC tier 1 method with country-specific and IPCC default EFs. The State Statistical Service and the Ministry of Construction, Architecture, Housing and Communal Services of Ukraine are the main providers of the AD and country-specific EFs for wastewater handling activities. The institutions presently use expert judgement for the characterization of wastewater sources and the estimation of fractions of sludge generated and treated anaerobically by different treatment methods and the country-specific per capita biochemical oxygen demand (BOD) load. CH_4 recovery in 2009 has been assumed to be zero because of the decommissioning of all 126 anaerobic digesters in Ukraine.

153. Considering that CH_4 emissions from wastewater handling is identified as a key category, the ERT recommends that Ukraine use the IPCC good practice guidance (figure 5.3) to identify and report comprehensive wastewater flows through the various treatment types (aerobic and anaerobic), the determination of the various fractions collected and uncollected, treated and untreated, sewered to aerobic and/or anaerobic plants and unsewered to septic tanks, as well as sludge generation, treatment and land application. The ERT notes that the use of the IPCC good practice guidance will also improve the determination of the weighted methane conversion factor (MCF) and will thus result in the reduction of uncertainty. The ERT therefore encourages Ukraine to implement the improvement plan identified in the NIR for this category.

3. Non-key categories

Waste incineration – CO_2 and CH_4

154. In response to the recommendations of the ERT, Ukraine applied appropriate IPCC default EFs for the fossil carbon content, calorific value and heat generation in order to disaggregate and estimate the fractions of biogenic and non-biogenic emissions from waste incineration. The refinement of the method has improved the transparency and completeness of the annual submission through the appropriate reporting of CO_2 emissions from non-biogenic waste incineration in the energy sector and from biogenic waste incineration as memo items in line with the Revised 1996 IPCC Guidelines and the IPCC good practice guidance.

155. Ukraine has not reported CH_4 emissions associated with waste incineration due to the lack of IPCC methods and EFs. The CH_4 emissions were thus reported appropriately as "NE" in the CRF tables.

Waste composting – CH_4

156. Ukraine indicated in the NIR that composting activity is emerging and reported AD representing 0.05 per cent of the total waste generated in 2009 for the first time in the 2011 annual submission. The ERT recommends that Ukraine continue to monitor and report AD for composting activities and include the emissions estimate in the 2012 annual submission in order to improve completeness as the category is likely to grow in line with the enforcement of resource management legislation in the waste sector to reduce waste disposal to SWDS.

4. Areas for further improvement

Identified by the Party

157. The 2011 NIR identifies several areas for improvement in the GHG inventory in the waste sector. The improvements identified by the Party include:

(a) The application of a national model developed and validated for the recalculation of CH_4 emissions from solid waste disposal on land;

(b) The development of country-specific chemical oxygen demands and BODs for different types of treatment systems to determine country-specific MCFs for the various wastewater flows in order to reduce the uncertainty in the emission estimates for the various wastewater flows in domestic and industrial wastewater management.

Identified by the expert review team

158. In addition to the improvements planned and identified by the Party, the ERT identified the following additional areas for improvement:

(a) The improvement of the completeness of the GHG inventory by estimating composting emissions in the next annual submission, which have been reported for the first time for 2009 but have not been estimated due to the high uncertainty (see para. 156 above);

(b) The improvement of consistency between the NIR and the CRF tables by enhancing QC procedures and providing tables and charts for key AD, EFs, parameters and coefficients in the NIR for ease of reference and to further improve the transparency of the reporting on the waste sector (see para. 144 above);

(c) The use of a decision tree for CH_4 emissions from domestic wastewater handling, as defined in the IPCC good practice guidance, figure 5.2, and the application of the recommendations on wastewater flows, treatment systems and potential CH_4 emissions contained in figure 5.3 of the IPCC good practice guidance in order to improve the methodological choices in the implementation of the improvement plan and to increase transparency and reduce uncertainty (see para. 153 above).

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

159. The ERT noted that Ukraine submitted estimates for afforestation, reforestation and deforestation activities under Article 3, paragraph 3, of the Kyoto Protocol. Ukraine also submitted estimates for forest management, the only elected activity under Article 3, paragraph 4, of the Kyoto Protocol for the first commitment period. Ukraine has chosen to account for activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol at the end of the commitment period.

160. The reporting of KP-LULUCF activities is in line with the IPCC good practice guidance for LULUCF in relation to the estimates of changes in carbon stocks from the activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol.

161. The ERT noted a significant improvement in the quality of the KP-LULUCF reporting, when compared to the 2010 annual submission.

162. Afforestation, reforestation and forest management have been identified as key categories.

163. Ukraine has made recalculations for the KP-LULUCF activities between the 2010 and 2011 submissions, in response to the 2010 annual review report, following changes in land representation (and consequently affecting each land-use category). The impact of these recalculations on each KP-LULUCF activity for 2008 is as follows:

(a) Activities under Article 3, paragraph 3, of the Kyoto Protocol: in the 2010 annual submission, removals of 1,609.15 Gg CO_2 eq were reported compared to emissions of 2,563.52 Gg CO_2 eq reported in the 2011 annual submission (an increase of 259.3 per cent);

(b) Afforestation and reforestation activities: in the 2010 annual submission, removals of 1,758.93 Gg CO_2 eq were reported compared to removals of 2,010.89 Gg CO_2 eq reported in the 2011 annual submission (an increase of 14.3 per cent);

(c) Deforestation activities: in the 2010 annual submission, removals of 149.77 Gg CO_2 eq were reported compared to emissions of 4,574.41 Gg CO_2 eq reported in the 2011 annual submission (an increase of 2,954.2 per cent);

(d) Activities under Article 3, paragraph 4, of the Kyoto Protocol (forest management): in the 2010 annual submission, removals of 47,718.08 Gg CO_2 eq were reported compared to removals of 53,298.02 Gg CO_2 eq reported in the 2011 annual submission (an increase of 11.7 per cent).

164. The ERT noted that the Party is going to compile a GIS database related to forestry activities aimed at supplying AD for the KP-LULUCF reporting. The ERT recommends that Ukraine use, in its 2014 submission at the latest, the GIS database to assess the forest land area and encourages the Party to do so earlier. Furthermore, the ERT recommends that Ukraine provide detailed and clear explanations of the methodology used to ensure consistency between the areas reported in the forest land category under the Convention and the area reported for activities under Article 3, paragraph 4, of the Kyoto Protocol.

165. The ERT noted that, in response to a recommendation in the previous review report, Ukraine has included in the NIR information aimed at demonstrating that afforestation and reforestation activities (under Article 3, paragraph 3, of the Kyoto Protocol) result from direct human-induced land-use change activities. In response to questions raised by the ERT during the review week, Ukraine provided additional information underlining that, in the assessment of afforestation and reforestation activities, the Party considered only those areas for which documentation exists with evidence of human-induced activities, such as some types of cutting or fire protection. The naturally regenerated areas without the presence of a direct human-induced activity aimed at managing forest growth have been excluded from the assessment of afforestation and reforestation activities. The ERT recommends that Ukraine include all the information provided to the ERT during the review in its next annual submission.

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

Afforestation and reforestation – CO_2, CH_4 and N_2O

166. Ukraine reported the carbon stock changes in the above-ground biomass, litter, dead wood and soil pools; the Party reported the below-ground carbon stock changes as included elsewhere (“IE”). In response to a recommendation in the previous review report, Ukraine reported the country-specific coefficients related to above-ground and below-ground biomass and the coefficients used to estimate the carbon stock changes

in living biomass (i.e. the above-ground and below-ground biomass pools) in the NIR. The ERT recommends that Ukraine estimate and report, in its next annual submission, the carbon stock changes for the below-ground and above-ground biomass pools separately, using the country-specific coefficients reported in the NIR.

167. Following a recommendation in the previous review report, Ukraine has reported GHG emissions from biomass burning. The Party has also included explanations and background information in the NIR related to GHG emissions and removals from lands harvested during the first commitment period following afforestation and reforestation on these units of land since 1990. The ERT commends Ukraine for the inclusion of this information.

Deforestation – CO_2

168. Ukraine reported the carbon stock changes in the above-ground biomass, litter, dead wood and soil pools and reported the below-ground carbon stock changes as "IE". In response to a recommendation in the previous review report, Ukraine reported the country-specific coefficients related to above-ground and below-ground biomass and the coefficients used to estimate the carbon stock changes in living biomass (i.e. the above-ground and below-ground biomass pools) in the NIR. The ERT recommends that the Party estimate and report, in its next annual submission, the carbon stock changes for the below-ground and above-ground biomass pools separately, using the country-specific coefficients reported in the NIR.

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

Forest management – CO_2

169. Ukraine reported the carbon stock changes in the above-ground biomass, litter and dead wood pools and reported the below-ground carbon stock changes as "IE". Ukraine did not report the carbon stock changes in the soils pool. The NIR provides information and references to country-specific studies based on which Ukraine has concluded that the soils pool is not a net source of emissions. The ERT agrees with this conclusion.

170. In response to a recommendation in the previous review report, Ukraine has included in the NIR the country-specific coefficients for above-ground and below-ground biomass. The ERT recommends that Ukraine estimate and report, in its next annual submission, the carbon stock changes for the below-ground and above-ground biomass pools separately, using the country-specific coefficients reported in the NIR. During the review week, Ukraine informed the ERT about the preliminary outcomes of an ongoing soil-typological survey, covering all Ukrainian forested land. The ERT encourages Ukraine to complete the survey and use all available data to estimate all the reporting pools in its next annual submission.

171. In response to a recommendation in the previous review report, Ukraine has reported GHG emissions from biomass burning. The ERT commends Ukraine for this improvement of completeness in the reporting of KP-LULUCF activities.

2. Areas for further improvement

Identified by the Party

172. The 2011 NIR identifies several areas for improvement in the LULUCF sector. The improvements identified by the Party include:

(a) The collection of additional data from an ongoing soil-typological survey covering all Ukrainian forested land in order to obtain forest litter and dead biomass data, taking into account the different Ukrainian climatic zones;

(b) The full implementation of the GIS database related to forestry activities aimed at supplying AD for the KP-LULUCF reporting.

Identified by the expert review team

173. During the review week, the ERT identified that there is a need to further enhance the archiving system by including a direct link to the different LULUCF data sources (e.g. the GIS database, the forest management database, etc.) in the centralized archiving system.

3. Information on Kyoto Protocol units

Standard electronic format and reports from the national registry

174. Ukraine 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 SIAR on the SEF tables and the SEF comparison report.[8] The SIAR was forwarded to the ERT prior to the review, pursuant to decision 16/CP.10. The ERT reiterated the main findings contained in the SIAR.

175. Information on the accounting of Kyoto Protocol units has been prepared and reported in accordance with chapter I.E of the annex to decision 15/CMP.1, and reported in accordance with decision 14/CMP.1 using the SEF tables. This information is consistent 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 set out in paragraph 88(a–j) of the annex to decision 22/CMP.1. 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.

National registry

176. The ERT took note of the SIAR and its finding that the reported information on the national registry is complete and has been submitted in accordance with the annex to decision 15/CMP.1. The ERT further noted from the SIAR and its finding that 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 decisions 16/CP.10 and 12/CMP.1. The national registry also has adequate security, data safeguard and disaster recovery measures in place and its operational performance is adequate. The national registry has fulfilled all the requirements regarding the public availability of information in accordance with section II.E of the annex to decision 13/CMP.1.

[8] The SEF comparison report is prepared by the 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.

Calculation of the commitment period reserve

177. Ukraine has reported its commitment period reserve in its 2011 annual submission. The Party reported its commitment period reserve to be 1,852,385,130 t CO_2 eq based on the national emissions in its most recently reviewed inventory. In response to questions raised by the ERT during the review, Ukraine revised its commitment period reserve to 1,870,598,400 t CO_2 eq based on the national emissions in its most recently reviewed inventory (374,119.68 Gg CO_2 eq) The ERT agrees with this figure.

4. Changes to the national system

178. Ukraine provided information on changes to its national system in its annual submission and these were further clarified during the review. The changes relate to an ongoing process of administrative reform in Ukraine, covering institutional arrangements and budget provision for the inventory and national system. Ukraine needs to continue to update the information on the national system as further elements of national administrative reform take effect. The ERT is of the view that Ukraine's national system has undergone significant change and has demonstrated its ability to respond to the recommendations from the review and to requests from the ERT during the review. Given the role of the national system in underpinning the quality, accuracy, transparency and timeliness of the inventory, the ERT recommends that Ukraine continue to give its national system high priority. The ERT concluded that, taking into account the confirmed changes to the national system, Ukraine's national system is in accordance with the requirements of national systems set out in decision 19/CMP.1.

5. Changes to the national registry

179. Ukraine has reported changes to its national registry in its 2011 annual submission including in response to previous review recommendations. These changes to the national registry include changes to the registry administrator and elements relating to publicly available information. The ERT concluded that, taking into account the confirmed changes to the national registry, Ukraine'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 CMP decisions. In response to questions raised by the ERT during the review, Ukraine explained that there are planned changes to the registry software which will ensure that the registry continues to function well. The ERT commends Ukraine for the clear presentation of the registry information in the NIR, particularly the use of tabular formats.

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

180. Ukraine provided information on the minimization of adverse impacts in accordance with Article 3, paragraph 14, of the Kyoto Protocol in its NIR, however did not provide information on changes in its reporting of this information. The ERT concluded that the information provided is complete and transparent and was submitted on time. During the review, the Party provided the ERT with additional information on new legislation that has implications for its reporting of the minimization of adverse impacts, and it will report on this legislation in future NIRs. The ERT recommends that Ukraine continue to improve the transparency of the information it reports in the NIR on the minimization of adverse impacts in

accordance with Article 3, paragraph 14, of the Kyoto Protocol and, in its next annual submission, report any change(s) in its information provided under Article 3, paragraph 14, in accordance with chapter I.H of the annex to decision 15/CMP.1.

181. The Party highlighted the institutional arrangements and the legal and policy background for the implementation of energy efficiency, energy saving measures and the promotion of renewable energy in Ukraine. The NIR notes that the National Agency of Ukraine for the Effective Use of Energy Resources is the key implementing agency for related policies and measures. Ukraine is taking measures to reduce the carbon intensity of its gross domestic product (GDP), through the development of economic mechanisms that will encourage the reduction of GHG emissions per unit of production. The "Law of Ukraine on Electric Power Industry" sets 'green tariffs' on the purchase of energy generated from alternative energy sources, including wind, solar, biomass and small hydro. Since the publication of the NIR, Ukraine has added biogas, both from landfills and from livestock waste, to the green tariff list.

182. In addition to its efforts to reduce its impact on climate systems, Ukraine has reported on training activities on climate change related issues for experts from developing countries and from the Commonwealth of Independent States. The training covers subjects such as ecology, climate science, meteorology and energy efficiency and is in the form of university courses or postgraduate courses available at more than 10 universities.

III. Conclusions and recommendations

183. Ukraine made its annual submission on 15 April 2011. Ukraine resubmitted the NIR and the CRF tables on 25 May 2011 and 8 June 2011, respectively. The annual submission contains the GHG inventory (comprising CRF tables and an NIR) and supplementary information under Article 7, paragraph 1, of the Kyoto Protocol (information on: activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, Kyoto Protocol units, changes to the national system and the national registry, and the minimization of adverse impacts in accordance with Article 3, paragraph 14, of the Kyoto Protocol). This is in line with decision 15/CMP.1, with the exception that the complete report was not submitted by 15 April 2011, although it was received within the six-week period before any consequences resulting from a late submission come into effect. The ERT recommends that Ukraine submit its next complete inventory by 15 April 2012 as required by decision 15/CMP.1.

184. The ERT concludes that the inventory submission of Ukraine has been prepared and reported in accordance with the UNFCCC reporting guidelines. The inventory submission is complete and the Party has submitted a complete set of CRF tables for the years 1990–2009 and an NIR; these are complete in terms of geographical coverage, years and sectors, as well as complete in terms of categories and gases. Some of the categories, particularly in the energy sector (e.g. military aviation and navigation, natural gas use in the chemical industry) and the industrial processes sector (e.g. natural gas used as feedstock) were not complete, but the missing estimates were provided and resubmitted during the review week.

185. 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.

186. Ukraine's inventory is generally in line with the Revised 1996 IPCC Guidelines, the IPCC good practice guidance and the IPCC good practice guidance

for LULUCF and the ERT commends Ukraine for the improvements made since the last submission. Areas that are not completely in line with the Revised 1996 IPCC Guidelines, the IPCC good practice guidance and the IPCC good practice guidance for LULUCF include:

(a) The application of the IPCC good practice guidance QA/QC methods to ensure consistency between the data reported in the NIR and in the CRF tables (e.g. in the industrial processes, agriculture and waste sectors);

(b) General issues relating to transparency across all sectors;

(c) The allocation of some emissions within and between the energy and the industrial processes sectors, and within the LULUCF sector.

187. Ukraine has made recalculations for the inventory between the 2010 and 2011 submissions in response to the 2010 annual review report, in order to lift applied adjustments, following changes in AD and EFs and in order to rectify identified errors. The impact of these recalculations on the national total GHG emissions is a decrease in emissions of 0.34 per cent for 2008 (without LULUCF). The main recalculations took place in the following sectors/categories:

(a) CO_2 emissions from energy industries (reflecting the use of country-specific or plant-specific coal data and the carbon content of natural gas);

(b) N_2O emissions from transport (as a result of new information on the export/import of diesel fuel);

(c) CO_2 emissions/removals in the LULUCF sector (as a result of clarifying land classification and sources of AD).

188. Responding to recommendations included in the previous review report, the ERT noted a considerable improvement in the quality of the reported information regarding activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol. LULUCF reporting under the Kyoto Protocol has been prepared in accordance with the IPCC good practice guidance for LULUCF.

189. Ukraine has made recalculations for the KP-LULUCF activities between the 2010 and 2011 submissions in response to the 2010 annual review report as a result of clarifying land classification and sources of AD. The impact of these recalculations on each KP-LULUCF activity for 2008 is as follows:

(a) Activities under Article 3, paragraph 3, of the Kyoto Protocol: in the 2010 annual submission, removals of 1,609.15 Gg CO_2 eq were reported compared to emissions of 2,563.52 Gg CO_2 eq reported in the 2011 annual submission (a decrease of 259.3 per cent);

(b) Afforestation and reforestation activities: in the 2010 annual submission, removals of 1,758.93 Gg CO_2 eq were reported compared to removals of 2,010.89 Gg CO_2 eq reported in the 2011 annual submission (an increase of 14.3 per cent);

(c) Deforestation activities: in the 2010 annual submission, removals of 149.77 Gg CO_2eq were reported compared to emissions of 4,574.41 Gg CO_2 eq reported in the 2011 annual submission (an increase of 2,954.2 per cent);

(d) Activities under Article 3, paragraph 4, of the Kyoto Protocol (forest management): in the 2010 annual submission, removals of 47,718.08 Gg CO_2 eq were reported compared to removals of 53,298.02 Gg CO_2 eq reported in the 2011 annual submission (an increase of 11.7 per cent).

190. Ukraine has reported information on its accounting of Kyoto Protocol units in accordance with chapter I.E of the annex to decision 15/CMP.1, and used the required reporting format tables as required by decision 14/CMP.1.

191. The national system performs its required functions as set out in the annex to decision 19/CMP.1; however, the ERT identified a need to further incorporate the LULUCF sector into the national system.

192. 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.

193. Ukraine has reported information under chapter I.H of the annex to decision 15/CMP.1, "Minimization of adverse impacts in accordance with Article 3, paragraph 14" as part of its 2011 annual submission. The information was provided on 15 April 2011. The information provided is complete and transparent and was submitted on time.

194. The ERT identifies the following cross-cutting issues for improvement:

(a) To continue to increase transparency across all aspects of the NIR, including the provision of more precise descriptions of methodologies that differ from those of the IPCC and to consider using tabular formats to streamline the presentation of information where appropriate;

(b) To continue reporting the categories that were included in the revised estimates submitted during the review week in response to questions raised by the ERT;

(c) To improve the timeliness of the annual submission by submitting the complete inventory (CRF tables and an NIR) by 15 April of each year;

(d) To develop a consolidated inventory improvement plan that encompasses improvements beyond one year;

(e) To more strictly apply the IPCC good practice guidance QA/QC methods to improve the consistency between the data reported in the NIR and the CRF tables;

(f) To improve the accuracy of the key categories by updating country-specific EFs or undertaking studies to develop country-specific EFs.

195. In the course of the review, the ERT formulated a number of recommendations relating to: transparency across all sectors (i.e. in the energy (see para. 45 above) and agriculture (see paras. 103, 104, 111 and 113 above) sectors); consistency between the NIR and the CRF tables in the industrial processes (see para. 79 above) and agriculture (see para. 101 above) sectors; the improvement of the accuracy of emission estimates (e.g. in the energy (see para. 61 above), industrial processes (see para. 82 above), agriculture (see para. 118 above), LULUCF (see para.126 above) and waste (see para. 148 above) sectors); the completeness of the time series in the energy sector (see para. 68 above); time-series consistency in the industrial processes (see para. 89 above) and agriculture (see para. 106 above) sectors; the allocation of some emissions within and between the energy and industrial processes sectors (see paras. 48 and 86 above) and within the LULUCF sector (see para. 129 above); the enhancement of the archiving system for LULUCF data (see para. 128 above); and the application of the IPCC good practice guidance to assist with the methodological choice in the waste sector (see para. 153 above).

196. The key recommendations are that Ukraine:

(a) Continue to give the national system high priority;

(b) Continue to increase transparency across all aspects of the NIR and to consider using tabular formats to streamline the presentation of information where appropriate;

(c) Ensure that estimates are reported for all categories for which an IPCC method exists;

(d) Improve the timeliness of the annual submission by submitting the complete inventory (CRF tables and an NIR) by 15 April of each year;

(e) Develop a consolidated inventory improvement plan that encompasses improvements beyond one year;

(f) More strictly apply the IPCC good practice guidance QA/QC methods to improve the consistency between the data reported in the NIR and the CRF tables;

(g) Improve the accuracy of the key categories by updating country-specific EFs or undertaking studies to develop country-specific EFs.

IV. Questions of implementation

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

Annex I

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>.

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UNFCCC. *Standard Independent Assessment Report*, parts I and II. 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. Oleksii Khabatiuk, Mr. Oleksandr Kolisnyk and Mr. Anatoliy Shmurak (State Environmental Investment Agency of Ukraine), Ms. Lyubov Polyakova (State Forest Resources Agency of Ukraine), Ms. Vera Bogok and Mr. Anatoliy Frizorenko (State Statistical Service of Ukraine), Ms. Maryna Bereznytska, Ms. Oksana Butrym, Ms. Olga Khabatyuk, Mr. Georgiy Panchenko, Mr. Yurii Pyrozhenko, Mr. Sergiy Skybyk, Mr. Kostyantyn Tadlya, Mr. Oleg Pokidko and Ms. Aleksandra Kolmogorceva (Environmental Green Investments Fund), Mr. Oleksii Dybkov (Ecosoft XXI), Mr. Iurii Nabyvanets (Ukrainian Hydrometeorological Research Institute), Mr. Oleksii Klymenko and Mr. Victor Ustymenko (State Road Transport Research Institute), Mr. Igor Prischepo (Ukrtransgaz AC), Mr. Vladimir Ivashchenko (MGM International), Ms. Tamara Kovenya and Mr. Igor Kanyuka (Cherkassky Research Institute of Technological and Economic Information in the Chemical Industry), Ms. Valentina Grechko (independent expert), Mr. Valeriy Grekov (State Science and Technology Centre of Soil Fertility Protection), Mr. Igor Buksha, Mr. Maksym Buksha, Mr. Volodymyr Pasternak, Mr. Georgiy Bondaruk, Mr. Vladimir Bogomolov and Ms. Svitlana Raspopina (Ukrainian order “Badge of Honour”, Scientific and Research Institute of Forestry and Forest Melioration named after G. Vysotsky), Ms. Ludmila Dats’ko (State Science and Technology Centre of Soil Fertility Protection “Tsentrderzhrodyuchist”) and Mr. Yuriy Matveev (Scientific Engineering Centre “Biomass” Ltd.), including additional material on the methodologies and assumptions used.

Annex II

Acronyms and abbreviations

AD	activity data
AWMS	animal waste management systems
BOD	biochemical oxygen demand
C	confidential
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
EF	emission factor
ERT	expert review team
FOD	first-order decay
GDP	gross domestic product
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
GIS	global information system
GJ	gigajoule (1 GJ = 109 joule)
HFCs	hydrofluorocarbons
IE	included elsewhere
IEA	International Energy Agency
IPCC	Intergovernmental Panel on Climate Change
ITL	international transaction log
JI	joint implementation
kg	kilogram (1 kg = 1,000 grams)
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
m^3	cubic metre
MCF	methane conversion factor
N	nitrogen
N_2O	nitrous oxide
NA	not applicable
NCV	net calorific value
NE	not estimated
NIR	national inventory report
NMVOC	non-methane volatile organic compounds
NO	not occurring
PFCs	perfluorocarbons
QA/QC	quality assurance/quality control
SEF	standard electronic format
SF_6	sulphur hexafluoride
SIAR	standard independent assessment report
SWDS	solid waste disposal sites
TJ	terajoule (1 TJ = 1012 joule)
UNFCCC	United Nations Framework Convention on Climate Change