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**Report of the individual review of the greenhouse gas inventories of Ukraine  
submitted in 2007 and 2008\***

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\* In the symbol for this document, 2008 refers to the year in which the inventory was submitted, and not to the year of publication.

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## I. Overview

### A. Introduction

1. This report covers the centralized review of the 2007 and 2008 greenhouse gas (GHG) inventory submissions of Ukraine, coordinated by the UNFCCC secretariat, in accordance with decision 22/CMP.1. In accordance with the conclusions of the twenty-seventh session of the Subsidiary Body for Implementation the focus of the review is on the most recent (2008) submission.<sup>1</sup> The review took place from 1 to 6 September 2008 in Bonn, Germany, and was conducted by the following team of nominated experts from the UNFCCC roster of experts: generalists – Mr. Bernd Gugele (European Community) and Ms. Inga Konstantinaviciute (Lithuania); energy – Mr. Michael Strogies (Germany) and Mr. Hristo Vassilev (Bulgaria); industrial processes – Mr. Masato Yano (Japan) and Ms. Valentina Idrisova (Kazakhstan); agriculture – Mr. Paul Duffy (Ireland) and Ms. Batima Punsalmaa (Mongolia); land use, land-use change and forestry (LULUCF) – Mr. Emil Cienciala (Czech Republic) and Mr. Richard Volz (Switzerland); and waste – Mr. Sabin Guendehou (Benin) and Ms. Tatiana Tugui (Republic of Moldova). Mr. Gugele and Ms. Tugui were the lead reviewers. The review was coordinated by Ms. Ruta Bubniene (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 stated that it had no comments on the report.

### B. Inventory submission and other sources of information

3. The 2008 inventory was submitted on 21 May 2008; it contains a complete set of common reporting format (CRF) tables for the period 1990–2006 and a national inventory report (NIR). This is in line with decision 15/CMP.1. The Party indicated that the 2008 submission is also its voluntary submission under the Kyoto Protocol.<sup>2</sup> In its 2007 submission, Ukraine included a complete set of CRF tables for the period 1990–2005 and an NIR. Where needed the expert review team (ERT) also used the 2006 submission, additional information provided during the review and other information. The full list of materials used during the review is provided in the annex to this report.

### C. Emission profiles and trends

4. In 2006 (as reported in the 2008 inventory submission), the main GHG in Ukraine was carbon dioxide (CO<sub>2</sub>), accounting for 77.7 per cent of total GHG emissions<sup>3</sup> expressed in CO<sub>2</sub> eq, followed by methane (CH<sub>4</sub>) (16.9 per cent) and nitrous oxide (N<sub>2</sub>O) (5.3 per cent). Perfluorocarbons (PFCs) accounted for 0.03 per cent of the total GHG emissions in the country. Hydrofluorocarbons (HFCs) and sulphur hexafluoride (SF<sub>6</sub>) are reported as not applicable (“NA”), not estimated (“NE”) and not occurring (“NO”). The energy sector accounted for 68.8 per cent of the total GHG emissions followed by industrial processes sector (21.9 per cent), agriculture (6.9 per cent), waste (2.3 per cent), and solvent and other product use (0.1 per cent). Total GHG emissions amounted to 443,183.48 Gg CO<sub>2</sub> eq and decreased by 54.8 per cent between the base year<sup>4</sup> and 2006.

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<sup>1</sup> FCCC/SBI/2007/34, paragraph 104.

<sup>2</sup> Parties may start reporting information under Article 7, paragraph 1, of the Kyoto Protocol from the year following the submission of the initial report, on a voluntary basis (decision 15/CMP.1).

<sup>3</sup> In this report, the term “total GHG emissions” refers to the aggregated national GHG emissions expressed in terms of CO<sub>2</sub> eq excluding LULUCF, unless otherwise specified.

<sup>4</sup> Base year refers to the base year under the Kyoto Protocol, which is 1990 for all gasses. The base year emissions do not include any possible emissions from deforestation; however, these are taken into account when the assigned amount is calculated.

5. In 2005 (as contained in the 2007 inventory submission), total GHG emissions amounted to 418,923.06 Gg CO<sub>2</sub> eq. The shares of gases and sectors in 2006 (2008 inventory submission) were similar to those of 2005 (2007 inventory submission). The emission trends by sector and by gas are comparable with those of other Parties with economies in transition.

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

#### **D. Key categories**

7. Ukraine has reported a key category tier 1 analysis, both level and trend assessment, and also applied a qualitative approach in determining its key categories, as part of its 2008 submission. The key category analyses performed by Ukraine and the secretariat produced similar results. Both identified 24 key categories. An additional key category – N<sub>2</sub>O emissions from road transportation – was identified by qualitative assessment.

8. Ukraine has included the LULUCF sector in its key category analysis, which was performed in accordance with the Intergovernmental Panel on Climate Change (IPCC) *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (hereinafter referred to as the IPCC good practice guidance) and the *IPCC Good Practice Guidance for Land Use, Land-Use Change and Forestry* (hereinafter referred to as the IPCC good practice guidance for LULUCF). Following the recommendation of the previous review Ukraine has reported a key category analysis for 1990 and for 2006. The ERT noted that Ukraine is using the key category analysis to prioritize the improvements of the inventory.

9. The following key categories were identified in the 2008 submission but not in the 2007 submission: CO<sub>2</sub> emissions from railways, CO<sub>2</sub> emissions from navigation, CH<sub>4</sub> emissions from stationary combustion (solid fuels), CH<sub>4</sub> emissions from manure management and N<sub>2</sub>O emissions from road transportation. The following key categories were identified in the 2007 submission but not in the 2008 submission: CO<sub>2</sub> emissions from grassland remaining grassland, CO<sub>2</sub> emissions from land converted to grassland and CH<sub>4</sub> emissions from road transportation.

10. Emissions from key categories were estimated mainly using a tier 2 approach, with the exception of two categories: CO<sub>2</sub> emissions from manufacturing and construction, and CO<sub>2</sub> emissions from road transportation. It is good practice to apply a tier 2 or higher method to estimate emissions from the key categories. The ERT therefore recommends that Ukraine estimate emissions from these two categories using one of these methods.

#### **E. Main findings**

11. The inventory is generally in line with the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the Revised 1996 IPCC Guidelines), the IPCC good practice guidance and the IPCC good practice guidance for LULUCF. The 2008 inventory submission shows improvement compared to the 2007 submission, as a number of recommendations of the previous review have been considered. However, the ERT identified a need for further improvements, such as the use of a tier 2 or higher method in estimating emissions from key categories (CO<sub>2</sub> from manufacturing and construction, and CO<sub>2</sub> from road transportation); estimates of emissions previously not estimated in the energy and industrial processes; and the improvement of transparency of reporting as indicated in the sectoral sections of this report.

**Table 1. Greenhouse gas emissions by gas, 1990–2006**

Greenhouse gas emissions	Gg CO <sub>2</sub> eq								Change base year – 2006 (%)
	Base year <sup>a</sup>	1990	1995	2000	2003	2004	2005	2006	
CO <sub>2</sub>	714 574.76	714 574.76	392 016.82	295 674.28	320 658.39	319 989.78	328 636.57	344 525.79	-51.8
CH <sub>4</sub>	151 515.20	151 515.20	95 765.93	77 348.78	74 758.40	74 735.11	74 207.37	74 878.09	-50.6
N <sub>2</sub> O	55 720.09	55 720.09	33 797.29	21 879.57	21 470.73	22 382.08	22 699.59	23 653.99	-57.5
HFCs	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	IE,NA,NE,NO	IE,NA,NE,NO	IE,NA,NE,NO	NA
PFCs	203.23	203.23	153.45	99.74	66.49	80.44	122.66	125.62	-38.2
SF <sub>6</sub>	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	IE,NA,NE,NO	IE,NA,NE,NO	IE,NA,NE,NO	NA

*Abbreviations:* IE = included elsewhere; NA = not applicable; NE = not estimated; NO = not occurring.

<sup>a</sup> Base year refers to the base year under the Kyoto Protocol, which is 1990 for all gases. The base year emissions do not include any possible emissions from deforestation; however, if applicable, these are taken into account when the assigned amount is calculated.

**Table 2. Greenhouse gas emissions by sector, 1990–2006**

Sectors	Gg CO <sub>2</sub> eq								Change base year – 2006 (%)
	Base year <sup>a</sup>	1990	1995	2000	2003	2004	2005	2006	
Energy	685 488.84	685 488.84	387 793.51	271 690.36	288 829.88	285 828.77	294 409.67	305 112.33	-55.5
Industrial processes	126 919.20	126 919.20	62 683.81	81 524.07	88 576.48	91 391.73	91 536.89	97 166.31	-23.4
Solvent and other product use	376.80	376.80	372.11	354.89	345.45	342.97	340.38	338.52	NA
Agriculture	100 800.19	100 800.19	62 335.58	32 748.41	30 146.94	30 441.72	29 787.02	30 447.48	-69.8
LULUCF	NA	-66 941.16	-60 327.07	-50 908.63	-48 984.49	-35 751.97	-29 459.30	-32 625.03	NA
Waste	8 428.24	8 428.24	8 548.48	8 684.65	9 055.25	9 182.22	9 592.24	10 118.85	20.1
Other	NA	NA	NA	NA	NA	NA	NA	NA	NA
<b>Total (with LULUCF)</b>	NA	855 072.12	461 406.42	344 093.75	367 969.51	381 435.44	396 206.89	410 558.46	NA
<b>Total (without LULUCF)</b>	922 013.28	922 013.28	521 733.49	395 002.38	416 954.00	417 187.41	425 666.19	443 183.48	-51.9

*Abbreviations:* LULUCF = land use, land-use change and forestry; NA = not applicable.

<sup>a</sup> Base year refers to the base year under the Kyoto Protocol, which is 1990 for all gases. The base year emissions do not include any possible emissions from deforestation; however, if applicable, these are taken into account when the assigned amount is calculated.

## **F. Cross-cutting topics**

### **1. Completeness**

12. Ukraine has provided inventory data for the years 1990–2006 with full geographical coverage and has included all the required tables. The CRF tables are complete and notation keys are used throughout. The ERT noted that Ukraine does not estimate such categories as coal mining and handling – CO<sub>2</sub>; actual and potential emissions from consumption of halocarbons and SF<sub>6</sub>; venting and flaring – CH<sub>4</sub>, asphalt roofing and road paving – CO<sub>2</sub>. The ERT encourages Ukraine to improve inventory completeness by providing, in its next annual submission, emission estimates for gases that have been reported as “NE”.

### **2. Transparency**

13. The NIR includes information on key categories, methods, data sources, emission factors (EFs), uncertainty estimates, quality assurance/quality control (QA/QC) procedures and verification. The ERT noted that transparency of the inventory has improved compared with the 2006 submission but more detailed methodological descriptions and activity data (AD), especially in industrial processes, are needed to ensure the transparency of the inventory. The ERT encourages Ukraine to provide this information in its next annual submission.

### **3. Recalculations and time-series consistency**

14. The ERT noted that Ukraine has recalculated emissions from all sectors, except waste and solvent and other product use, for the entire time series between 1990 and 2005. The reasons for recalculations include the use of higher-tier methods, the update of AD and EFs, the reallocation of emissions and the reporting of some sources that were not estimated before (for example, PFC emissions from aluminium production). The recalculations resulted in a decrease of 0.2 per cent of total GHG emissions in 1990 and an increase of 1.6 per cent in 2005. The most significant differences from the recalculations for 2005 were for CO<sub>2</sub> from LULUCF (decrease of 49.7 per cent) and for CO<sub>2</sub> from the energy sector (increase of 2.6 per cent).

15. The ERT noted that the rationale for the recalculations is provided in the NIR but not reported in CRF table 8(b). The ERT recommends that Ukraine report the rationale for recalculations in CRF table 8(b) in its next annual submission.

### **4. Uncertainties**

16. In the 2008 submission Ukraine provided quantitative uncertainty estimates by level and by trend based on tier 1 of the IPCC good practice guidance, and reported the separate uncertainty estimates for AD and EFs. For 2006 uncertainty of the total GHG emissions is 7.3 per cent and for 2005 (as reported in the 2007 submission) it is 7.6 per cent.

17. The ERT noted that uncertainty by level for the LULUCF sector in 2006 (11 per cent) is considerably lower than that reported in the 2006 submission (65.1 per cent). The rationale for such a difference is not well explained in the NIR. The ERT recommends that Ukraine explain the estimation of the level of uncertainty better in its next annual submission.

### **5. Verification and quality assurance/quality control approaches**

18. Ukraine provided information on its QA/QC procedures in line 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. The QA/QC plan includes general QC procedures (tier 1) and some source/category-specific QC procedures (tier 2) for key categories.

19. The ERT noted that the NIR lacks documentation on the QC procedures and detailed information on how the relevant activities have been implemented. The ERT recommends that Ukraine include more detailed information on the QA/QC plan and its implementation in its next annual submission.

#### 6. Follow-up to previous reviews

20. The ERT noted that Ukraine has implemented several improvements recommended by the previous review, especially inclusion of the description of the institutional arrangements for inventory preparation; reporting of the key category assessment for 1990 in the NIR; inclusion of additional information on methodologies applied for emission estimation; improvement of the consistency between the CRF and the NIR; revision of several emission estimates; and performance of the QA/QC procedures in energy sector.

### **G. Areas for further improvement**

#### 1. Identified by the Party

21. In its 2008 submission Ukraine identifies several areas for improvement:

- (a) Collection of additional AD, especially the AD for estimation of CO<sub>2</sub> and CH<sub>4</sub> emissions from oil and gas exploration, the AD for the estimation of the use of halocarbons in refrigeration and air conditioning equipment, and the plant-specific data for gas consumption in ammonia production;
- (b) Further research on country-specific EFs and emissions, especially the research on EFs for CO<sub>2</sub> emissions from combustion of oil and gas and on EFs for CO<sub>2</sub> from limestone and dolomite use, and fugitive CH<sub>4</sub> emissions from closed coal mines;
- (c) Application of higher-tier methods for key categories, especially the use of tier 2 for estimation of CO<sub>2</sub> emissions from road transportation.

#### 2. Identified by the ERT

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

- (a) Report the explanatory information on recalculations in the CRF tables and in the NIR;
- (b) Include detailed information on the QA/QC plan and more information on implemented QA/QC activities in the NIR;
- (c) Improve transparency, through better documentation of the country-specific EFs used in the inventory for the energy sector and for iron and steel production and through provision of the disaggregated EFs for fuel combustion sources.

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

## **II. Energy**

### **A. Sector overview**

24. The energy sector is the main sector in the GHG inventory of Ukraine. In 2006, emissions from the energy sector amounted to 305,112.33 Gg CO<sub>2</sub> eq, or 68.8 per cent of total GHG emissions. Since the base year emissions from the sector have decreased by 55.5 per cent. Within the sector, 82.7 per cent of the emissions were from combustion of fuels and 17.3 per cent were fugitive emissions. The ERT noted that Ukraine is a major producer of bituminous coal, and imports crude oil and natural gas to cover almost all its domestic demand for these materials.



25. Most of the emissions in the energy sector came from energy industries, which accounted for 36.3 per cent of the sectoral emissions; manufacturing industries and construction accounted for 16.1 per cent, other sectors for 15.4 per cent and transport for 14.4 per cent.

26. Detailed energy consumption data are provided only for the base year and the years between 1997 and 2006. The ERT reiterates the recommendation of the previous review that Ukraine use the IPCC recommended methods to interpolate detailed energy consumption data for the years where no official detailed energy balance is available, and provide an energy balance in the NIR in its next annual submission.

27. The ERT noted that most of the categories are estimated in the energy sector with the exception of CO<sub>2</sub> emissions from coal mining and handling and CO<sub>2</sub> and CH<sub>4</sub> emissions from natural gas exploration which are reported as "NE". The ERT recommends that Ukraine include these emissions in its next annual submission.

## **B. Reference and sectoral approaches**

### **1. Comparison of the reference approach with the sectoral approach**

28. The ERT noted that in the year 2006, as reported in the 2008 submission, energy consumption and CO<sub>2</sub> emissions estimated using the reference approach were 4.6 per cent and 5.9 per cent lower, respectively, than those estimated using the sectoral approach. The consumption of liquid fuels, estimated using the reference approach, is 3.4 per cent lower than that estimated using the reference approach, and consumption of solid fuels estimated using the reference approach is 10.9 per cent higher than that estimated by the sectoral approach. The ERT noted that the NIR briefly presents the reasons for the differences in CO<sub>2</sub> emission estimates between these two approaches.

29. In 2005 (as reported in the 2007 submission) energy consumption and CO<sub>2</sub> emissions estimated using the reference approach were 11.2 and 10.5 per cent higher, respectively, than those estimated using the sectoral approach. The NIR does not provide an explanation for these differences.

30. ERT encourages Ukraine to check if the differences in fuel consumption between the reference and the sectoral approach could be decreased by analysing in detail the energy balance and estimating CO<sub>2</sub> emissions from non-energy use under the sectoral approach. The ERT recommends that Ukraine extensively use its energy balance for preparation of the GHG inventory, analyse the differences (especially for natural gas production and consumption) and explain the reasons for these differences in its next annual submission.

### **2. International bunker fuels**

31. Emissions of CO<sub>2</sub> from international aviation decreased by 68.2 per cent and from international navigation by 93.8 per cent between the base year and 2006. The ERT noted that Ukraine estimates fuel consumption using a country-specific method, which is tier 1b, and uses default IPCC EFs to estimate CH<sub>4</sub> and N<sub>2</sub>O emissions.

### **3. Feedstocks and non-energy use of fuels**

32. The NIR provides a short description of feedstock and non-energy use of fuels in the CRF tables. The ERT noted that a part of CO<sub>2</sub> emissions from non-energy use is reported under industrial processes (e.g. CO<sub>2</sub> emissions from coke in iron and steel production) and CO<sub>2</sub> emissions from non-energy use of fuels are not included in totals of GHG emissions, which is in line with the IPCC good practice guidance.

33. The ERT noted that for all fuels, with the exception of lubricants, the fraction of carbon stored in products is incorrectly reported as 100 per cent (meaning that there are no CO<sub>2</sub> emissions). The ERT

encourages Ukraine to revise the fraction of carbon stored in products, and subsequently the AD, in its next annual submission.

### **C. Key categories**

#### **1. Stationary combustion: gaseous and solid fuels – CO<sub>2</sub>**

34. The ERT noted that the AD for other fuels are not transparently reported in the NIR. In response to the ERT request during the review Ukraine clarified that it has no detailed information about the composition of AD to be reported under this category. The ERT encourages Ukraine to collect additional information from the institutions responsible for the statistical data collection and explain the content of this category in its next annual submission.

#### **2. Road transportation – CO<sub>2</sub>**

35. The ERT noted that Ukraine uses a tier 1 approach to estimate CO<sub>2</sub> emissions from this key category, which is not in line with the IPCC good practice guidance. During the review Ukraine informed the ERT that it has been searching for alternative sources of the data needed for application of a tier 2 method. The ERT encourages Ukraine to strengthen its efforts and to report the estimates from this category using tier 2 or higher approach in its next annual submission.

#### **3. Fugitive emissions: solid fuels – CH<sub>4</sub>**

36. The ERT noted that Ukraine reports almost the same share of CH<sub>4</sub> capture (7.4 per cent) of total fugitive emissions from underground mines between 2001 and 2006. The NIR states that research results were available only for the period between 1990 and 2001 and the percentage of CH<sub>4</sub> capture for the period between 2002 and 2006 was reported as constant based on the estimated value for 2001. The ERT further noted that the NIR states that following expert judgment, the emissions recovered or flared have increased since 2001 but does not provide any documentation for this. The ERT encourages Ukraine to substantiate the expert judgment, and revise the value of CH<sub>4</sub> recovered accordingly, in its next annual submission.

#### **4. Fugitive emissions: liquid fuels – CH<sub>4</sub>**

37. The ERT noted that the NIR provides an analysis of the results of the measurements in oil and natural gas pipelines and compares these results with the outcomes of studies of similar systems.<sup>5</sup> Based on the results of this analysis and on the expert judgment, Ukraine has identified country-specific EFs for CH<sub>4</sub> from oil and gas systems. The ERT commends Ukraine for this inventory improvement.

38. The ERT further noted a discrepancy between the NIR and the CRF tables in reporting the EFs for natural gas transmission pipelines (1.B.2.b.iii). The NIR reports an EF that equals to 6,485 m<sup>3</sup>/km/year whereas the CRF reports 5,846,899.87 kg/1,000 km. The ERT also noted that the country-specific EF is 80.4 per cent higher than the IPCC default EF. The ERT recommends that Ukraine explain the reason for these differences and correct the discrepancy in its next annual submission.

### **D. Non-key categories**

39. The ERT noted that Ukraine does not provide a description of non-key categories in the NIR. As several non-key categories (e.g. stationary combustion of other fuels – CO<sub>2</sub>, railway transport – CO<sub>2</sub>, stationary combustion of fuels – CH<sub>4</sub>, N<sub>2</sub>O, water transport – CO<sub>2</sub> and civil aviation – CO<sub>2</sub>) are related to important economic activities, the ERT recommends that Ukraine include some information on the non-key categories in its next annual inventory.

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<sup>5</sup> Wuppertal Institute. 2005. *Greenhouse Gas Emission from the Russian Natural Gas Export Pipeline System*.

40. The ERT commends Ukraine for using a tier 3 approach for estimating CH<sub>4</sub> emissions from coal mining. The ERT noted that Ukraine has commissioned research on all country mines to determine the country-specific EFs for CH<sub>4</sub>. The ERT further noted that CO<sub>2</sub> emissions from coal mining are reported as “NE”. Taking account of the extensive research undertaken by the Party and the detailed AD that are apparently available, the ERT recommends that Ukraine estimate CO<sub>2</sub> emissions from this category and include these in the next annual submission.

### **III. Industrial processes and solvent and other product use**

#### **A. Sector overview**

41. In 2006, emissions from the industrial processes sector amounted to 97,166.31 Gg CO<sub>2</sub> eq, or 21.9 per cent of total GHG emissions. Emissions from the industrial processes sector decreased by 23.4 per cent between 1990 and 2006 mainly due to economic recession. The key driver for the fall in emissions is a decrease in emissions from cement production by 40.5 per cent, from lime production by 36.3 per cent and from iron and steel production by 23.9 per cent between 1990 and 2006.

42. Within the industrial processes sector, 63.7 per cent of GHG emissions were from the iron and steel industry, 11.0 per cent were from ammonia production, 8.9 per cent were from limestone and dolomite use, and 5.7 per cent were from cement production. Lime production accounted for 3.7 per cent and aluminium and ferroalloys production accounted for 3.6 per cent. CO<sub>2</sub> emissions accounted for 96.2 per cent of the sectoral GHG emissions (mostly from iron and steel production), and N<sub>2</sub>O emissions from adipic and nitric acid production for 2.8 per cent. CH<sub>4</sub> and PFC emissions accounted for 0.9 and 0.1 per cent of the sectoral GHG emissions, respectively.

43. PFC emissions (CF<sub>4</sub> and C<sub>2</sub>F<sub>6</sub>) are a by-product of aluminium and ferroalloy production, which is the only category where these emissions are reported. There is no halocarbon and SF<sub>6</sub> production in Ukraine. Neither actual nor potential emissions from consumption of halocarbons and SF<sub>6</sub> are reported because, as the NIR explains, no reliable data are available. The ERT noted that refrigeration production exists in Ukraine and recommends that Ukraine collect the AD and report emissions from the use of halocarbons especially in refrigeration and air conditioning equipment. The NIR states that these improvements are planned for 2008–2009, but no detailed description is provided. In response to an ERT request during the review, Ukraine submitted a plan for estimation of the HFC, PFC and SF<sub>6</sub> emissions in Ukraine for 2008–2009.

44. The ERT noted that Ukraine reports asphalt roofing and road paving as “NE” because, as it is explained by the Party, no IPCC methodology exists; and reports soda ash, adipic acid, methanol, ethylene, propylene, polypropylene and aluminium production as confidential (“C”). Aggregated emissions are reported for these categories, which reduces the overall transparency of the industrial processes sector. The ERT recommends that Ukraine investigate whether all the emissions reported as “C” should be confidential and consider reporting these emissions for the beginning of the time series in its next annual submission.

45. In 2006 emissions from solvent and other product use sector amounted to 338.52 Gg CO<sub>2</sub> eq, or 0.08 per cent of total GHG emissions. Emissions from this sector decreased by 10.2 per cent between 1990 and 2006. In the sector, Ukraine has estimated only N<sub>2</sub>O use for anaesthesia and non-methane volatile organic compounds emissions from paint application, degreasing and dry cleaning, chemical products, manufacture and processing. CO<sub>2</sub> emissions were reported as “NE” due, as explained by the Party, to the absence of an IPCC methodology. The ERT encourages Ukraine to strengthen its efforts to estimate CO<sub>2</sub> emissions and apply the available European Union Emission Inventory Programme (CORINAIR) methodology or other methodology based on the recognized international scientific literature.

## B. Key categories

### 1. Cement production – CO<sub>2</sub>

46. Ukraine uses plant-specific data for emission estimates in this category, in accordance with the IPCC good practice guidance. The EFs are the result of averaging the data from 12 plants operating in the country. The explanations given in the NIR are sufficiently transparent and complete. Recalculations for 1993–2000 due to refinement of the AD resulted in an increase of emissions in this period by 0.02–0.16 per cent. The ERT recommends that Ukraine continue to apply this revised approach in its next annual submission.

### 2. Ammonia production – CO<sub>2</sub>

47. There are no statistical data on natural gas consumption for ammonia production in Ukraine but data on total non-energy consumption of natural gas by the chemical and petrochemical industries are available. Ukraine has refined the share of gas being used directly for ammonia production and developed country-specific values for gas consumption per tonne of ammonia produced for several years. The ERT noted that Ukraine, following the recommendation of the previous ERT, intends to collect plant-specific data on gas consumption for ammonia production in the future, and encourages Ukraine to persevere with this intention.

### 3. Iron and steel production – CO<sub>2</sub>

48. The ERT noted a discrepancy within the NIR. Under the industrial processes sector, Ukraine reports that coke is mostly produced at petrochemical plants, and under the energy sector it states that coke is mainly used for metallurgical purposes and all emissions from coke production are reported under industrial processes. The NIR also states that only one big iron and steel plant produces coke and it seems that emissions are accounted for. The ERT recommends that Ukraine correct this discrepancy, and include more AD and explanations on the balance of coke production between energy and industrial processes in its next annual submission.

### 4. Lime production – CO<sub>2</sub>

49. Emissions from lime production are estimated using data on two types of lime produced in Ukraine and based on known CaO content. The ERT noted that for 1990–2003 no lime production data by type of lime were available and the country-specific ratio for hydrated/quicklime (55/45) was used instead. Since 2004 disaggregated data have been available and applied. The inconsistent method applied for the time series has led to fluctuations of the CO<sub>2</sub> implied emission factor. The ERT noted that further improvements in the category are planned and recommends that Ukraine collect AD from lime producing plants and report emissions based on these actual data in its next annual submission.

### 5. Limestone and dolomite use – CO<sub>2</sub>

50. The ERT noted that a tier 1 approach is used to estimate CO<sub>2</sub> emissions from limestone and dolomite use and that the AD do not take into account the purity of limestone/dolomite used. The ERT also noted that the structure of limestone/dolomite use for different industrial processes was available only for 2004 and was interpolated accordingly for later years. Given that this is a key category, the ERT recommends that Ukraine collect more precise data on the structure of limestone/dolomite use in metallurgy and glass production, and plant-specific information on the purity of limestone/dolomite used, and report on this in its next annual submission. In doing so, Ukraine may wish to consider the inventories of other reporting Parties with similar conditions.

## 6. Aluminium and ferroalloy production – CO<sub>2</sub>

51. The ERT noted that tier 1b was applied to estimate CO<sub>2</sub> emissions from ferroalloys, which is not consistent with the Revised 1996 IPCC Guidelines for the key categories. Production volumes were used as the AD. The ERT recommends that Ukraine apply higher-tier methods, collect plant-specific data on the amount of reducing agent used for production of ferroalloys, and report on this in its next annual submission.

### **C. Non-key categories**

#### Adipic acid production – N<sub>2</sub>O

52. The ERT noted that AD for adipic acid production are reported as “C” for 1990–2002 so emissions are reported together with nitric acid production under other (nitric and adipic acid production). The ERT noted that there are two adipic acid plants in Ukraine and that AD for 1990–2002 exist in Ukraine. In 2006 plant-specific information was obtained and interpolated for 2003–2005 and reported in the inventory submission. The ERT encourages Ukraine to collect relevant information from existing plants for the entire time series and use this information for emission estimates in its next annual submission.

## **IV. Agriculture**

### **A. Sector overview**

53. In 2006, emissions from the agriculture sector amounted to 30,447.5 Gg CO<sub>2</sub> eq, or 6.9 per cent of total GHG emissions. Emissions from the sector decreased by 69.8 per cent between 1990 and 2006. The key driver for the fall in emissions is the sharp decline in animal population. Within the sector, 52.2 per cent of the GHG emissions were from agricultural soils, 34.4 per cent were from enteric fermentation, 13.1 per cent were from manure management and 0.3 per cent were from rice cultivation.

54. CH<sub>4</sub> emissions accounted for 37.7 per cent and N<sub>2</sub>O emissions for 62.3 per cent of the sectoral emissions. Most of the N<sub>2</sub>O emissions within the sector came from direct N<sub>2</sub>O emissions from agricultural soils, which accounted for 31.9 per cent of the sectoral GHG emissions; CH<sub>4</sub> emissions from enteric fermentation (dairy cattle) accounted for 23.9 per cent, indirect soils emissions for 12.7 per cent and N<sub>2</sub>O emissions from manure management (soils storage and dry lot) for 10.0 per cent of sectoral GHG emissions.

55. Field burning of agricultural residues is prohibited by law in Ukraine and is reported as “NO”. The ERT noted that the fractions (a fraction of livestock N excreted and deposited onto soil during grazing (Frac<sub>graz</sub>) and a fraction of total above-ground crop biomass that is removed from the field as a crop product (Frac<sub>R</sub>)) are reported as “NE”, whereas the related activities are reported as “NO”. The ERT encourages Ukraine to provide explanations on the use of these notation keys in its next annual submission.

56. The majority of the data are supplied by the State Committee on Statistics and, where necessary, data gaps are filled using data from the Food and Agriculture Organization of the United Nations and interpolation when required. Tier 1 QA/QC procedures have been performed for emissions estimates, EFs and AD. Quantitative estimates of uncertainty were provided for the sector. Ukraine has included emissions from mules and asses in the 2007 submissions and rabbits and fur animals in the 2008 submission. Ukraine recalculated the entire time series in 2007 and 2008 submissions because of changes in AD and methodologies.

## B. Key categories

### 1. Enteric fermentation – CH<sub>4</sub>

57. The ERT noted that Ukraine identifies the use of a combination of country-specific methods (tier 3 for dairy and non-dairy cattle and tier 1 for other animals) to estimate CH<sub>4</sub> emissions from enteric fermentation. The country-specific methodology estimates gross energy in feed intake based on the amount and structure of feed. This allows Ukraine to estimate CH<sub>4</sub> emissions independently of livestock performance characteristics. In response to the ERT request during the review, Ukraine provided additional information on the methodology used, confirming that the method is tier 3 following the recognized international scientific literature. The ERT recommends that Ukraine improve the documenting of the methodology used in its next annual submission.

58. The ERT noted that in its 2007 and 2008 submissions for reporting CH<sub>4</sub> emissions from enteric fermentation from cattle Ukraine has switched from option B for GHG emission reporting under the IPCC good practice guidance (used in the previous submissions) to option A and reports in the CRF tables emissions from dairy and non-dairy cattle. The ERT further noted that Ukraine has enhanced characterization of the cattle, which will allow the Party to use option B methodology, which is apparently more accurate. The ERT recommends that Ukraine improve the consistency of reporting livestock characterizations in its next annual submission.

59. The ERT noted that in its 2007 submission Ukraine reported country-specific methane conversion factors (MCFs) for cattle (0.066–0.067) based on the national source (Tsvigun et al., 2004).<sup>6</sup> In its 2008 submission, the MCFs were revised to 0.06 based on another national source (Martinez et al., 1995).<sup>7</sup> During the review, in response to the ERT request to clarify this revision, Ukraine explained that the revised values are more accurate, as these take into account feed rations, climatic conditions and animal breeds in different natural zones (marshy woodlands, forest-steppe and steppe). The ERT recommends that Ukraine improve the documenting of the methods used in its next annual submission.

### 2. Direct soils emissions – N<sub>2</sub>O

60. Ukraine used tier 1a and tier 1b methods, the country-specific methodology and the IPCC default EFs to estimate N<sub>2</sub>O emissions from synthetic fertilizers, animal manure applied to soils, crop residues, N-fixing crops and the cultivation of histosols. Recalculated N<sub>2</sub>O emissions are higher by 0.01–0.08 per cent in 2005 and by 0.17–0.50 per cent in 2006 compared to the previous submissions. The methodologies are in accordance with the IPCC good practice guidance. The ERT commends the Party for these improvements.

## C. Non-key categories

### Manure management – CH<sub>4</sub> and N<sub>2</sub>O

61. Ukraine used a tier 2 method for CH<sub>4</sub> emission estimates for cattle, swine and poultry and a tier 1 method for emission estimates for other animal categories. Ukraine identified the types of animal waste management systems (AWMS) that are used in the country and developed country-specific data on allocation of manure to different types of AWMS for cattle, swine and poultry, as well as country-specific volatile solid excretion rates and EFs. The same AWMS were used for the estimation of emissions in 2005 but the manure management system for swine was changed on the base of additional

<sup>6</sup> Tsvigun A.T., Povochnikov M.G. and Blusuk S.M. 2004. Questions about livestock metabolism. // Visnyk NAU. – K., 2004. – № 74. – 394 p. (До питання вивчення обміну речовин в організмі тварин // Науковий вісник НАУ.) In Ukrainian.

<sup>7</sup> Martinez A., Johnson, D.E., Bogdanov, G.A. and Rust, J. 1995. *Reducing Methane Emissions from Ruminant Livestock. Ukraine Pre-feasibility Study*. Final report to the United States Environmental Protection Agency. Morrilton, Arkansas: Winrock International Institute for Agricultural Development.

study in 2006. The recalculation resulted in an increase of CH<sub>4</sub> emissions by 0.01–0.03 per cent in 2005 and by 1–61 per cent in 2006 compared to the previous submissions; N<sub>2</sub>O emissions increased by 1–4 per cent in 2006 compared to 2005.

62. The ERT noted that in the estimate of CH<sub>4</sub> emissions from manure management in the NIR, Ukraine reports enhanced characteristics of the population, taking into account the age of the animals following the option B reporting requirements. However, the CRF tables include information on basic characterization that subdivides cattle only into dairy and non-dairy following the option A requirements. The ERT recommends that Ukraine improve the consistency of reporting livestock characteristics between the NIR and CRF tables in its next annual submission.

## **V. Land use, land-use change and forestry**

### **A. Sector overview**

63. In 2006, the LULUCF sector was a net sink of 32,625.03 Gg CO<sub>2</sub> eq. The removals from the sector decreased by 51.3 per cent between 1990 and 2006. The key driver for the fall in removals is the trend of carbon stock change in agricultural soils.

64. Within the LULUCF sector, cropland was the major source of emissions, accounting for 93.9 per cent of net sectoral emissions; grassland and wetlands accounted for 5.9 and 0.2 per cent, respectively. The emissions in the LULUCF sector were offset by the removals from forest land, which was the only major land-use category that was a net sink in 2006.

65. The ERT noted that the estimated emissions differ between the 2007 and 2008 inventory submissions for the entire time series. This is due to changes in the reported land-use areas, changes in the system of land-use change identification, alteration of adopted assumptions, and major changes in methodologies to estimate emissions for some categories.

66. Ukraine elaborated a system of land-use representation using the IPCC approach 2, which is able to detect land-use conversions. The system applied in the 2007 submission was modified in the 2008 submission, where only the changes under land converted to forest land are considered, and all other mandatory categories of land-use conversion are reported as “NE”.

67. The ERT noted substantial differences in the AD on land areas reported in the 2007 and 2008 submissions. In the 2008 submission, land-use representation of Ukraine is complete as it reported the land areas that are not captured within other land-use categories under the category other land (5.F.) However, the share of the land areas reported under category other land for reconciliation purposes varies from 26 to 36 per cent of the country’s territory.

68. The ERT noted a decreasing trend in the total reported area (under categories other than other land (5F)) amounting to over 3 million ha, which indicates that this area was apparently not reported in 1990–2006. In response to the ERT request for clarification during the review, Ukraine advised the ERT that it used different sources of information for land-use areas. The ERT noted that the information on land-use areas as well as trends provided by Ukraine are not adequately reconciled and the areas given in the NIR do not always match those reported in the CRF tables.

69. The ERT recommends that Ukraine verify and reconcile its land-use area source data and revise its approach to the land-use representation to comply with the requirements of the IPCC good practice guidance for LULUCF. Further the ERT encourages Ukraine to divide cropland by different management practices and intensity. To improve transparency of the emission inventory, the ERT also recommends that Ukraine provide summary tables on the national areas under different land use per year, including the areas of managed and unmanaged land, in its next annual submission.

## **B. Key categories**

### **1. Forest land remaining forest land – CO<sub>2</sub>**

70. Ukraine applied a tier 2 IPCC default method to estimate biomass carbon stock change, using country-specific AD and parameters. The carbon pools of dead organic matter and soil were estimated using a tier 1 method, country-specific AD and default parameters. The country-specific biomass increment data are prescribed for major forest types and climatic zone. However, only a single expansion and conversion factor is used to estimate woody biomass from harvested wood volumes for all tree species. The ERT encourages Ukraine to further verify its set of biomass increment factors and ratios and apply species-specific factors for harvested wood volumes in its next annual submission.

### **2. Land converted to forest land – CO<sub>2</sub>**

71. The ERT noted that Ukraine used country-specific biomass increment rates for estimating the changes in biomass carbon pools. The ERT encourages Ukraine to further verify the applied set of biomass increment factors and ratios, and specifically their applicability for young forests on afforested lands, to justify the estimated CO<sub>2</sub> removals in this category.

### **3. Cropland remaining cropland – CO<sub>2</sub>**

72. The key driver for the sharply decreasing sink and increasing emissions during the time series is carbon stock changes in soils, which were estimated using a country-specific approach based on balance of nitrogen fluxes, applied for the first time in the 2008 submission. This resulted in substantially different estimated emissions as compared to those reported in the 2007 submission where the IPCC methods were applied. The ERT noted that although the method is described in the NIR, the model applies many country-specific assumptions and averaged values that are not well elaborated and thus could not be assessed. The observed emission trend was attributed to actual volumes of crop production and application of fertilizers.

73. The ERT recommends that Ukraine verify its approaches to estimation of carbon stock changes in mineral and organic soil and perform uncertainty analysis using, for example the Monte Carlo approach. The ERT further recommends that Ukraine provide additional information on the methodology used, which would demonstrate the links to and accordance with the IPCC methodologies, in its next annual submission.

## **C. Non-key categories**

### **Grassland remaining grassland – CO<sub>2</sub>**

74. As for the category of cropland remaining cropland described above, Ukraine adopted a new, country-specific approach to estimate emissions and removals from this category based on balance of nitrogen fluxes. This resulted in substantially different results compared to those reported in the 2007 submission where the IPCC methodology was applied. The ERT recommends that Ukraine verify its approaches for estimation of soil carbon stock changes and perform uncertainty analysis using, for example the Monte Carlo approach. Additionally, the ERT recommends that Ukraine provide additional information on the methodology, which would demonstrate the links to and accordance with the IPCC methodologies, in its next annual submission.

## **VI. Information on activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol**

75. In its 2008 submission, Ukraine has submitted on a voluntary basis information required under Article 7, paragraph 1, of the Kyoto Protocol with respect to activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol.



76. The ERT noted that the CRF summary table NIR-1 reports above-ground biomass, litter and soil under afforestation, reforestation and deforestation and only above-ground biomass is reported under the elected activity of forest management. All other parameters were reported as “NA”. The ERT suggests that Ukraine use the appropriate notation keys “NE” for items that shall be but are not estimated in its next annual submission.

77. In CRF table 5(KP-II)5, Ukraine reports GHG emissions from biomass burning as “NE”, although emissions from wildfires are reported in the 2007 and 2008 inventory submissions under the LULUCF sector. The ERT encourages Ukraine to report GHG emissions from biomass burning in its next annual submission.

78. The ERT also noted that land-use areas for afforestation and reforestation reported as total in table P5 1 of the NIR and the sum of the areas under individual categories do not match. It is unclear how the land area undergoing afforestation and reforestation is linked to the total areas of forest land and the land converted to forest land in the 2008 inventory submission. The ERT encourages Ukraine to describe the above-mentioned relationships in its next annual submission.

79. The ERT noted some discrepancies in reporting between CRF summary tables NIR-1 and NIR-2. The areas of deforestation and forest management are not reported in CRF summary table NIR-2 but is indicated in CRF summary table NIR-1 as reported (“R”). The ERT encourages Ukraine to report all the mandatory categories and provide transparent information on the methods used in its next annual submission.

## **VII. Waste**

### **A. Sector overview**

80. In 2006 emissions from the waste sector amounted to 10,118.85 Gg CO<sub>2</sub> eq, or 2.28 per cent of total GHG emissions. Emissions from the sector increased by 20.1 per cent between the base year and 2006. The CH<sub>4</sub> emissions from solid waste disposal on land contributed 1.7 per cent, and CH<sub>4</sub> and N<sub>2</sub>O emissions from wastewater handling contribute 0.34 per cent to total GHG emissions in 2006. CO<sub>2</sub> and N<sub>2</sub>O emissions from waste incineration are reported in the energy sector under energy recovery.

81. The NIR covers emissions from all categories and describes the assumptions used for estimating emissions, aggregated AD and EFs. The CRF includes estimates of most gases and sources of emissions from the waste sector. The ERT noted that CH<sub>4</sub> emissions from industrial waste have been estimated for the first time, following recommendations of the previous review. The ERT commends Ukraine for this improvement.

82. Qualitative estimates of uncertainty are provided in the NIR for the waste sector. Ukraine applied general QA/QC activities for the GHG estimates in the waste sector. The ERT welcomes these efforts.

### **B. Key categories**

#### Solid waste disposal on land – CH<sub>4</sub>

83. Ukraine applies the IPCC first order decay (FOD) method and IPCC default EFs and parameters to estimate CH<sub>4</sub> emissions from solid waste disposal on land. Application of the FOD method requires historical and current data on waste, and information on waste composition and management practices. The ERT noted that detailed information on the AD and EFs used in the waste sector were not provided in the NIR and recommends that Ukraine improve documentation of these in its next annual submission.

84. The ERT noted that Ukraine made considerable efforts to compile data on waste for the period 1948–2006 and report it in the 2008 submission. Ukraine recalculated historical data on waste

composition since 1948 based on different data sources, and provided references for these sources. In order to ensure a stable trend, a linear interpolation has been used. The ERT commends Ukraine for these efforts.

85. The ERT noted that in its 2006 submission Ukraine used the coefficient of waste density (250 kg/m<sup>3</sup>) to transform the volume of waste into mass units; this value is the lowest among the reporting Parties and could result in underestimation of CH<sub>4</sub> emissions. The ERT encourages Ukraine to use weighted quantities of disposed municipal solid waste for reporting on the amount of waste. The ERT recommends that Ukraine continue investigations on the waste density factor for the entire time series, improve documentation on it, and provide revised estimates, if needed, in its next annual submission.

### **C. Non-key categories**

#### **1. Wastewater handling – CH<sub>4</sub> and NO<sub>2</sub>**

86. Emissions from wastewater handling constitute 25.5 per cent of total emissions from the waste sector in 2006. Emissions from wastewater handling decreased by 18.3 per cent from the base year to 2006 mainly due to reduction of wastewater streams. The country-specific EFs and a tier 2 method were used to estimate the emissions. The ERT notes and commends the efforts by the Party to obtain the AD and country-specific EFs required to report emissions from wastewater handling.

#### **2. Waste incineration – CO<sub>2</sub>**

87. Waste incineration is reported under the energy sector. Notation key “IE” is used correctly in the CRF table under the waste sector. The NIR contains a detailed description of the data used for estimating emissions from incineration of municipal solid waste, based on the IPCC default methodology. CO<sub>2</sub> emissions from waste incineration between 1990 and 2006 are relatively constant, with the exception of fluctuations in 1998 and 2001 due to the closure of two incineration plants.

## **VIII. Other issues**

#### **1. Changes to the national system**

88. In its 2008 submission, Ukraine has provided a short description of the structure and the functions of its national system and the institutions involved in the preparation of the GHG inventory. During the review Ukraine informed the ERT that the National Agency of Ecological Investment (NAEI) is responsible for inventory planning, preparation and management according to Decree No. 554 of the Cabinet of Ministers of Ukraine of 21 April 2006 on the adoption of operational procedures for the national system for estimating anthropogenic emissions from sources and removals by sinks of GHG emissions not controlled by the Montreal Protocol (with revisions in Decree No. 392 of the Cabinet of Ministers of Ukraine of 17 April 2008). The ERT recommends that Ukraine include detailed information on the changes to its national system in its next annual submission.

#### **2. Changes to the national registry**

89. In its 2008 submission, Ukraine has not provided information on the changes to its national registry. During the review Ukraine advised the ERT that the NAEI is responsible for the functioning of its national registry according to Decree No. 504 of the Cabinet of Ministers of Ukraine of 28 May 2008 on the formation and maintaining of a national electronic registry of anthropogenic emissions and adsorption of greenhouse gases. Following this Decree and Order No. 1028P of the Cabinet of Ministers of Ukraine of 30 June 2008 on the introduction of assigned amount units, the software and hardware meets all technical and security requirements for the registry. The ERT recommends that Ukraine include information on the changes in implementation, operation, maintenance and allocation of human resources for the functioning of the national registry in its next annual submission.

### 3. Commitment period reserve

90. Ukraine has not reported its commitment period reserve (CPR) in the 2008 submission. In response to the ERT request during the review Ukraine submitted its revised CPR. Based on the total GHG emissions in the most recently reviewed inventory (443,183.48 Gg CO<sub>2</sub> eq), the Party calculates its commitment period reserve to be 2,215,917,415 t CO<sub>2</sub> eq. The ERT agrees with this figure. The ERT recommends that Ukraine include information on its commitment period reserve in its next annual submission.

## **IX. Conclusions and recommendations**

91. The ERT concludes that the 2008 inventory submission has been prepared generally in accordance with the Revised 1996 IPCC Guidelines, the IPCC good practice guidance and the IPCC good practice guidance for LULUCF. The inventory covers all sectors and most categories of sources and sinks and is generally transparent and complete in terms of years, gases and geographic coverage. The ERT noted that Ukraine has improved its 2008 inventory submission compared to its 2007 submission; however, it identified some gaps in the reporting of several categories in the energy and industrial processes sectors.

92. The ERT commends Ukraine for the voluntary submission of the CRF tables for the activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol. The ERT noted the change in the system of land-use change identification and encourages Ukraine to reconcile land-use areas reported in the NIR and the CRF tables and to improve completeness of reporting of information under Article 3, paragraphs 3 and 4, of the Kyoto Protocol.

93. In the course of the review, the ERT formulated a number of recommendations relating to the completeness, consistency, accuracy and transparency of the information presented by Ukraine. The main recommendations are that Ukraine, in its next annual submission, should:

- (a) Include information on changes to its national system for planning, preparation and management of the GHG inventory and the changes to the national registry;
- (b) Describe the QA/QC plan and document the implementation of the QA/QC activities;
- (c) Improve transparency and documentation on methodological description and AD, in particular for industrial processes, and improve transparency of reporting uncertainties;
- (d) Provide explanatory information on recalculations in the CRF tables and in the NIR;
- (e) Apply a tier 2 or higher method in the estimation of emissions from key categories where these methods are not yet used;
- (f) Improve the completeness of reporting by estimating emissions that are not yet estimated in the energy and industrial processes sectors.

## **X. Questions of implementation**

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

Annex**Documents and information used during the review****A. Reference documents**

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

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

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

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

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

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

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

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

Status report for Ukraine 2007. Available at <<http://unfccc.int/resource/docs/2007/asr/ukr.pdf>>.

Status report for Ukraine 2008. Available at <<http://unfccc.int/resource/docs/2008/asr/ukr.pdf>>.

Synthesis and assessment report on the greenhouse gas inventories submitted in 2007. Available at <[http://unfccc.int/files/national\\_reports/annex\\_i\\_ghg\\_inventories/inventory\\_review\\_reports/application/pdf/sa\\_2007\\_part\\_i\\_final.pdf](http://unfccc.int/files/national_reports/annex_i_ghg_inventories/inventory_review_reports/application/pdf/sa_2007_part_i_final.pdf)>.

Synthesis and assessment report on the greenhouse gas inventories submitted in 2008. Available at <[http://unfccc.int/files/national\\_reports/annex\\_i\\_ghg\\_inventories/inventory\\_review\\_reports/application/pdf/sa\\_2008\\_part\\_i\\_final.pdf](http://unfccc.int/files/national_reports/annex_i_ghg_inventories/inventory_review_reports/application/pdf/sa_2008_part_i_final.pdf)>.

FCCC/ARR/2006/UKR. Report of the individual review of the greenhouse gas inventory of Ukraine submitted in 2006. Available at <<http://unfccc.int/resource/docs/2007/arr/ukr.pdf>>.

FCCC/IRR/2007/UKR: Report of the review of the initial report of Ukraine. Available at <<http://unfccc.int/resource/docs/2007/irr/ukr.pdf>>.

**B. Additional information provided by the Party**

Responses to questions during the review were received from Ms. Natalya Ivanenko (Department of National Inventory System, National Agency of Ecological Investments of Ukraine), including additional material on the methodology and assumptions used.

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