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COMPLIANCE COMMITTEE

CC/ERT/ARR/2010/37  
29 November 2010

**Report of the individual review of the annual submission of  
Bulgaria submitted in 2010**

**Note by the secretariat**

The report of the individual review of the annual submission of Bulgaria submitted in 2010 was published on 29 November 2010. For purposes of rule 10, paragraph 2, of the rules of procedure of the Compliance Committee (annex to decision 4/CMP.2, as amended by decision 4/CMP.4), the report is considered received by the secretariat on the same date. This report, FCCC/ARR/2010/BGR, contained in the annex to this note, is being forwarded to the Compliance Committee in accordance with section VI, paragraph 3, of the annex to decision 27/CMP.1.





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\* In the symbol for this document, 2010 refers to the year in which the inventory was submitted, and not to the year of publication.

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## I. Introduction and summary

1. This report covers the in-country review of the 2010 annual submission of Bulgaria, coordinated by the UNFCCC secretariat, in accordance with decision 22/CMP.1. The review took place from 4 to 9 October 2010 in Sofia, Bulgaria, and was conducted by the following team of nominated experts from the UNFCCC roster of experts: generalist – Mr. Michael Strogies (Germany); energy – Mr. Frank Neitzert (Canada); industrial processes – Mr. Justin Goodwin (United Kingdom); agriculture – Mr. Jorge Alvarez (Peru); land use, land-use change and forestry (LULUCF) – Ms. Marina Vitullo (Italy); and waste – Ms. Tatiana Tugui (Republic of Moldova). Mr. Strogies and Ms. Tugui were the lead reviewers. The review was coordinated by Mr. Matthew Dudley (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 Bulgaria, which provided comments that were considered and incorporated, as appropriate, into this final version of the report.

3. In 2008, the main greenhouse gas (GHG) in Bulgaria was carbon dioxide (CO<sub>2</sub>), accounting for 74.2 per cent of total GHG emissions<sup>1</sup> expressed in CO<sub>2</sub> eq, followed by methane (CH<sub>4</sub>) (18.1 per cent) and nitrous oxide (N<sub>2</sub>O) (7.2 per cent). Hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF<sub>6</sub>) collectively accounted for 0.4 per cent of the overall GHG emissions in the country. The energy sector accounted for 70.0 per cent of total GHG emissions, followed by waste (13.9 per cent), agriculture (8.0 per cent), industrial processes (8.0 per cent) and solvent and other product use (0.1 per cent). Total GHG emissions amounted to 75,195.90 Gg CO<sub>2</sub> eq and decreased by 37.4 per cent between the base year<sup>2</sup> and 2008.

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, respectively. In table 1 CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O 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.

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<sup>1</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>2</sup> “Base year” refers to the base year under the Kyoto Protocol, which is 1988 for CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O and 1995 for HFCs, PFCs and SF<sub>6</sub>. 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 2008<sup>a</sup>**

	Greenhouse gas	Base year <sup>a</sup>	Gg CO <sub>2</sub> eq							Change Base year–2008 (%)	
			1990	1995	2000	2005	2006	2007	2008		
Annex A sources	CO <sub>2</sub>	96 281.18	85 246.45	65 541.66	50 813.59	54 584.14	56 006.83	59 441.79	55 830.91	–42.0	
	CH <sub>4</sub>	20 199.79	19 418.09	16 663.14	14 556.51	14 077.42	13 896.28	13 744.85	13 603.96	–32.7	
	N <sub>2</sub> O	15 058.95	12 767.53	6 821.97	5 664.29	5 635.14	5 349.27	5 221.45	5 445.03	–63.8	
	HFCs	10.93	NE	10.93	30.12	113.29	176.66	205.98	305.97	2 700.2	
	PFCs	NE	NE	NE	NE	NE	NE	NE	0.00	NA	
	SF <sub>6</sub>	5.44	NE	5.44	7.21	8.94	9.29	9.66	10.03	84.5	
KP-LULUCF	Article 3.3 <sup>b</sup>	CO <sub>2</sub>							–1 093.27		
		CH <sub>4</sub>							NO		
		N <sub>2</sub> O							NO		
	Article 3.4 <sup>c</sup>	CO <sub>2</sub>	NA							NA	NA
		CH <sub>4</sub>	NA							NA	NA
		N <sub>2</sub> O	NA							NA	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, NE = not estimated, NO = not occurring.

<sup>a</sup> “Base year” for Annex A sources refers to the base year under the Kyoto Protocol, which is 1988 for CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O and 1995 for HFCs, PFCs and SF<sub>6</sub>. The “base year” for activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol is 1988. GHG data are based on the official resubmission of Bulgaria on 10 November 2010.

<sup>b</sup> 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.

<sup>c</sup> 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 years of the commitment period inventory must be reported.

Table 2

**Greenhouse gas emissions by sector and activity, base year to 2008**

	Sector	Gg CO <sub>2</sub> eq							Change		
		Base year <sup>a</sup>	1990	1995	2000	2005	2006	2007	2008	Base year–2008 (%)	
Annex A	Energy	89 762.41	79 445.70	59 551.44	47 000.20	50 659.78	52 177.22	55 378.41	52 658.44	–41.3	
	Industrial processes	12 302.73	10 739.04	10 099.82	6 485.53	6 656.52	6 416.09	6 861.63	6 017.77	–51.1	
	Solvent and other product use	75.99	73.30	70.90	67.21	53.47	55.42	53.99	54.47	–28.3	
	Agriculture	17 984.31	15 683.86	7 426.21	6 557.85	6 383.04	6 198.15	5 824.79	6 029.95	–66.5	
	Waste	11 430.84	11 490.15	11 894.79	10 960.91	10 666.12	10 591.45	10 504.90	10 435.28	–8.7	
	Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	
	LULUCF	NA	–13 387.06	–12 459.97	–9 678.06	–10 813.89	–10 872.58	–9 710.94	–11 012.75	NA	
	<b>Total (with LULUCF)</b>	NA	92 554.85	64 688.38	50 432.74	52 938.92	53 974.31	68 912.78	64 183.14	NA	
	<b>Total (without LULUCF)</b>	120 125.44	105 941.91	77 148.35	60 110.80	63 752.81	64 846.89	78 623.72	75 195.90	–37.4	
KP-LULUCF	Article 3.3 <sup>b</sup>	Afforestation & reforestation							–1 366.32	NA	
		Deforestation							273.05	NA	
		<b>Total (3.3)</b>							–1 093.27	NA	
	Article 3.4 <sup>c</sup>	Forest management	NA							NA	NA
		Cropland management	NA							NA	NA
		Grazing land management	NA							NA	NA
		Revegetation	NA							NA	NA
		<b>Total (3.4)</b>	NA							NA	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.

<sup>a</sup> “Base year” for Annex A sources refers to the base year under the Kyoto Protocol, which is 1988 for CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O and 1995 for HFCs, PFCs and SF<sub>6</sub>. The “base year” for activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol is 1988. GHG data are based on the official resubmission of Bulgaria on 10 November 2010.

<sup>b</sup> 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.

<sup>c</sup> 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 tonnes of CO<sub>2</sub> equivalent**

	<i>As reported</i>	<i>Adjustment<sup>a</sup></i>	<i>Final<sup>b</sup></i>	<i>Accounting quantity<sup>c</sup></i>
<b>Commitment period reserve</b>	<b>378 963 955</b>		<b>375 979 492</b>	
<b>Annex A emissions for current inventory year</b>				
CO <sub>2</sub>	55 464 790		55 830 911	
CH <sub>4</sub>	13 549 647		13 603 961	
N <sub>2</sub> O	4 994 025		5 445 029	
HFCs	299 319		305 965	
PFCs	0		0	
SF <sub>6</sub>	10 032		10 032	
<b>Total Annex A sources</b>	<b>74 317 814</b>		<b>75 195 898</b>	
<b>Activities under Article 3, paragraph 3, for current inventory year</b>				
3.3 Afforestation and reforestation on non-harvested land for current year of commitment period as reported		-1 366 318	-1 366 318	
3.3 Afforestation and reforestation on harvested land for current year of commitment period as reported		NA	NA	
3.3 Deforestation for current year of commitment period as reported		273 048	273 048	
<b>Activities under Article 3, paragraph 4, for current inventory year<sup>d</sup></b>				
3.4 Forest management for current year of commitment period				
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				

*Abbreviation:* NA = not applicable.

<sup>a</sup> "Adjustment" is relevant only for Parties for which the ERT has calculated a or several adjustment(s).

<sup>b</sup> "Final" includes revised estimates, if any, and/or adjustments, if any.

<sup>c</sup> "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.

<sup>d</sup> Activities under Article 3, paragraph 4, are relevant only for Parties that elected one or more such activities.



6. The GHG 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 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). Further, the GHG inventory submission is generally of a high quality; it covers all sectors and most categories and gases and all years of the inventory time series and geographical coverage. The expert review team (ERT) found that the 2010 annual submission has, in general, been reported 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). The ERT identified areas for further improvement in relation to transparency, accuracy, completeness, comparability and consistency that are listed in paragraph 17 below.

7. Bulgaria acknowledged this finding at the time of the review and undertook steps to improve the accuracy and completeness of the inventory submission by submitting revised emission estimates to the ERT during the review week in the energy, industrial processes, agriculture and waste sectors, and further information in relation to LULUCF. In response to the potential issues and questions raised by the ERT, Bulgaria submitted revised emission estimates on 22 October 2010 in the energy, industrial processes, agriculture and waste sectors, and further information in relation to KP-LULUCF and LULUCF.

8. By submitting the revised inventories and submitting the additional information requested by the ERT during, before and after the review week, Bulgaria has demonstrated sufficient capacity to develop an inventory in line with the Revised 1996 IPCC Guidelines, the IPCC good practice guidance and the IPCC good practice guidance for LULUCF.

9. The Party 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. However, during the course of the review, the ERT could not resolve with the Party a mandatory reporting requirement set out in paragraph 8(a) of the annex to decision 15/CMP.1 in relation to demonstrating that activities under Article 3, paragraph 3, are directly human-induced. Recommendations concerning this requirement are mentioned in paragraphs 179 and 201 below.

10. Bulgaria has chosen to account for activities under Article 3, paragraph 3, of the Kyoto Protocol at the end of the commitment period. The Party has not elected any activities under Article 3, paragraph 4, of the Kyoto Protocol.

11. Bulgaria 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.

12. Bulgaria prepared and reported its 2010 annual submission under a national system that had been significantly improved and strengthened since its previous annual submission (see chapters II.A.3 and II.G.3). The ERT met with all staff within the single national entity, the Executive Environment Agency (ExEA), and with members of institutions and consultants that are part of the national system and the inventory development process. The ERT concludes that this national system is performing its required functions as set out in the annex to decision 19/CMP.1 with respect to the institutional, legal and procedural arrangements to perform these functions; that the institutional, legal and procedural arrangements established and formalized by the “Ordinance on the way and order of organization of the national inventories of hazardous substances from greenhouse gases in

the ambient air”<sup>3</sup> that entered into force on 21 September 2010 is fully operational; and that Bulgaria has in place the institutional arrangements and the capacity (including the arrangements for the technical competence of staff involved in the national system) to plan, prepare and manage inventories on an annual basis.

13. During the review week, Bulgaria informed the ERT that it had initiated a process to address the problem of annual contracts with consultants used to develop certain sectors of the inventory. The ERT is satisfied that the intent of the Party is not only to ensure the security of these services during the first commitment period by extending the period of the contract, but also for these consultants to transfer knowledge and understanding of inventory compilation to staff within ExEA.

14. The ERT concludes that the 2010 annual submission is a considerable improvement on the Party’s previous annual submissions. Further, Bulgaria was able to provide specific information during the in-country review in response to questions of the ERT.

15. 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 decisions of the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol (CMP). However, the ERT reiterates a finding of the standard independent assessment report (SIAR), namely that the national registry does not fulfil the requirements regarding the public availability of information in accordance with section I.E of the annex to decision 13/CMP.1 (see para. 187 below).

16. Bulgaria 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 national inventory report (NIR).

17. In the course of the review, the ERT formulated a number of recommendations relating to:

- (a) Transparency (see paras. 54, 60(b–d), 91, 118(d), 119(b), 152(b), 155, 156, 158 and 206(a) and (d) below);
- (b) Accuracy (see paras. 43, 47, 176 and 206(b) below);
- (c) Completeness (see paras. 25, 27, 28, 87 and 90 below);
- (d) Comparability (see para. 60(i) below);
- (e) Consistency (see paras. 25 and 60(g) and (h) below).

## **II. Technical assessment of the annual submission**

### **A. Overview**

#### **1. Annual submission and other sources of information**

18. The 2010 annual inventory submission was submitted on 15 April 2010; it contains a complete set of common reporting format (CRF) tables for the period 1988–2008 and an NIR. Bulgaria also submitted information required under Article 7, paragraph 1, of the Kyoto Protocol, including information on: activities under Article 3, paragraph 3, of the

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<sup>3</sup> Council of Ministers. 2010. *Ordinance on the way and order of organization of the national inventories of hazardous substances from greenhouse gases in the ambient air*, according to Ordinance No. 215/21.09.2010 by the Council of the Ministers [published in SG 76/2010]. Available at <<http://dv.parliament.bg/DVWeb/broeveList.faces>>.

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 15 April 2010. Bulgaria resubmitted its NIR on 27 May 2010 and 13 August 2010 and resubmitted its CRF tables (including KP-LULUCF CRF tables) on 19 May 2010, 27 May 2010 and 13 August 2010. The ERT has used the 13 August 2010 resubmission as the basis for this review; other information, including revised estimates, submitted to the ERT during the review week were noted by the ERT. The annual submission was submitted in accordance with decision 15/CMP.1. However, the ERT strongly recommends that Bulgaria submit its official and final 2011 annual submission on 15 April 2011 and minimize resubmissions thereafter.

19. Bulgaria officially submitted revised emission estimates on 22 October 2010 in response to questions raised by the ERT during the course of the in-country visit. Some of the revised estimates received had been received informally during the review week. Bulgaria also submitted on 22 October 2010 revised information in response to questions of the ERT on KP-LULUCF:

(a) Reporting of carbon pools (see paras. 181 and 184 below) as required by paragraph 6(e) of the annex to decision 15/CMP.1;

(b) Information to demonstrate that activities under Article 3, paragraph 3, began on or after 1 January 1990 and are directly human-induced, as required by paragraph 8(a) of the annex to decision 15/CMP.1 (see para. 179 below).

20. In response to further questions by the ERT, Bulgaria submitted revised estimates for the agriculture sector on 10 November 2010.

21. In addition, the ERT used the 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.<sup>4</sup>

22. During the review, Bulgaria provided the ERT with additional information and documents which 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

23. The 2010 annual submission covers all sectors and most categories, gases and years, and is complete in terms of geographical coverage. Bulgaria reported this information in line with the UNFCCC reporting guidelines, including the CRF tables for all years of the inventory time series, and using the annotated outline of the NIR to report elements under the Kyoto Protocol. Bulgaria reported actual emissions of fluorinated gases (F-gases) and potential emissions only for HFCs, but only for the period 1995–2008.

24. The ERT identified gaps in the reporting of the Party, in relation to:

(a) Gaps in the NIR with respect to requirements of the UNFCCC reporting guidelines regarding cross-cutting issues such as the uncertainty analysis, key category analysis and recalculations;

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<sup>4</sup> 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 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.

(b) Coverage of CRF tables, as tables 8(a) and 8(b) (recalculations) were not reported;

(c) Coverage of years in the F-gas emission time series, as the Party only reported emissions for the period 1995–2008;

(d) Verifiable information which demonstrates that the carbon pools reported as not estimated (“NE”) are not a net source of emissions;

(e) Information demonstrating that activities under Article 3, paragraph 3, of the Kyoto Protocol are directly human-induced and had begun after 1 January 1990 and before 31 December 2008.

25. The ERT recommends that Bulgaria address the gaps in the NIR and CRF tables identified above and report on this in its next annual submission in accordance with the UNFCCC reporting guidelines. Further, it is recommended that Bulgaria report actual and potential emissions for all years of the inventory time series, namely 1988–2008, and report potential emissions for PFCs and SF<sub>6</sub>.

26. In response to questions from the ERT during the review, Bulgaria submitted revised information on 22 October 2010 to:

(a) Demonstrate that land activities under Article 3, paragraph 3, of the Kyoto Protocol are directly human-induced. The ERT concludes that the additional information provided by the Party did not demonstrate that all units of land reported under afforestation and reforestation are directly human-induced;

(b) Demonstrate that the deadwood pool for afforestation and reforestation is not a net source. The ERT concludes that the additional information provided by the Party did not address the issue of concern.

27. As issues listed in paragraph 26 (above) remain unresolved, Bulgaria is strongly recommended to include the information required by paragraphs 6(e) and 8(a) of the annex to decision 15/CMP.1 in its next annual submission.

28. The ERT identified gaps in the inventory where the following categories are reported as “NE”:

- (a) Waste fuel combustion in cement kilns – all GHGs (1.A.2.f);
- (b) Road transport: biofuels – CH<sub>4</sub> and N<sub>2</sub>O;
- (c) Refrigeration and air-conditioning equipment – HFCs;
- (d) Foam blowing – HFCs and PFCs;
- (e) Fire extinguishers – PFCs;
- (f) Aerosols/metered dose inhalers – PFCs;
- (g) Solvents – HFCs and PFCs;
- (h) Semiconductor manufacture – HFCs and PFCs;
- (i) Electrical equipment – HFCs and PFCs;
- (j) Other (consumption of halocarbons and SF<sub>6</sub>) – HFCs, PFCs and SF<sub>6</sub>;
- (k) Other (direct emissions) – N<sub>2</sub>O.

29. In response to questions raised by the ERT, Bulgaria submitted revised estimates on 22 October 2010 for categories listed in paragraph 28 above. The ERT accepted these revised estimates and concludes that these have been prepared in line with the Revised 1996 IPCC Guidelines and the IPCC good practice guidance.

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

Overview

30. The ERT concluded that the national system performed its required functions in line with the general and specific functions set out in the annex to decision 19/CMP.1.

31. The Party described the changes in the national system, including the strengthening of institutional, legal and procedural arrangements, and technical competence of staff involved in inventory development, since the previous annual submission and these changes are discussed in chapter II.G.3 of this report. The ERT commends Bulgaria for its efforts in this regard.

Inventory planning

32. During the in-country visit, Bulgaria explained the institutional arrangements for the preparation of the inventory. The Ministry of Environment and Water (MoEW) has overall ministerial responsibility for the national inventory, and ExEA is the single national entity. Other government departments and agencies, institutions and organizations are also involved in the planning and preparation of the inventory.

33. ExEA is tasked with specific responsibilities in its agreement with MoEW, including:

- (a) Choice of methodology;
- (b) Collection of activity data (AD) and emission factors (EFs) from statistical services and other bodies;
- (c) Inventory preparation, including the calculation of emission estimates and preparation of the CRF tables and NIR;
- (d) Coordinating quality assurance/quality control (QA/QC) activities;
- (e) Archiving.

34. Institutional agreements exist between MoEW and:

(a) The National Statistics Institute (NSI), covering cooperation and the exchange of information between MoEW and the NSI with respect to providing statistical data under the “emissions of hazardous substances under the United Nations Framework Convention on Climate Change (UNFCCC) and under the Convention on Long-Range Transboundary Air Pollutants” (RD21-35/12.02.2010) dated 12 February 2010, for the compilation of the energy, industrial processes and waste sectors;

(b) The Ministry of Agriculture and Food (MAF), covering cooperation and the exchange of information between MoEW and MAF (04-00-517/26.02.2010 and RD 50-47/15.03.2010) dated 15 March 2010, for the compilation of the agriculture and LULUCF sectors;

(c) The Ministry of Economy, Energy and Tourism (MEET), covering cooperation and the exchange of information between MoEW and MEET dated 14 June 2010, for the compilation of the energy sector (fugitive emissions from fuel);

(d) The Ministry of the Interior (MI) dated 8 June 2010 to provide information and data for the compilation of the transport subsector.

35. Cooperation agreements exist between ExEA and:

(a) The University of Forests (UF), by agreement “Development of methodology for calculation of emissions and removals for LULUCF sector according to requirements of UNFCCC and Kyoto Protocol” of 24 November 2009;

(b) The private contractor, Denkstatt, by contractual agreement to provide services for the compilation of the energy and industrial processes sectors;

(c) The Bulgarian Academy of Sciences Geophysical Institute (BASGI) by agreement “Recalculations of previously submitted estimates of emissions under UNFCCC and CLRTAP” dated 1 December 2009.

36. During the review week, the ERT was informed that arrangements included above had been extended for the following:

(a) The UF to assist ExEA in its compilation of the LULUCF inventory;

(b) Denkstatt to prepare the energy and F-gas emission estimates, including implementation of the COPERT model to estimate emissions from road transportation;

(c) BASGI to cross-check results of the improved 2010 annual submission;

(d) The University of Chemical Technology and Metallurgy to prepare the 2011 annual submission for waste incineration.

37. The period of the contract with Denkstatt is annual. This is of concern to the ERT, because this form of contract does not provide certainty regarding the Party’s capacity to ensure the function and service provided by Denkstatt for all the years of the commitment period. However, the Party informed the ERT during the review week that a contract extension was in the last stages of finalization. The ERT welcomes this development.

38. The ERT noted with some concern the allocation of resources within ExEA to each sector of the inventory. The development of the GHG inventory, including emission estimates, is overseen by ExEA. However, using the energy sector as an example, one member of ExEA, who also functions as the national inventory compiler, has sole responsibility for the sector and is assisted in this task by a private contractor (Denkstatt) in preparing the energy estimates. The estimates for the 13 August 2010 resubmission and the 22 October 2010 resubmission were prepared in a short period by a new team using newly developed methods and software tools. As a result, the methodologies are largely based on tier 1 approaches, which imply a number of simplifying assumptions and limitations.

39. To ensure continuous improvement, as required under the IPCC good practice guidance, the documentation of methods and procedures to allow ongoing consistency and knowledge retention is essential. It has been noted that, in the Bulgarian inventory submission, procedures to document methods and procedures have only just begun and are at the preliminary stages. Again, using the energy sector as an example, although the energy team seems to operate with good cooperation and a high level of determination, resources are limited and, at this level, will continue to be strained to maintain an appropriate improvement programme and ongoing quality (especially considering the short development period remaining for the 2011 submission). The ERT recommends that Bulgaria make additional resources available to ensure adequate support for the compilation of emission estimates for all sectors of the inventory.

40. Bulgaria has developed an inventory improvement plan that was included in the 13 August 2010 resubmission. The ERT found that this plan addressed the recommendations raised in the previous expert review, including the legal basis, institutional arrangements, expert resources inside ExEA and the strengthening of cooperation agreements, the quality management system and sectoral improvements. The plan further includes a prioritization of the different tasks and an overview for reporting of the 2010 annual submission.

## Inventory preparation

### *Key categories*

41. Bulgaria has reported a key category tier 1 analysis, both level and trend assessment, as part of its 2010 submission. The key category analysis performed by the Party and that performed by the secretariat<sup>5</sup> for 2008 produced similar results. Bulgaria 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. Bulgaria is planning to implement a tier 2 analysis in 2012. The ERT encourages Bulgaria to continue its efforts with this planned improvement.

42. During the review week, Bulgaria informed the ERT that it did, in part, use the output of the key category analysis to improve the quality of its 2010 inventory submission because the focus of improvement in this submission was completeness. The ERT encourages the Party to extend the use of the key category analysis as a basis to improve the quality of its inventory submission.

### *Uncertainties*

43. Bulgaria has reported a tier 1 uncertainty analysis for the overall inventory. The uncertainty analysis excludes the LULUCF sector, because uncertainty estimates for AD are not yet available. For the other sectors, information on uncertainties is reported quantitatively for some categories and qualitatively for others; no information on uncertainty is reported for some categories (e.g. LULUCF). The ERT recommends that Bulgaria complete the uncertainty analysis by including quantitative estimates for all categories (including the LULUCF sector). The ERT further recommends that the Party improve its reporting of the results of the uncertainty analysis in the NIR that was partly provided to the ERT during the review week by reporting this analysis using the tables provided in the IPCC good practice guidance.

44. The ERT noted that the reported quantitative uncertainty for total GHG emissions in 2008 was estimated to be 13.2 per cent, while the corresponding uncertainty introduced by the trend was estimated to be 3.6 per cent. The uncertainty analysis is mainly based on the default uncertainties included in the IPCC good practice guidance and in the CORINAIR guidebook, on country-specific information obtained directly from AD providers (plants and associations) and on expert judgement. The ERT encourages the Party to use more country-specific information and to request the institutions providing AD, or those institutions in charge of estimating emissions (especially for the LULUCF sector), to estimate the relevant uncertainty data as well as emissions.

45. Bulgaria only uses the results of the uncertainty analysis to a limited extent to prioritize further improvements in the inventory.

46. Bulgaria is planning to perform a tier 2 uncertainty analysis in 2012. The ERT encourages Bulgaria to continue with this planned improvement.

47. Bulgaria has not identified uncertainties for activities under Article 3, paragraph 3, of the Kyoto Protocol, which is a reporting requirement. The ERT recommends that the

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<sup>5</sup> 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.

Party report its uncertainty analysis for both LULUCF and KP-LULUCF in its next annual submission.

*Recalculations and time-series consistency*

48. Recalculations have been performed in accordance with the IPCC good practice guidance; however, the ERT noted that the recalculations have not been reported in accordance with the IPCC good practice guidance and the UNFCCC reporting guidelines. The ERT further noted that this shortcoming is a result of the numerous resubmissions of the 2010 annual submission and that the Party did not update its NIR and CRF table 8 to reflect recalculations undertaken in each resubmission when compared with the 2009 annual submission, nor did it provide the rationale for these recalculations. Recalculations reported in the 13 August 2010 resubmission were explained to the ERT during the course of the review week.

49. In the 13 August 2010 resubmission, the ERT noted that recalculations reported by the Party for the time series 1988–2007 had been undertaken, as follows:

(a) Energy sector – changes and/or improvements in AD regarding the use of Eurostat data and some industry-sourced energy data and a wide variety of new EFs, including those derived from verified reports under the European Union emissions trading scheme (EU ETS) (for coal and waste combusted by industry) and IPCC default factors, utilized for new transportation, fugitive and stationary combustion methods;

(b) Industrial processes sector – changes and/or improvements in AD and EFs in the mineral products and the chemical industries subsectors, including the use of data obtained under the EU ETS, and improvements in AD, EFs and other parameters obtained from a recent study on F-gases to estimate emissions from the consumption of halocarbons and SF<sub>6</sub>;

(c) Agriculture sector – changes and/or improvements in AD regarding milk production and the weight of sheep and pigs; the inclusion of emission sources previously not reported (sludge and buffalo); and based on the correct application of the IPCC good practice guidance in relation to the distribution of animal waste management systems (AWMS) and the use of the methane conversion factor (MCF) for different areas of the country;

(d) LULUCF sector – changes and/or improvements in AD, EFs and reporting of non-CO<sub>2</sub> gases;

(e) Waste sector – changes and/or improvements in AD on the amount of waste incinerated based on information received from 49 waste incinerators.

50. The major changes, and the magnitude of the impact, include: a decrease in estimated total GHG emissions in the base year (1988) (4.3 per cent), a decrease in 1995 (1.1 per cent) and an increase in 2007 (2.0 per cent). The rationale for these recalculations is not provided in the NIR or in CRF table 8(b). The ERT recommends that, in its next annual submission, Bulgaria report recalculations in accordance with the requirements set out in the IPCC good practice guidance.

51. The major changes in the 22 October 2010 resubmission and the 10 November 2010 agriculture resubmission, and the magnitude of the impact when compared with the 2009 annual submission, include: a decrease in estimated total GHG emissions in the base year (1988) (1.7 per cent), an increase in 1995 (0.5 per cent) and an increase in 2007 (3.7 per cent). These recalculations were undertaken in response to potential issues identified by, and questions from, the ERT; however, the rationale for these recalculations is not reported in CRF table 8 (the NIR was not resubmitted by the Party). The ERT recommends that, in its next annual submission, Bulgaria report recalculations in accordance with the



requirements set out in the IPCC good practice guidance and the UNFCCC reporting guidelines.

*Verification and quality assurance/quality control approaches*

52. Since the previous annual submission, ExEA has implemented its QA/QC system. This system is based on the “national plan for data quality management in the national emission inventories under the UN Framework Convention on Climate Change” approved by MoEW, and is coordinated by an expert not directly involved in the inventory development process. The system covers all participants in the Bulgarian national system and uses specific checklists. The NIR provided a description of the QA/QC plan and its implementation in the context of the inventory preparation process. However, the ERT noted that information on QA/QC procedures does not cover all the steps of the process of inventory compiling (e.g. cross-checks between the NIR and CRF). The ERT recommends that the Party include provisions in its QA/QC activities for a final check of the consistency between the NIR and CRF. The ERT further recommends that Bulgaria develop guidance on the use of checklists to ensure that there is a common and consistent understanding and use of QA/QC procedures and checklists.

53. Results of the QA/QC activities are considered in the review of the inventory improvement plan. The ERT commends Bulgaria in this undertaking and recommends that the Party also consider including this information in its NIR.

*Transparency*

54. Improvements have been made to the NIR in response to previous review recommendations (specifically in respect to cross-cutting issues). The ERT noted that the NIR could be further improved by including more detailed information on:

- (a) Methodologies, AD and EFs and other parameters at the category level and the rationale for their selection;
- (b) Trend analysis;
- (c) Recalculations;
- (d) Key category analysis;
- (e) Uncertainty analysis;
- (f) Verifiable information demonstrating that carbon pools “NE” in the KP-LULUCF inventory are not a net source;
- (g) Information demonstrating that activities under Article 3, paragraph 3, are directly human-induced.

Inventory management

55. Bulgaria has a centralized archiving system, which includes the archiving of disaggregated EFs and AD, and documentation on how these factors and data have been generated and aggregated for the preparation of the inventory. The archived information also includes internal documentation on QA/QC procedures, external and internal reviews, documentation on annual key categories and key category identification, and planned inventory improvements. The archive is kept in the offices of ExEA. The ERT encourages Bulgaria to develop a file management system for its archive, as this will ensure the transparency required in the future process of archiving all information. The ERT also encourages Bulgaria to implement its stated improvements in relation to archiving information and data from previous annual submissions.

### 3. Follow-up to previous reviews

56. Bulgaria has, in general, implemented most of the recommendations from the previous expert review. Of particular note are improvements made to the national system with respect to its institutional arrangements and the technical competence of staff, and the implementation of its QA/QC system. Bulgaria has also made significant improvements in the quality of its GHG inventory by implementing most of the recommendations from the previous expert review.

57. However, recommendations from the previous annual review report not addressed by the Party in its 2010 annual submission include:

(a) Improvement in the preparation and reporting of the uncertainty analysis by including the LULUCF sector in the analysis (see para. 142 below);

(b) Improvements in the allocation of fuels used for national and international transportation (see para. 69 below);

(c) Preparation of emission estimates for iron production using data on the amount of reducing agent (coke) collected or derived from national statistics and/or from industry (see para. 97 below);

(d) Improvement of the AD time series used to estimate emissions from enteric fermentation for the years before 2001 (see para. 128 below);

(e) Improvement of the documentation on AD for field burning of agricultural residues (see para. 134 below);

(f) Improvement of the documentation on the basis of emission estimates for the waste sector by including information on relevant waste management practices as well as further information and detailed descriptions of the background data and references, AD and EFs used (see para. 155 below).

### 4. Areas for further improvement

#### Identified by the Party

58. The 2010 NIR identified several areas for improvement, including:

(a) Further improvements to its national system;

(b) Incorporating country-specific EFs derived from the analysis of data obtained under the EU ETS;

(c) Improved implementation of the QA/QC system in the compilation of its annual submission (NIR and CRF);

(d) Revising AD for numerous categories in the energy, industrial processes, agriculture and waste sectors;

(e) Developing uncertainty estimates for LULUCF.

59. During the review week, Bulgaria communicated to the ERT additional areas of improvement, including:

(a) Extending the period of agreements with other agencies, ministries and organizations that currently have institutional or cooperation agreements, with a view to ensuring that the national system can provide a GHG inventory for each year of the commitment period;

(b) A tier 2 uncertainty analysis;

- (c) More effort in developing country-specific EFs.

Identified by the expert review team

60. The ERT identified the following cross-cutting issues for improvement:

(a) Addressing recommendations from the previous expert review in relation to transparency, accuracy, completeness, consistency and comparability of its annual submission;

(b) Transparency in relation to improved documentation of category-level methodologies, AD, EFs and other parameters used to estimate emissions, references to sources of AD and the rationale for selecting a methodology;

(c) Transparency in relation to the use of EU ETS data in the inventory and information demonstrating how its use is in line with the IPCC good practice guidance;

(d) Transparency in relation to providing information that demonstrates that the use of an EF from the *2006 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the 2006 IPCC Guidelines) instead of a corresponding EF from the Revised 1996 IPCC Guidelines and/or the IPCC good practice guidance better suits national circumstances;

(e) Accuracy in relation to reporting the uncertainty analysis in line with the requirements of the UNFCCC reporting guidelines, the IPCC good practice guidance and the IPCC good practice guidance for LULUCF, including reporting of uncertainty estimates for KP-LULUCF;

(f) Exploring higher-tier methods for key categories;

(g) Consistency in relation to the inventory time series of some emission estimates (e.g. F-gases);

(h) Consistency in relation to addressing discrepancies between the NIR and CRF tables, including expanding QA/QC procedures to include explicit provisions for this activity;

(i) Comparability in relation to ensuring that the allocation of emissions is in line with the Revised 1996 IPCC Guidelines and/or the IPCC good practice guidance (e.g. for limestone and dolomite use and soda ash use);

(j) Definition of the role and responsibilities of the many 'actors' in the QA/QC system, and to consider the outcomes of the key category analysis, uncertainty analysis and QA/QC procedures in the revision of the inventory improvement plan.

61. Recommended improvements relating to specific categories are presented in the relevant sector chapters of this report.

## **B. Energy**

### **1. Sector overview**

62. The energy sector is the main sector in the GHG inventory of Bulgaria. In 2008, emissions from the energy sector amounted to 52,658.44 CO<sub>2</sub> eq, or 70.0 per cent of total GHG emissions. Since 1988, emissions have decreased by 41.3 per cent. The key driver for the fall in emissions is the shift from a planned to a market economy in 1988–89. This led to a sharp drop in electricity demand from thermal generation and a correspondingly large emission reduction. An internal political crisis in 1996–97, resulting in an economic downturn, caused emissions to fall further in the late 1990s, but not to as large an extent.

Within the sector, 60.4 per cent of the emissions were from energy industries, followed by 16.7 per cent from transport, 16.4 per cent from manufacturing industries and construction and 4.1 per cent from other sectors. Fugitive emissions from fuel accounted for 2.4 per cent.

#### Completeness

63. The 13 August 2010 resubmission is generally complete and prepared in line with the Revised 1996 IPCC Guidelines. In this resubmission, Bulgaria did not report fugitive emissions from solid fuels and oil and natural gas activities, emissions from combusting waste fuels at industrial facilities, or emissions from the combustion of biofuels in transport.

64. During the review week, Bulgaria submitted CO<sub>2</sub> and CH<sub>4</sub> emission estimates for solid fuels and oil and natural gas activities. These emissions were submitted officially by the Party in its 22 October 2010 response to questions raised by the ERT. GHG emissions from the combustion of waste fuels at industrial facilities and CH<sub>4</sub> and N<sub>2</sub>O emissions from the combustion of biofuels in transport were also submitted in the 22 October 2010 submission. These estimates were found by the ERT to have been prepared in line with the Revised 1996 IPCC Guidelines and, in the case of waste fuels combusted at industrial facilities, with country-specific data and EFs. The ERT commends the Party for these improvements, but recommends that Bulgaria estimate CO<sub>2</sub> emissions from the combustion of biofuels in transport under memo items in its next annual submission.

#### Transparency

65. With a view to improving transparency, Bulgaria established a new set of calculation procedures for the stationary combustion, transport and fugitive emissions categories and used them to estimate emissions from the energy sector for all years from 1988 to 2008. This has resulted in a clear view of the flow of data through the emission estimation process with very good transparency. The ERT commends Bulgaria for this improvement.

#### Verification and quality assurance/quality control approaches

66. The ERT found that the Party had used a mixture of automated and manual data entry with copy-and-paste actions in its calculation procedures for the energy sector. The manual actions carry the risk of transcription and other errors in the emission estimation process. The ERT recommends that Bulgaria explore the possibility of developing and implementing more automated procedures (e.g. electronic links and formulae) to manage data entry, as recommended by the previous ERT. The ERT also recommends that Bulgaria expend further efforts to reduce errors in the energy section of its NIR.

## **2. Reference and sectoral approaches**

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

67. The primary source of energy data is the detailed national energy balance provided by the NSI. This in turn has supplied data to the Eurostat database system since 1990. Over the years, a number of alterations have been made to the nomenclature and allocations in the national energy balance. The Eurostat format, however, has remained stable and is therefore the basis for current AD for energy. For 1988 and 1989, the International Energy Agency (IEA) energy data set, which is very close in format to Eurostat, has been relied upon. Although there are some limitations in using these datasets instead of the detailed national balances, these limitations appear to be more than offset by the transparency and consistency offered by Eurostat, coupled with the IEA for the early years. Furthermore, with this approach, the AD used for the estimates match international statistics.

68. CO<sub>2</sub> emissions from fuel combustion were calculated using both the reference approach and the sectoral approach. The differences varied by year, but in all cases the differences in CO<sub>2</sub> emission estimates remained below 6 per cent. Explanations for this have been provided in the NIR. This description is an improvement over the last submission and Bulgaria is commended for this by the ERT.

#### International bunker fuels

69. In the previous review report, a number of issues were identified regarding the allocation of fuel consumption between civil aviation and aviation bunkers and between navigation and marine bunkers. The time series showed significantly unstable trends and possible inconsistencies owing to changes in methodologies. Bulgaria has not yet been able to respond to the recommendations of the previous review report on these issues. The ERT therefore reiterates the recommendations made in the previous review report, namely that Bulgaria revise its assumptions and review available data for the allocation of fuel consumption between civil aviation and aviation bunkers and between navigation and marine bunkers for the complete time series, and ensure the consistency of the AD used in its emission estimations, correcting if necessary, in accordance with the IPCC good practice guidance. The ERT also recommends that Bulgaria document any new methods, AD and assumptions used to estimate emissions from aviation and marine bunkers in the NIR of its next annual submission.

#### Feedstocks and non-energy use of fuels

70. In the course of the review, Bulgaria reported that coke consumption in the iron and steel industry (including that used as a reductant) is included in the inventory under energy (stationary combustion). The ERT recommends that Bulgaria make efforts to reallocate this reductant coke to the industrial processes sector in line with the Revised 1996 IPCC Guidelines and the IPCC good practice guidance.

### **3. Key categories**

#### Stationary combustion: solid and gaseous fuel – CO<sub>2</sub>

71. Bulgaria has developed an updated, transparent and logically thought out stationary combustion model to prepare emission estimates for its 13 August 2010 resubmission. These estimates are based on both tier 1 and 2 methods. The EFs used are generally from the IPCC good practice guidance, but country-specific EFs have been developed for most coals. The ERT reviewed these country-specific EFs and found that they are based on averages of verified 2008 EU ETS data, appear to be appropriately applied and result in conservative estimates. The ERT commends Bulgaria for its new model.

72. During the review, it was noted that there have been some allocation issues with respect to Bulgaria's solid fuel AD. For example, the national energy balance combines lignite and brown coal data together in one fuel category and "other bituminous" and anthracite coal data together into a second category in the years before 2004. The contractor which developed the stationary model software (Denkstatt) explained that the lignite CO<sub>2</sub> EF was used for the first coal category and the "other bituminous" EF was used for the second. As the lignite factor is the higher of the two, the EF used provides a conservative emission estimate. However, the "other bituminous" factor is lower than that for anthracite, so this approximation generates a potential underestimate. During the review week, Bulgaria provided the ERT with a revised CO<sub>2</sub> estimate for solid fuels, which more appropriately applies the anthracite EF to the combined anthracite and other bituminous coal data category. This change was incorporated in the 22 October 2010 resubmission.

73. In the previous annual review report, the ERT recommended that Bulgaria report emissions related to the combustion of gaseous fuels from utility combined heat and power plants under public electricity and heat production instead of other – manufacturing industries and construction. Although, during the review week, Bulgaria attempted to reallocate utility combined heat and power plants to public electricity and heat production, this revised allocation was not formally submitted in its 22 October 2010 resubmission. The ERT reiterates the recommendation of the previous annual review report that Bulgaria implement this reallocation of emissions and report on it in the next annual submission.

Road transportation: liquid fuel – CO<sub>2</sub>

74. New road transportation estimates were prepared by Bulgaria for the 13 August 2010 resubmission. The updated model estimates emissions according to an IPCC tier 1 method. Although the method is simple in structure, the estimates are consistent and transparent. The ERT commends Bulgaria for this improvement in transparency.

75. EFs utilized by the road transport methodology have been based on the 2006 IPCC Guidelines even though, in almost all cases, appropriate values are available in the Revised 1996 Guidelines or the IPCC good practice guidance. Bulgaria could not justify the use of the EFs from the 2006 IPCC Guidelines and so, during the review, the ERT recommended that these be altered. Before the end of the review, Bulgaria had submitted an updated version of its transport model that utilized EFs from the Revised 1996 IPCC Guidelines and the IPCC good practice guidance. The 22 October 2010 resubmission contained these new estimates based on updated CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O factors. The ERT notes that these are more appropriate EFs and that the method now produces slightly higher emission estimates.

76. The Party's transport model estimates emissions for residual fuel oil in road transport because there are quantities of this fuel reported under road transport in the energy balance. This is an improbable allocation, as road vehicles are highly unlikely to be using residual fuel oil. The ERT strongly encourages Bulgaria to determine a better allocation for this fuel, possibly through discussions with the NIS.

Fugitive emissions from fuel: coal mining and oil and natural gas – CO<sub>2</sub> and CH<sub>4</sub>

77. The ERT noted that emission estimates prepared for the 13 August 2010 resubmission lacked sufficient transparency for evaluation. However, during the review week, ExEA presented revised estimates to the ERT which were generated from a model that utilized IPCC tier 1 methods and default values. The ERT reviewed this new model. Although the method is simple, the estimates are consistent and transparent throughout the time series.

78. Initially, the new fugitive model did not provide estimates for CO<sub>2</sub> and CH<sub>4</sub> emissions from oil and gas exploration. However, during the review week, Bulgaria provided yet another version, with these estimates included. The updated fugitive estimates are approximately 9 per cent (about 100 kt CO<sub>2</sub> eq) lower than those developed for the 13 August 2010 resubmission, but the method is more acceptable due to its superior transparency. This version of the estimates was provided in Bulgaria's resubmission of 22 October 2010. The ERT commends Bulgaria for this additional improvement to its inventory.

#### **4. Non-key categories**

Road transportation: liquid fuel – CH<sub>4</sub> and N<sub>2</sub>O

79. Bulgaria's spreadsheet-based transport model develops emission estimates for all three GHGs from all vehicle types. Thus, emissions of CH<sub>4</sub> and N<sub>2</sub>O from road

transportation are estimated via this simple, tier 1 method. IPCC good practice guidance suggests that these estimates should be developed through higher-tier methodologies, because CH<sub>4</sub> and N<sub>2</sub>O emissions are highly dependent upon vehicle type and emission control technology. The Party has demonstrated the availability of detailed vehicle AD, a prerequisite for the operation of higher-tier models. In addition, Bulgaria has indicated its intention to commence a project to develop such a model, possibly based on the European COPERT platform. The ERT commends Bulgaria's initiative to work on developing a tier 2 or tier 3 model in order to improve the accuracy of its emission estimates and their allocations across vehicle types. An additional benefit of this improvement is that it would allow a secondary estimate of CO<sub>2</sub> emissions, allowing additional verification of tier 1 CO<sub>2</sub> estimates for road transportation.

#### Civil aviation and navigation: liquid fuel – CO<sub>2</sub>

80. As had been noted in the previous annual review report, Bulgaria's emission estimates for domestic aviation and navigation show exceedingly large annual variations in some years. In addition, estimated navigation emissions fall to zero after the year 2000, which is incorrect. Although these estimates are related to the (likely variable) way fuel sales are allocated in the energy balance, other transportation data should provide clues for the development of more appropriate trends. The ERT strongly recommends that new methods be developed to allocate a more robust time series of emissions to domestic aviation and navigation emissions.

### **5. Areas for further improvement**

#### Identified by the Party

81. Bulgaria has indicated plans to develop a higher-tier model for emissions from road transportation.

#### Identified by the expert review team

82. In the development of its estimates, Bulgaria has primarily utilized default EFs obtained from the Revised 1996 IPCC Guidelines, the IPCC good practice guidance and, in some cases, the 2006 IPCC Guidelines. The use of EFs from the 2006 IPCC Guidelines is usually warranted because the circumstances indicate that, for the specific Bulgarian situation, there is no default EF available from the other two IPCC sources. However, the ERT reminds Bulgaria that, if available, methods and default EFs from the Revised 1996 IPCC Guidelines and the IPCC good practice guidance are to be used. The ERT also recommends that the Party:

- (a) Review its use of default EFs from the 2006 IPCC Guidelines in order to clearly define and confirm the need for their use;
- (b) Develop and use country-specific EFs, which are considered to be the best solution, if available.

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

### **1. Sector overview**

83. In 2008, emissions from the industrial processes sector amounted to 6,017.77 Gg CO<sub>2</sub> eq, or 8.0 per cent of total GHG emissions, and emissions from the solvent and other product use sector amounted to 54.47 Gg CO<sub>2</sub> eq, or 0.1 per cent of total GHG emissions. Since the base year, which is 1988 for CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O and 1995 for F-gases, emissions have decreased by 51.1 per cent in the industrial processes sector and decreased by 28.3 per

cent in the solvent and other product use sector. The key driver for the fall in emissions in the industrial processes sector is a general reduction in production across all categories (except for F-gases) resulting from the economic crises of 1989–1990 and 1997–1998. From 1999, emissions from mineral products have increased significantly due to the increase in production of cement and lime as Bulgaria begins to develop its economy following the economic crisis. However, emissions from iron and steel production continue to fall due to falling production. Within the industrial processes sector, 56.7 per cent of the emissions were from mineral products, followed by 26.1 per cent from chemical industries, 11.9 per cent from metal production and 5.3 per cent from the consumption of halocarbons and SF<sub>6</sub>.

84. The ERT notes the significant improvement in Bulgaria's national system and capacity to plan, prepare and manage the development of the inventory for the industrial processes sector. During the review week, experts from Bulgaria proved to be knowledgeable about the nature of industrial processes operating in Bulgaria, and were able to provide detailed answers to the ERT's questions and provided and explained data obtained from industry and industrial associations. The ERT also notes that the majority of the recommendations in the 2009 annual review report had been taken into account in the 13 August 2010 resubmission, including:

- (a) Improved capacity within the single national entity and more broadly the national system to plan and prepare an industrial processes inventory;
- (b) Improved QA/QC of emission estimates;
- (c) Improved documentation in the NIR on methodologies and EFs;
- (d) Using plant-specific data to estimate emissions with use of higher-tier methods for key categories;
- (e) Improved coverage of actual F-gas emissions.

85. However, the ERT also notes that to take full account of the recommendations in the 2009 annual review report more work is still needed in the:

- (a) Documentation of methodologies, data sources and assumptions in the NIR;
- (b) Allocation of emissions to the correct IPCC category in the CRF tables (e.g. for desulphurization under limestone and dolomite use);
- (c) Completeness of the inventory;
- (d) QC activities to identify discrepancies between the NIR and CRF tables;
- (e) Methodology to estimate emissions from iron and steel production.

86. The ERT encourages Bulgaria to continue to develop its expertise and level of engagement with industry, to further involve industry in its inventory QA/QC and development of estimates and to include this information in the NIR.

#### Completeness

87. The ERT identified a number of potential underestimates in the industrial processes sector, namely missing activities under limestone and dolomite use and under soda ash use. The ERT also notes that Bulgaria has not reported a complete time series for the F-gases between 1988 and 1994 on the basis that the Party assumed that it only needed to report this from the base year under the Kyoto Protocol (1995). The ERT recommends that Bulgaria include estimates for all F-gas species and categories where emissions occur in its next annual submission.



88. The ERT identified that Bulgaria reports the following as “NE”:
- (a) PFC emissions from foam blowing;
  - (b) PFC emissions from fire extinguishers;
  - (c) PFC emissions from aerosols/metered dose inhalers;
  - (d) HFC and PFC emissions from solvents;
  - (e) HFC and PFC emissions from semiconductor manufacture;
  - (f) HFC and PFC emissions from electrical equipment;
  - (g) HFC, PFC and SF<sub>6</sub> emissions from other (consumption of halocarbons and SF<sub>6</sub>).

89. The reporting of “NE” (see para. 88 above) was communicated to the Party on 9 October 2010, and the Party subsequently informed the ERT that emissions from these categories and gases do not occur. The ERT recommends that Bulgaria use the appropriate notation keys for these categories and gases in the CRF and provide in its NIR the information to substantiate that emissions from these categories and gases do not occur.

90. In response to completeness issues (see para. 88 above) and potential underestimates (see para. 87 above) identified by the ERT, Bulgaria submitted revised estimates on 22 October 2010. The ERT concluded that the Party’s inventory submission is now complete and has been prepared in accordance with the Revised 1996 IPCC Guidelines and the IPCC good practice guidance. However, Bulgaria has not reported F-gas emissions for the years 1988–1994 and the ERT recommends that Bulgaria provide these estimates in its next annual submission.

#### Transparency

91. The ERT commends Bulgaria for the improvement in its documentation of methodologies, AD, EFs, and so on, in the NIR. However, the ERT identified improvements including for the NIR to include, in separate sections, information on: carbide production and ferroalloys production; flue gas desulphurization; missing detail on the non-confidential country-specific parameters (e.g. calcium oxide (CaO) and magnesium oxide (MgO) contents, the types of cement and lime produced, etc.); and EFs and AD (e.g. for limestone and dolomite use, feedstocks for ammonia and iron and steel production) in the cement, lime, limestone and dolomite, soda ash, glass, ceramics and iron and steel sections. In some cases, the calculation sheets lack transparency in: the labelling of data sources; calculations and assumptions; and QC. The ERT recommends that Bulgaria revise the chapter on industrial processes in the NIR to ensure that it provides the level of information to understand the basis and rationale behind AD, EFs and parameters, assumptions and methods where possible, and to further elaborate its calculation sheets with details of data sources, assumptions and QC.

#### Recalculations and time-series consistency

92. The ERT notes that recalculations undertaken in this sector have resulted in considerable improvement to the industrial processes inventory. Recalculations have been performed to account for higher-tier 2/3 methods and country-specific data that have been used in the subsector consumption of halocarbons and SF<sub>6</sub> and in the activities cement, lime, glass, ceramics, nitric acid production, ammonia production and steel production (using data for electric arc furnaces). These recalculations have been performed for all years of the inventory time series.

93. In response to questions from the ERT on completeness and potential underestimation, Bulgaria submitted a revised inventory submission for the industrial processes sector. The ERT recommends that the Party's next annual submission include explanations for the recalculations performed and their impact on the emission trend.

#### Verification and quality assurance/quality control approaches

94. The ERT found that a reasonable level of sector-specific QA/QC procedures had been applied in many of the individual calculation sheets. However, the ERT identified a copy-and-paste error in the iron and steel CRF table (13 August 2010 annual submission) that QC checks should have identified. The ERT encourages Bulgaria to further develop the calculation checks by highlighting more clearly checking areas and by recording dates and details of individuals who perform the checking. In addition, the ERT encourages Bulgaria to further strengthen its engagement with industry and national statistics for the checking of the final estimates, for the development of category-specific verification studies and in further developing and improving the inventory estimates. The ERT also recommends that Bulgaria strengthen its routine CRF checking to ensure that the CRF is correct and that it is consistent with the data in the individual calculation sheets and in the NIR.

## **2. Key categories**

### Lime production – CO<sub>2</sub>

95. Bulgaria estimated CO<sub>2</sub> emissions from lime production using IPCC default EFs for high-calcium quicklime (785 kg CO<sub>2</sub>/t high-calcium quicklime) from the IPCC good practice guidance. During the review week, Bulgaria confirmed that for the years 1988–1997, its national statistics separated the production of high-calcium and dolomitic quicklime with a ratio of between 86/14 and 92/8 (calcium/dolomitic). However, for the years 1998–2008, the Party's national statistics did not separate the production of calcium and dolomitic quicklime and 100 per cent calcium quicklime production is assumed. The ERT concluded that this is an underestimation.

96. In response to questions from the ERT, Bulgaria submitted revised estimates on 9 October 2010 and further clarification on 8 November 2010 on the sources of data requested by the ERT. The ERT concluded that these estimates have been prepared in line with the Revised 1996 IPCC Guidelines and the IPCC good practice guidance. The ERT recommends that Bulgaria report on this recalculation, including its rationale, in its next annual submission. The ERT also recommends that Bulgaria include information in its next annual submission on data sources, EFs and associated parameters, methods and assumptions to ensure that all estimates can be independently verified.

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

97. Bulgaria reported emissions from the production of steel under iron and steel production (2.C.1), whereas emissions from iron production are included in iron and steel production in the energy sector (1.A.2.a). This is not consistent with the IPCC good practice guidance. The ERT reiterates the recommendation from the previous annual review report that Bulgaria estimate emissions from iron production using data on the amount of reducing agent (coke) collected or derived from national statistics and/or from industry. The ERT notes that page 28 under section 3.1.3 of the IPCC good practice guidance provides a method for estimating the reducing agent needed for iron production from the mass balance of the chemical formula to reduce iron ore. The ERT also recommends that Bulgaria describe clearly in its NIR the data sources, EFs and associated parameters, methods and assumptions to ensure that all estimates can be independently verified.

98. The ERT identified a copy-and-paste error in the CRF tables for steel production, which resulted in an overestimate in CO<sub>2</sub> emissions for the year 2008.

99. The ERT commends Bulgaria on its use of a country-specific methodology for estimating emissions from electric arc furnaces (EAFs). However, the ERT notes that Bulgaria uses default EFs from the 2006 IPCC Guidelines to estimate CO<sub>2</sub> emissions from basic oxygen furnaces (BOF) and open hearth furnaces (OHF) without providing a justification as to why these factors improve the quality of the estimates and better represent national circumstances. The ERT also notes that these BOF and OHF EFs include CO<sub>2</sub> emissions from iron production; therefore, Bulgaria's emission estimates double count on some of the iron production emissions accounted for in the energy sector. With respect to steel production, the ERT recommends that Bulgaria:

(a) Revise its methodology for estimating steel production emissions following the IPCC good practice guidance;

(b) Estimate emissions from BOF and OHF using the difference between iron and steel carbon contents obtained from industry and, if this information is not available, apply expert judgement on the range of carbon contents contained in the IPCC good practice guidance (iron (3–5 per cent) and steel (0.5–2 per cent));

(c) Ensure that any carbon retained in the steel and estimated from the steel-making processes (EAF, BOF, OHF) are balanced with the estimates for iron production to minimize double counting of CO<sub>2</sub> emissions;

(d) Describe clearly in its NIR the data sources, EFs and associated parameters, methods and assumptions to ensure that all estimates can be independently verified.

#### Refrigeration and air-conditioning equipment – HFCs

100. The ERT found that Bulgaria did not include emissions from equipment disposal for all refrigeration and air-conditioning equipment in its GHG inventory, and that the Party did not estimate in-use emissions from refrigerated trucks. The ERT recommends that Bulgaria collect data on the lifetimes of HFC refrigeration and air-conditioning equipment and use this to estimate emissions from equipment disposal using section 3.7 of the IPCC good practice guidance. In addition, for refrigeration trucks, the ERT recommends that HFC emissions be estimated using data on the number of units and their charge and leakage rates collected from the industry and/or national statistics.

101. In response to questions from the ERT on 9 October 2010, Bulgaria submitted revised estimates for in-use emissions from refrigerated trucks on 22 October 2010. The ERT concluded that these estimates had been prepared in line with the Revised 1996 IPCC Guidelines and the IPCC good practice guidance. Bulgaria also confirmed that its assumptions for equipment lifetime are longer than the period for which HFCs have been used in Bulgaria and that, as a result, estimates for equipment disposal are currently estimated to be zero. The ERT recommends that Bulgaria develop its methodology to estimate emissions from equipment disposal and describe clearly in its NIR the data sources, EFs and associated parameters, methods and assumptions used to estimate emissions from refrigerated trucks.

### **3. Non-key categories**

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

102. Bulgaria reported emissions from limestone and dolomite use under a number of categories – namely cement, lime, glass, ceramics and bricks production – based on detailed data collected from industry. Further, Bulgaria reported lime production used in the

iron and steel industry under limestone and dolomite use. In response to a question from the ERT during the review week, Bulgaria confirmed that it does not collect national statistics on total limestone and dolomite use and therefore could not verify that all emissions from limestone and dolomite use are accounted for in the GHG inventory submitted on 13 August 2010. In response to further questions from the ERT on 9 October 2010 and 8 November 2010, Bulgaria provided additional information in its resubmission of 22 October 2010 to confirm that there were no additional users of limestone and dolomite compared with those already accounted for in the 13 August 2010 resubmission, and also confirmed double counting in emissions (limestone and dolomite use (2.A.3) and lime production (2.A.2) that had been subsequently rectified by the Party in its resubmission of 22 October 2010. In its response, Bulgaria also confirmed that it would continue to look for data on total production, imports and exports to cross-check estimates in the future. The ERT recommends that Bulgaria provide this information in its next annual submission, including in the respective chapter of the NIR a description and a table that illustrate the production, imports and exports, and users of limestone and dolomite and to which categories emissions are attributed if estimates are to be included under the category glass production reported under other (mineral products).

#### Soda ash production and use – CO<sub>2</sub>

103. Bulgaria estimated emissions from soda ash use based on detailed data collected from industry and with use of the factor 415 kg CO<sub>2</sub>/t sodium carbonate (Na<sub>2</sub>CO<sub>3</sub>) based on the stoichiometry of the chemical process. However, Bulgaria confirmed that it does not collect statistics on total national soda ash use and could not verify that all emissions from soda ash use are accounted for in the GHG inventory submitted on 13 August 2010, hence there could be an underestimate in emissions. Further, the ERT found that Bulgaria had collected additional industry-specific data on emissions from the use of soda ash in the glass industry, and that reported emissions from the use of soda ash in the glass industry (59.5 Gg CO<sub>2</sub>) are higher than the emissions for soda ash submitted on 13 August 2010 (57.3 Gg CO<sub>2</sub>).

104. In its questions on 9 October 2010, the ERT recommended that Bulgaria revise its emission estimates from soda ash use taking into account specific data from the glass industry and by obtaining statistics on soda ash production, imports and exports. In response to questions from the ERT, Bulgaria submitted revised estimates on 22 October 2010 for soda ash use using statistics on soda ash production, imports and exports obtained from the NSI. The EF for these revised estimates is based on the stoichiometric ratio of Na<sub>2</sub>CO<sub>3</sub>. The ERT is satisfied that these emission estimates are prepared in line with the Revised 1996 IPCC Guidelines. The ERT recommends that Bulgaria provide this information in its next annual submission and that it include in the chapter of the NIR on soda ash use a description and a table that illustrate the production, imports and exports, and users of soda ash and which categories (glass, ceramics) emissions are attributed to.

#### Carbide production – CO<sub>2</sub>

105. The ERT found that Bulgaria did not have a reference for the 2.19 t CO<sub>2</sub>/t carbide produced EF used in the 13 August 2010 resubmission. The ERT recommends that Bulgaria review this EF and, where emissions cannot be estimated using a country-specific estimate based on coke and other reducing agents used in the process, apply the default EF from the Revised 1996 IPCC Guidelines. The ERT also recommends that Bulgaria describe clearly in its NIR the data sources, EFs and associated parameters, methods and assumptions to ensure that all estimates can be independently verified.

Glass production (2.A.7) – CO<sub>2</sub>

106. During the review week, Bulgaria identified an underestimate in the emissions from glass production contained in the 13 August 2010 annual submission (49.77 Gg CO<sub>2</sub>). This underestimate was identified by the Party after its analysis of plant-specific (EU ETS and IPPC) data on emissions from lime used in the glass industry (68.33 Gg CO<sub>2</sub>).

107. In its questions on 9 October 2010, the ERT recommended that Bulgaria revise its emission estimates for glass production using the industry-specific data the Party had presented to the ERT during the review week. In response to the questions from the ERT, Bulgaria submitted revised estimates on 22 October 2010 for lime use in glass production taking into account CaO and MgO content from industry-specific data. Bulgaria confirmed that emissions from soda ash use have been excluded from these estimates and that these emissions are reported separately as part of the emission estimates under the category soda ash use. The ERT concluded that these estimates have been prepared in line with the Revised 1996 IPCC Guidelines and the IPCC good practice guidance. The ERT recommends that Bulgaria describe clearly in its NIR the data sources, EFs and associated parameters, methods and assumptions to ensure that all estimates can be independently verified and that it consider reporting emissions under the category limestone and dolomite use rather than under the category other (2.A.7).

Consumption of halocarbons and SF<sub>6</sub> – HFCs

108. During the review, the ERT sought clarification from the Party on the reporting of HFC emissions from imported foams. Bulgaria was not able to demonstrate to the ERT that these emissions are not occurring in the country. In its questions on 9 October 2010, the ERT recommended that Bulgaria endeavour to collect the information necessary to estimate these emissions, or to demonstrate that they do not occur. In response to the questions of the ERT, Bulgaria indicated that representatives of the largest importer companies of insulation panels and foams have confirmed that they do not use any HFCs in their products as a foam-blowing agent. In its response, Bulgaria informed the ERT that around 50 per cent of the production using HFCs is exported, but that it accounts for all produced foams in its reported estimates and does not discount in-use emissions from exported foams. The ERT recommends that Bulgaria collect additional data in order to estimate emissions that exclude exported foams and to describe this clearly in its next annual submission; and that the Party also report in the NIR data sources, EFs and associated parameters, methods and assumptions to ensure that all estimates can be independently verified.

109. Bulgaria estimates HFC emissions from fire extinguishers using a default EF (4 per cent) from the 2006 IPCC Guidelines, rather than using the default value from the IPCC good practice guidance table 3.26 (5 per cent). Further, Bulgaria did not provide any justification for the use of the value from the 2006 IPCC Guidelines and why this value provides a more accurate estimate. In its questions on 9 October 2010, the ERT recommended that Bulgaria develop country-specific information to justify the use of the 2006 IPCC Guidelines EF and, if this information is not available, the ERT recommends the use of the corresponding default EF from the IPCC good practice guidance. In response to the questions from the ERT, Bulgaria submitted revised estimates based on the default EF (5 per cent) from the IPCC good practice guidance. The ERT recommends that Bulgaria describe clearly in its next NIR the data sources, EFs and associated parameters, methods and assumptions to ensure that all estimates can be independently verified.

110. Bulgaria confirmed that it does not collect statistics on imports of HFC-containing aerosols and metered dose inhalers and only accounts for emissions resulting from metered dose inhalers produced in Bulgaria. The ERT concluded that this approach is not in line with the IPCC good practice guidance and is likely to result in a potential underestimate. In its questions on 9 October 2010, the ERT recommended that Bulgaria collect data on any

imports of HFC-containing aerosols and metered dose inhalers from national statistics, industry representatives and/or health services experts, and, if data are not available, the ERT recommended that Bulgaria estimate activity based on drivers (e.g. population, GDP), using expert judgement, and estimate emissions from imported HFC-containing aerosols and metered dose inhalers using the methodology from the IPCC good practice guidance (section 3.7.3) or a country-specific methodology and data. Bulgaria should document clearly where expert judgement is used and if evidence exists to show that there are no imported HFC-containing aerosols and metered dose inhalers. In response to the questions from the ERT, Bulgaria confirmed that there is no production of metered dose inhalers within the country; instead, these are imported containing HFC-134a. Bulgaria provided estimated emissions from imported aerosols and metered dose inhalers using GDP and a German study *Emissions, Activity Data, and Emission Factors of Fluorinated Greenhouse Gases (F-gases) in Germany 1995–2002*<sup>6</sup> as the proxy to estimate these emissions. The ERT concludes that, in the absence of national statistics, these emissions have been prepared in line with the Revised 1996 IPCC Guidelines and the IPCC good practice guidance. The ERT recommends that Bulgaria describe clearly in its NIR the data sources, EFs and associated parameters, methods and assumptions to ensure that all estimates can be independently verified.

#### 4. Areas for further improvement

##### Identified by the Party

111. For lime production:

- (a) Obtain from the Association of Lime Producers country-specific data on the content and type of lime produced, country-specific ratio and EFs;
- (b) Increase transparency in the reporting of this activity in the NIR.

112. For limestone and dolomite: to update and revise AD and EFs and to improve documentation of these in the NIR.

113. For soda ash production and use: to improve QA/QC procedures and to confirm emission estimates by comparing with emissions calculated using alternative approaches.

114. For glass production: to revise the EF by obtaining country-specific information on the annual cullet ratio.

115. For ceramics: to obtain conversion factors for different types of ceramics from the NSI with a view to estimating country-specific AD and to ensure their consistency. Also, the Party identified that it could obtain the mass of carbonate consumed or the mass of limestone or dolomite consumed with a view to exploring the use of a higher-tier method to estimate emissions.

116. For nitric acid production, ammonia production and iron and steel production: to obtain plant-specific estimates of uncertainty and to resolve the issue of confidentiality in relation to AD.

117. For the F-gases, the Party highlighted in its NIR a number of detailed improvements in relation to data collection on the consumption of these gases arising from the *National*

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<sup>6</sup> Schwarz W. 2005. *Emissions, Activity Data, and Emission Factors of Fluorinated Greenhouse Gases (F-gases) in Germany 1995–2002*. Berlin, Germany. Publisher: Federal Environmental Agency (Umweltbundesamt), Berlin. Available at <http://www.oekorecherche.de/english/berichte/berichteOzonschicht.html>.

*Study for Determining the Quantity of Actual Fluorinated Gases (F-gases) (HFCs, PFCs and SF<sub>6</sub>) in Bulgaria and Methods for their Calculation.*<sup>7</sup>

Identified by the expert review team

118. The ERT recommends that Bulgaria continue to:

- (a) Develop its expertise within ExEA in planning, preparing and managing inventories for the industrial processes and solvent sectors;
- (b) Enhance the level of engagement with industry with a view to improving the quality of AD, EFs and uncertainty data;
- (c) Further involve industry in its inventory QA/QC and development of estimates and to include this information in the NIR;
- (d) Improve documentation in the NIR with a specific focus on descriptions of methodologies used (e.g. iron and steel production) and the rationale for their selection, AD, EFs and other parameters used, data sources, assumptions, allocation of emissions within the industrial processes sector (e.g. desulphurization under limestone and dolomite), discussion on the completeness of the industrial processes and solvent sectors, and on QA/QC applied in the inventory, especially in the underlying calculation sheets used to derive emission estimates.

119. The ERT recommends that Bulgaria:

- (a) Obtain statistics on limestone and dolomite production and its end-use, quarrying, mining industry and imports to ensure that detailed data collected from industry are complete;
- (b) Improve documentation on the methodology used to derive the CH<sub>4</sub> emission estimate for coke production CH<sub>4</sub>.

## **D. Agriculture**

### **1. Sector overview**

120. In 2008, emissions from the agriculture sector amounted to 6,029.95 Gg CO<sub>2</sub> eq, or 8.0 per cent of total GHG emissions. Since the base year (1998), emissions have decreased by 66.5 per cent. The key driver for the fall in emissions is a decrease in crop production and also a decrease in livestock populations. Within the sector, 60.4 per cent of the emissions were from agricultural soils, followed by 22.0 per cent from enteric fermentation, 14.6 per cent from manure management and 1.8 per cent from field burning of agricultural residues. Rice cultivation accounted for 1.2 per cent.

121. On the Friday before the review week (30 September 2010) Bulgaria submitted to the ERT a revised calculation sheet for the agriculture sector. The ERT identified many changes when compared with the 13 August 2010 resubmission; however, there were no CRF tables provided with this informal submission and, therefore, it was difficult to appraise comparability, which had been raised as an issue by the previous expert review team in relation to enteric fermentation and manure management.

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<sup>7</sup> Denkstatt. 2010. *National Study for Determining the Quantity of Actual Fluorinated Gases (F-gases) (HFCs, PFCs and SF<sub>6</sub>) in Bulgaria and Methods for their Calculation*. Contract between MoEW and Denkstatt. N 1505/28.12.2009. Sofia, 2009.

122. Bulgaria submitted revised estimates on 22 October 2010 in response to questions from the ERT and also submitted revised estimates on 9 November 2010 in response to further questions from the ERT.

#### Completeness

123. Bulgaria has included emissions from buffalo for the first time in its agriculture inventory. The ERT identified during the review week that a fraction of sewage sludge is applied to agricultural soil but is not included in the agriculture inventory, and the ERT therefore considers that this is a potential underestimate of emissions. In its 22 October 2010 resubmission, Bulgaria submitted estimates for the sewage sludge that is applied to agricultural soil. The ERT concluded that the agriculture inventory is complete.

#### Transparency

124. In relation to the 13 August 2010 resubmission, the ERT identified:

- (a) Numerous inconsistencies between CRF tables and between the NIR and the CRF tables (e.g. tables 2, 4 and 142 of the NIR);
- (b) Reporting of emissions from cattle to option-B in the latest submission with no explanation or justification for this provided in the NIR;
- (c) Emissions from the cultivation of histosols had been changed to not occurring (“NO”) with no explanation provided.

125. The ERT recommends that Bulgaria implement appropriate QA/QC procedures to its NIR to ensure that it is consistent with corresponding information contained in the CRF tables and that the Party include descriptions of important changes in its NIR.

#### Recalculations and time-series consistency

126. Bulgaria performed recalculations of its 2007 inventory based on the recommendations of the previous review report in relation to a revision of default methodologies and EFs used to estimate N<sub>2</sub>O emissions from agricultural soils. The ERT found that these recalculations did improve time-series consistency, but not always the quality of the inventory. The ERT recommends that Bulgaria increase the quality of its inventory by using available country-specific parameters in its estimations and that the Party document these in its next annual submission, including any recalculations undertaken and their impact on time-series consistency and the emission trend.

## **2. Key categories**

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

127. The ERT found that the NIR did not include sufficient documentation on the milk yield of dairy cattle or the live weight of animals (cattle, sheep and swine), which also result in underestimates in CH<sub>4</sub> emissions. However, Bulgaria indicated to the ERT during the review week that it has initiated studies that will provide improved information and data in support of higher-quality emission estimates. The ERT welcomes this development. In response to questions raised by the ERT on these matters, Bulgaria submitted revised estimates in its 10 November 2010 resubmission. The ERT noted that this resubmission included information on milk production and on the weight of sheep and swine; however, it did not include revised information on cattle weight and instead the Party has used IPCC default values. Bulgaria explained that the reason for continuing to use the IPCC default values is that the national study to provide this information is yet to conclude. The ERT accepted the revised estimates of the Party and also accepted the justification for the interim



use of the IPCC defaults for cattle weight. The ERT recommends that the Party report the above information and the rationale for the recalculation in its next annual submission and that the Party recalculate the time series when results from the studies mentioned above become available.

128. Consistent with the finding of the previous ERT, there are inconsistencies in the AD trend in the years leading up to 2001 that the Party explained to be a result of a change in data provider. The ERT reiterates a recommendation of the previous ERT that Bulgaria improve the consistency of the time series by using national statistics in the first instance, and, if this is not possible, that it use international statistical data from the Food and Agriculture Organization of the United Nations (FAO) for the years before 2001 which are well harmonized with recent national statistics. The ERT also recommends that Bulgaria improve the transparency of information on emission trends by explaining any fluctuations in the trends in its next annual submission.

#### Manure management – CH<sub>4</sub>

129. Bulgaria used a default IPCC EF for Eastern Europe (temperate climate) from the Revised 1996 IPCC Guidelines. However, during the review, the ERT noted that some regions have cooler climates, which would be better represented by corresponding cool climate factors. In response to a question from the ERT, Bulgaria submitted revised estimates based on differentiated climate zones (cool and temperate). The ERT accepted these revised estimates and recommends that the Party further improve emission estimates by obtaining more precise data on animal populations by climate zone within the country. The ERT also recommends that Bulgaria report on these recalculations in its next annual submission.

130. Bulgaria used IPCC default values for the distribution of AWMS and the MCF. However, during the review week, the Party informed the ERT that it had initiated studies to provide country-specific factors and that they will initially focus on the key livestock types (cattle and swine). The ERT recommends that Bulgaria report on this improvement in its next annual submission and any subsequent recalculations and impact on time-series consistency.

#### Direct soil emissions – N<sub>2</sub>O

131. In relation to the 13 August 2010 resubmission, Bulgaria reported N<sub>2</sub>O emissions from other direct soil emissions as not applicable (“NA”). However, the ERT identified references in the waste sector that indicated the possibility that a fraction of sewage sludge is applied to agricultural soil. During the review week, Bulgaria informed the ERT that information on this activity is currently being appraised with a view to obtaining information that can be used to estimate emissions from this activity, and that there is a law that controls the use of sewage sludge on agricultural soil. The ERT and the Party agreed that this is a potential underestimate because emissions from this activity are not included in the GHG inventory. The ERT requests Bulgaria to obtain information on the amount of sewage sludge that is applied to agricultural soil and to estimate emissions from this activity.

132. In relation to the 13 August 2010 resubmission, Bulgaria reported emissions from the cultivation of histosols (205 ha and 0.003 Gg N<sub>2</sub>O). However, in the informal submission received in the week before the review week, this activity was reported as “NA”. During the review week, Bulgaria was able to justify this reporting in that areas of organic soils are in areas that have been protected. The ERT recommends that an explanation for this reporting be included in the Party’s next annual submission.

Indirect emissions – N<sub>2</sub>O

133. In relation to the 13 August 2010 resubmission, Bulgaria estimated N<sub>2</sub>O emissions from indirect emissions from atmospheric deposition and nitrogen leaching and runoff using the IPCC tier 1a default methodology and default EFs. This is not in line with the IPCC good practice guidance. The ERT recommends that Bulgaria collect and harmonize the necessary input data and parameters in order to increase the transparency and accuracy of the inventory and report on these matters in its next annual submission.

**3. Non-key categories**Field burning of agricultural residues – CH<sub>4</sub>, N<sub>2</sub>O

134. In relation to the 13 August 2010 resubmission, Bulgaria estimated CH<sub>4</sub> and N<sub>2</sub>O emissions for this category assuming that 10 per cent of the cereal residues were burned on site. The ERT reiterates a recommendation of the previous ERT that Bulgaria improve the transparency of the AD on crop areas across subsectors and reconsider the aforementioned assumption. The ERT noted that, in similar countries, the share of residues burned on site is higher than 10 per cent. The ERT encourages the Party to initiate a study to confirm the assumptions used as a basis to estimate emissions.

**4. Areas for further improvement**Identified by the Party

135. Bulgaria has initiated a process of improvement that includes the collection of information necessary to support emissions estimation. However, improvements will continue beyond 2011 (i.e. new surveys for manure management systems) and will not be available until the 2012 annual submission.

136. Bulgaria also identified the following areas for improvement:

- (a) Revise MCF, milk yield and milk fat content for dairy cattle and live weight for farm animals (e.g. cattle, sheep and swine);
- (b) Correct the incorrect use of notation keys in the CRF tables;
- (c) Develop country-specific data for swine in relation to animal weight for each category and by sex and by age;
- (d) Identify the quantity of sewage sludge that is applied to agricultural soil;
- (e) Revise the allocation of AWMS per livestock for all years of the inventory time series;
- (f) Develop country-specific factors for dry matter fractions, nitrogen fractions and carbon fractions of crops;
- (g) Develop country-specific factors for the fraction oxidized and the fraction burned on the field.

Identified by the expert review team

137. The ERT recommends that Bulgaria:

- (a) Compile emission estimates accounting for the different climatic zones (cool and temperate);
- (b) Use higher-tier methods to estimate emissions from agricultural soils;
- (c) Improve the transparency of its inventory;

- (d) Apply QA/QC checks.

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

### **1. Sector overview**

138. In 2008, net removals from the LULUCF sector amounted to 11,012.75 Gg CO<sub>2</sub> eq. Since 1988, net removals have decreased by 19.8 per cent. The key driver for the fall in removals relates to the decrease of carbon stock changes in forest land remaining forest land in the period. Within the sector, removals from forest land accounted for 13,655.23 Gg CO<sub>2</sub> eq, followed by emissions from cropland accounting for 2,155.77 Gg CO<sub>2</sub> eq, removals of 786.64 Gg of CO<sub>2</sub> eq from grassland, emissions of 784.55 Gg of CO<sub>2</sub> eq from wetlands and emissions of 488.80 Gg of CO<sub>2</sub> eq from settlements. Within the sector, 76.5 per cent of the emissions/removals<sup>8</sup> were from forest land, followed by 12.0 per cent from cropland, 4.4 per cent from wetlands and 4.4 per cent from grassland. Settlements accounted for 2.7 per cent of the emissions/removals.

139. The ERT noted a significant improvement in the quality of reporting of LULUCF under the Convention when compared with the 2009 annual submission. The ERT found that the inventory for the LULUCF sector has been prepared in accordance with the IPCC good practice guidance for LULUCF. The Party developed a methodology to collect data on areas of land use and land-use change and the NIR also included a land-use change (LUC) matrix. Nevertheless, land representation is still a critical issue, as it is not clear how and if the LUC matrices have been used in the land representation and in subsequent estimates of emissions and removals. The ERT recommends that the Party ensure land representation is consistent with the use of the LUC matrices and provide a detailed explanation of any eventual occurrences of national area fluctuations.

140. The ERT noted that the greenhouse emissions and removals time series reported in CRF tables are different from those detailed in the sectoral overview (NIR, table 7.1). The ERT recommends that the Party check the coherence of reported data, and apply QC checks.

141. The ERT noted inconsistencies between data reported in the NIR and those reported in the CRF tables (e.g. grassland remaining grassland, wetlands remaining wetlands). In response to a question raised by the ERT during the review week, Bulgaria clarified that these inconsistencies were based on mistakes that occurred in the CRF reporting, in particular referring to the subcategories grassland remaining grassland and wetlands remaining wetlands. In the 22 October 2010 resubmission, Bulgaria provided revised AD concerning these subcategories. The ERT strongly recommends that Bulgaria check the coherence of reported data, apply QC checks and ensure consistency and accuracy in the estimation process and in the reporting phase.

142. Bulgaria did not perform an uncertainty assessment for the different categories of the sector. The ERT reiterates the recommendation made in the previous review report that the Party include the LULUCF sector in its uncertainty analysis for its next annual submission, assessing uncertainties for each LULUCF category.

143. The ERT noted, from the 2010 annual submission, that the methodology had been revised, resulting in considerable differences when compared with the previous annual submission. Reported removals increased by 42.7 per cent in the 2010 submission compared with the 2009 submission. The ERT recommends that the Party provide an

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<sup>8</sup> 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.

explanation of changes resulting from recalculations, the rationale for the recalculations and the impact on emission trends in its next annual submission.

## 2. Key categories

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

144. AD is provided by the State Forestry Agency, while the EFs used are from the National Forest Inventories. Biomass expansion factors and other parameters used are country-specific.

145. The ERT noted that only the living biomass carbon pool has been reported, whereas dead organic matter and soil carbon stock changes have been reported as “NO”. Bulgaria has reported litter carbon stock changes under the soil organic matter (SOM) pool. This approach is not in accordance with the IPCC good practice guidance for LULUCF. The ERT strongly recommends that Bulgaria report litter carbon stock changes under the dead organic matter (DOM) pool, as required by the IPCC good practice guidance for LULUCF.

146. Bulgaria reported the area of organic soil as included elsewhere (“IE”), while reported carbon stock changes in living biomass were reported as “NO”. The ERT recommends that the Party provide in its next annual submission clarification on the cultivation of organic soils and the necessary emission estimates.

### Cropland remaining cropland – CO<sub>2</sub>

147. The ERT noted an improvement in the reporting of cropland remaining cropland; Bulgaria reported CO<sub>2</sub> emissions and removals for the mandatory pools (living biomass and soils). CO<sub>2</sub> emissions and removals from land converted to cropland have been also reported.

148. Bulgaria reported the area of organic soil as “IE” whereas carbon stock changes in living biomass were reported as “NO”. In the 22 October 2010 resubmission, Bulgaria provided revised AD and corrected the notation keys in CRF tables 5.A, 5.B and 5.C. The ERT recommends that the Party provide in its next annual submission clarification on the cultivation of organic soils and the necessary emission estimates.

149. The ERT noted an error in the reporting of AD for cropland. The area for each inventory year has been calculated as the 20-year sum of the area. The ERT found that this is most likely due to a misinterpretation of the IPCC good practice guidance for LULUCF default inventory period (20-year) definition. The ERT strongly recommends that Bulgaria check the coherence of reported data, apply QC checks and ensure consistency and accuracy in the estimation process and in the reporting phase.

## 3. Non-key categories

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

150. The ERT identified an inconsistency in the carbon stock change estimates for the living biomass pool. The average annual aboveground biomass increment (t dm/ha/year) is not consistent with the reported value of the average annual increment in biomass. The ERT recommends that Bulgaria ensure consistency and accuracy in the estimation process.

#### 4. Areas for further improvement

##### Identified by the Party

151. The NIR states that in the near future Bulgaria is going to carry out an assessment of the most important factors contributing to the results of the LULUCF sector, assessing uncertainties and potential improvements. On the basis of this assessment, a plan of improvement will be made and actions will be prioritized. For 2010, the Party plans to improve the inventory of the areas of cropland as well as estimations of the soil organic content in cropland and grassland categories, by soil groups. In 2011, it plans to estimate the soil organic content in forest soil, by soil groups. The ERT recommends that Bulgaria undertake these improvements and report on them in its next annual submission, including any recalculations, the rationale for the recalculations and the impact on emission trends.

##### Identified by the expert review team

152. The ERT identified the following cross-cutting areas for improvement in the LULUCF sector:

- (a) Strengthen arrangements to ensure the sustainability of existing capacities and competence of technical staff for LULUCF reporting in accordance with the IPCC good practice guidance;
- (b) Improve the transparency of the LULUCF inventory by reporting information in the NIR on methodologies, parameters and AD used;
- (c) Ensure consistency in land classification by using the LUC matrices;
- (d) Check the coherence of reported data and apply QC checks, ensuring consistency and accuracy in the estimation process and in the reporting phase;
- (e) Include the LULUCF sector in its uncertainty analysis, assessing the uncertainties for each LULUCF category.

## F. Waste

### 1. Sector overview

153. In 2008, emissions from the waste sector amounted to 10,481.87 Gg CO<sub>2</sub> eq, or 14.1 per cent of total GHG emissions. Since 1988, emissions have decreased by 8.1 per cent. The key driver for the fall in emissions is a decline in the amount of municipal solid waste disposed to landfills (a 54.5 per cent decrease between 1988 and 2008). Within the sector, 89.5 per cent of the emissions were from solid waste disposal on land, followed by 8.3 per cent from wastewater handling and 2.1 per cent from waste incineration.

##### Completeness

154. In relation to the 13 August 2010 annual submission, the Party has reported emissions from solid waste disposal on land, industrial, domestic and commercial wastewater treatment, emissions from human sewage and waste incineration. The CRF tables are complete and many of the background data tables have been updated in the 2010 annual submission. However, the ERT found that there are many inconsistencies between the NIR and CRF tables. During the review week, Bulgaria provided revised tables with additional information.

### Transparency

155. The ERT reiterates a recommendation of the previous review report that information on relevant waste management practices in Bulgaria, as well as clear statements on the EFs used (as recommended in the IPCC good practice guidance and the UNFCCC reporting guidelines), are to be included in the NIR.

156. The ERT noted that the 2010 annual submission included general descriptions of the methods used to estimate emissions from the waste sector, as well as the AD on the amount of waste disposed to landfills or incinerated, and wastewater treated for the whole time series. The ERT reiterates the encouragement of the previous review report that Bulgaria provide, in its next annual submission, further information and detailed descriptions of background data and references, AD and EFs and methodologies and assumptions used.

157. The ERT noted inconsistencies in the reporting of interrelated emissions in the waste, agriculture and energy sectors. For example, during the review week, the Party informed the ERT that there are some cement kilns where hazardous waste is incinerated and that sewage sludge from wastewater treatment plants is partially disposed on agricultural land. However, there is no reference to these emissions under the energy and agriculture sectors. These inconsistencies are apparently caused by a lack of communication among the sectoral experts and a lack of QA. The ERT encourages Bulgaria to strengthen the QA to ensure consistent intersectoral reporting.

158. To improve the transparency of the NIR, the ERT recommends that Bulgaria provide, in its next annual submission, more information on waste management policies and existing practices and technologies of waste recovery and waste disposal facilities.

### Recalculations and time-series consistency

159. In relation to the 13 August 2010 annual submission, emissions from managed and unmanaged waste disposal on land and waste incineration have been recalculated based on the recommendations of the previous review report. However, the Party did not report in the NIR or CRF table 8 any explanations for the recalculations, the rationale for the recalculations and the impact on the emission trend. The ERT recommends that Bulgaria report on recalculations in line with the UNFCCC reporting guidelines.

## **2. Key categories**

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

160. In 2008, CH<sub>4</sub> emissions from solid waste disposal on land contributed 12.6 per cent to total GHG emissions. The emissions from solid waste disposal on land decreased by 8.1 per cent, due to a decrease in the waste generation rate, from 2.36 to 1.30 kg/cap/day. The amount of municipal solid waste disposed to landfills decreased by 54.5 per cent between 1988 and 2008, whereas the fraction of municipal solid waste disposed at solid waste disposal sites during the entire time series remained almost constant (0.95–0.93). The decrease in the waste generation rate per capita is not in line with the global tendency of increasing consumption. The ERT recommends that the Party provide an explanation for the trend in the waste generation rate in its next annual submission.

161. The ERT found that historical data are not well documented in the NIR. In response to a question from the ERT during the review week, Bulgaria explained that a regression model was used to calculate quantities of waste generated in the period 1950–1978, based on a correlation between statistical data from 1979–1993 received from waste collectors serving settlements and on the size of the urban population. The ERT found that this approach is not well founded and does not reflect the real situation. According to the regression model, waste generation is increasing whereas the urban population is

decreasing; hence, the ERT concludes that the statistical data used from 1979–1993 are an overestimate. During the review, the Party and the NSI acknowledged that the data used in the correlation model are an overestimate. The ERT recommends that the Party verify and revise the historical data using the available data from neighbouring Balkan countries or recognized international scientific literature.

162. In response to a recommendation of the previous ERT, Bulgaria has developed country-specific data for degradable organic carbon (DOC); however, this has been developed only for the period 2002–2008. Further, the ERT noted that the DOC value of 0.3014 for the period 1950–2001 is up to two times higher than IPCC default values (0.15–0.21). The Party acknowledged that this is an error in the application of the IPCC good practice guidance. The ERT recommends that Bulgaria analyse alternatives, including the application of the extrapolation techniques for reconstructing a time series which are provided in the IPCC good practice guidance, improve the quality of data on waste composition and the determination of DOC values for earlier years in the inventory time series, and report on this in its next annual inventory submission.

163. Bulgaria has categorized its landfill as managed and unmanaged and has used a revised value for the methane correction factor (MCF) of 1 and 0.8, respectively, for the period 1950–2008. This implies that all landfills since 1950 are ‘deep’ and the ERT concluded that this assumption is unlikely for the beginning of the time series. The ERT recommends that Bulgaria revise the landfill parameters for the entire time series.

164. Bulgaria did not report any recovery of CH<sub>4</sub> from landfill. Further, there is no information in the NIR on this practice. During the review week, the Party informed the ERT that at least six new landfills are equipped with a methane recovery system. With a view to improving transparency, information on landfill recovery facilities is to be included in the NIR in line with the requirements of the IPCC good practice guidance. The ERT recommends that Bulgaria include an estimate of CH<sub>4</sub> recovery from landfill in its next annual submission.

#### Wastewater handling – CH<sub>4</sub>, N<sub>2</sub>O

165. Emissions from wastewater handling decreased by 64.5 per cent over the period 1988–2008. The ERT noted an unstable trend in the emissions and that no explanation is provided in the NIR for this trend. The ERT identified an inconsistency in the reporting of the share of anaerobic treated wastewater between the NIR (8–11 per cent) and the CRF table (15 per cent). The ERT recommends that Bulgaria strengthen the QA to ensure coherent reporting.

166. During the review week, the Party mentioned that it is not clear whether Bulgaria has any wastewater treatment plants equipped with CH<sub>4</sub> tanks, nor whether CH<sub>4</sub> recovered is used for energy purposes. The ERT recommends that Bulgaria provide in its NIR improved information on the wastewater streams and treatment technologies used at wastewater treatment plants.

167. Emissions of N<sub>2</sub>O from human sewage were estimated following the methodology from the Revised 1996 IPCC Guidelines. The protein consumption value decreased in the period 1988–2008 from 44.33 to 24.19 kg/head/year of the inventory time series for protein consumption reported in recent years. However, data from the FAO on protein consumption for Bulgaria ranges between 45 kg/head/year and 47 kg/head/year in the period 1990–2005. The ERT concluded that this has led to an underestimate of emissions for the year 2008, in the order of 48 per cent. During the review week, Bulgaria recalculated N<sub>2</sub>O emissions from human sewage using the FAO data. The ERT recommends that Bulgaria investigate the protein consumption trend and report on this in its next annual submission, including recalculations, if undertaken, based on country-specific values or FAO data.

### 3. Non-key categories

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

168. Emissions from the incineration of waste are reported for the first time in the 2010 annual submission for the period 2004–2008 in response to a recommendation of the previous review report. The ERT found the trend in CO<sub>2</sub> emissions to be unstable and no explanation of the trend was given in the NIR. In response to questions raised by the ERT during the review week, Bulgaria submitted revised estimates for waste incineration and for all years of the inventory time series. The revised estimates are based on information received from 49 incinerators and led to a decrease in emissions of 90 per cent when compared with the previous submission. The ERT recommends that Bulgaria include an explanation of the trend in its next annual submission.

169. During the review week, Bulgaria explained that waste is used as an alternative fuel in cement production and confirmed that emissions arising from this activity are not included in the inventory. The ERT concluded that this is a potential underestimate of emissions and that emissions from this activity relate to energy recovery and, as such, are to be reported in the energy sector in line with the IPCC good practice guidance. The ERT recommends that Bulgaria provide relevant information in its next annual submission on incineration facilities and the composition of incinerated waste streams, including references to the corresponding section in the energy sector explaining the emission allocation.

### 4. Areas for further improvement

#### Identified by the Party

170. The ERT noted from the NIR that Bulgaria is planning a general revision of AD with a view to improving the quality of its waste sector inventory. The ERT recommends that Bulgaria use its key category analysis and uncertainty analysis as a driver for improvement in the waste sector.

#### Identified by the expert review team

171. The ERT recommends that Bulgaria improve the transparency of its inventory for the waste sector by explaining the methods, AD and EFs used to prepare its emission estimates; for example, further information could be reported in the NIR on the reasons for changes in the rate of waste generation between the years 1988 and 2007.

## 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

172. Bulgaria has not elected to account for any of the activities under Article 3.4 over the commitment period, and has chosen to account for the Article 3.3 activities at the end of commitment period.

173. The reporting of KP-LULUCF is generally in line with the IPCC good practice guidance for LULUCF in relation to estimates of changes in carbon stocks from afforestation, reforestation and deforestation (ARD) areas. Incoherencies still remain in the reporting of carbon pools (i.e. the deadwood pool has been reported as “NO” in the



afforestation and reforestation categories, whereas the litter pool has been included in the soil pool).

174. The ERT noted that there are arrangements within the national system (MAF) for the provision of data and general cooperation in KP-LULUCF reporting. The ERT strongly recommends that Bulgaria strengthen these arrangements to ensure the sustainability of existing capacities and competence of technical staff for KP-LULUCF reporting.

175. Afforestation and reforestation have been identified as key categories.

176. The ERT noted from the NIR that a model-based approach will be used to assess the uncertainties of emissions/removals of ARD units, and that this is planned for 2011–2015. The ERT strongly recommends that Bulgaria assess the uncertainty of ARD units for its next annual submission in line with the requirement mentioned in decision 15/CMP.1.

177. The ERT noted an overall coherence and consistency between the reporting of the forest land category under the Convention and the Article 3, paragraph 3, ARD activities reported under the Kyoto Protocol.

178. The ERT noted an error in CRF table NIR.2. The Party did not fill the column 'other', which resulted in a total national area of 251 kha versus the value of 11,000 kha deduced by data reported under the Convention. In response to a question from the ERT on this discrepancy, Bulgaria indicated that it would resolve the problem in its 22 October resubmission. However, this error was not corrected. The ERT recommends that the Party rectify this error in its next annual submission.

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

##### Afforestation and reforestation – CO<sub>2</sub>

179. The ERT found that no information was reported in the annual submission to demonstrate that activities under Article 3, paragraph 3, began on or after 1 January 1990 and are directly human-induced, as required by paragraph 8(a) of the annex to decision 15/CMP.1. During the review week, Bulgaria provided information to demonstrate that afforestation and reforestation activities are directly human-induced. Nevertheless, the ERT concluded that this information does not demonstrate that activities of planting, seeding and/or human-induced promotion of natural seed sources have been carried out in the units of land converting to forest (see paragraph 1 of the annex to decision 16/CMP.1). Further, Bulgaria did not provide information that demonstrates that afforestation and reforestation activities began on or after 1 January 1990 and before 31 December 2008. The ERT concluded that this leads to a potential overestimation of removals by sinks in afforestation and reforestation areas.

180. The ERT noted that no information was reported in the annual submission in relation to the size and geographical location of forest areas that have lost forest cover but which are not yet classified as deforested. During the review week, Bulgaria provided the requested information. The ERT strongly recommends that the Party include this information in its next annual submission.

181. Bulgaria reported carbon stock changes in aboveground biomass and soil pools. Belowground biomass carbon stock changes have been included in the estimates of aboveground biomass, whereas carbon stock changes in deadwood have been reported as "NO", and carbon stock changes in the litter pool have been included in estimates of soil carbon stock changes. The ERT concluded that this approach is not in line with the IPCC good practice guidance for LULUCF because Parties to the Kyoto Protocol are required to estimate carbon stock changes for each pool unless transparent and verifiable information is provided to demonstrate that the missing pool is not a net source in accordance with

paragraph 6(e) of the annex to decision 15/CMP.1. During the review week, Bulgaria provided additional information to demonstrate that the litter pool was taken into account in the soil organic carbon assessment carried out in the framework of the international cooperative programme Assessment and Monitoring of Air Pollution Effects on Forests – a United Nations Economic Commission for Europe (UNECE) Convention on Long-Range Transboundary Air Pollution report. The ERT strongly recommends that Bulgaria report separately carbon stock changes from the litter pool, as required by the IPCC good practice guidance for LULUCF. The ERT also strongly recommends that Bulgaria report carbon stock changes from the deadwood pool, as required by the IPCC good practice guidance for LULUCF, or that the Party supply transparent and verifiable information to demonstrate that this carbon pool is not a net source.

182. The ERT noted an inconsistency in the carbon stock change estimates for the living biomass pool in relation to afforestation and reforestation areas. The average annual aboveground biomass increment (t dm/ha/year) is not consistent with the reported value of the average annual increment in biomass. The ERT recommends that the Party ensure consistency and accuracy in the estimation process.

#### Deforestation – CO<sub>2</sub>

183. The ERT found that no information had been reported in the annual submission to illustrate how harvesting or forest disturbance that is followed by the re-establishment of forest is distinguished from deforestation. During the review week, Bulgaria provided the requested information. The ERT strongly recommends that the Party include this information in its next annual submission, as required by paragraph 8(b) of the annex to decision 15/CMP.1.

184. Bulgaria reported carbon stock changes in aboveground biomass and soil pools. The ERT concluded that this approach is not in accordance with the IPCC good practice guidance for LULUCF because Parties to the Kyoto Protocol are required to estimate carbon stock changes for each carbon pool unless transparent and verifiable information is provided to demonstrate that the carbon pool is not a net source (paragraph 6(e) of the annex to decision 15/CMP.1). The ERT strongly recommends that Bulgaria report separately carbon stock changes from the litter pool as required by the IPCC good practice guidance for LULUCF.

## **2. Information on Kyoto Protocol units**

#### Standard electronic format and reports from the national registry

185. Bulgaria 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 and recommendations included in the SIAR on the SEF tables and the SEF comparison report.<sup>9</sup> The SIAR was forwarded to the ERT prior to the review, pursuant to decision 16/CP.10. The ERT reiterated the main findings and recommendations contained in the SIAR.

186. Information on the accounting of Kyoto 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

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<sup>9</sup> 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.

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. However, the ERT reiterates a recommendation of the SIAR that Bulgaria report information on transaction discrepancies as required by paragraph 12 of the annex to decision 15/CMP.1. The national registry has adequate procedures in place to minimize discrepancies.

#### National registry

187. 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 measures for security, data safeguard and disaster recovery in place and its operational performance is adequate. However, the ERT reiterates a finding of the SIAR that the national registry does not fulfil the requirements regarding the public availability of information in accordance with section I.E of the annex to decision 13/CMP.1. The ERT reiterates a recommendation of the SIAR that the Party make publicly available information required by paragraph 45 (account information), paragraph 46 (Article 6 JI project information), and paragraph 47 (holding and transaction information) of the annex to 13/CMP.1. If any part of this information is deemed confidential, the Party should include an explicit statement in its NIR and on its public website indicating exactly which data are confidential, referencing the relevant regulations.

#### Calculation of the commitment period reserve

188. Bulgaria has reported its commitment period reserve in its 2010 annual submission. Prior to the review week, Bulgaria submitted a revised calculation of the commitment period reserve of 371,589.05 t CO<sub>2</sub> eq based on the national emissions in its most recently reviewed inventory (74,317.81 Gg CO<sub>2</sub> eq) (2008 is contained in the 2010 annual submission).

189. In its resubmission of 10 November 2010, Bulgaria calculated its commitment period reserve to be 375,979,492 t CO<sub>2</sub> eq based on its most recently reviewed inventory (75,195.90 Gg CO<sub>2</sub> eq). The ERT agrees with this figure.

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

190. Bulgaria included in its 2010 annual submission, and provided to the ERT during the review week, information outlining changes in its national system when compared with the previous annual submission. Changes in the national system include:

- (a) ExEA has increased the number of resources (e.g. staff) within ExEA involved in inventory development;
- (b) MoEW and ExEA have strengthened institutional arrangements with other ministries, agencies and entities involved in inventory planning and preparation;
- (c) The technical competence of staff has improved with the implementation of training programmes early in 2010;
- (d) A new legal framework for the national system was enshrined in the “Ordinance on the way and order of organization of the national inventories of hazardous

substances from greenhouse gases in the ambient air”, and this ordinance entered into force on 21 September 2010;

(e) Existing annual agreements for cooperation with external institutions (e.g. Denkstatt) have been extended for the next year.

191. The ERT concluded that changes in the national system of Bulgaria since the previous annual submission have resulted in a national system that:

(a) Is now performing its required general and specific functions, as set out in the annex to decision 19/CMP.1 with respect to the institutional, legal and procedural arrangements to perform these functions; that the institutional, legal and procedural arrangements established and formalized by the “Ordinance on the way and order of organization of the national inventories of hazardous substances from greenhouse gases in the ambient air” (Ordinance No. 215) that entered into force on 21 September 2010;

(b) Is fully operational;

(c) Has in place the institutional arrangements and the capacity, including the arrangements for the technical competence of staff involved in the national system, to plan, prepare and manage inventories on an annual basis.

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

192. The ERT noted the finding of the SIAR that Bulgaria reported extensive information regarding the registry (chapter 14 of the NIR), but it is unclear if this information reflects a change in the national registry compared with the previous annual submission. However, during the review week, Bulgaria informed the ERT that changes in the national registry since the last annual submission had occurred, namely: a change in the database administrator, virtual private network connectivity and an upgrade in the GRETA software. Acknowledging the above and based on the finding of the SIAR, the ERT concluded that the Party’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. The ERT reiterates a recommendation from both the 2008 and 2009 SIARs that the Party report changes in the national registry system from the previous reporting year as required by paragraph 32 (a–j) of the annex to decision 15/CMP.1.

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

193. Bulgaria 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 2010 annual submission.

194. The reported information is considered complete and transparent. Information reported by the Party includes how the Party strives under Article 3, paragraph 14, to implement its commitments under Article 3, paragraph 14, of the Kyoto Protocol to minimize adverse impacts in line with paragraph 23 of the annex to decision 15/CMP.1, and also includes information on how the Party gives priority in implementing its commitments under Article 3, paragraph 14, (e.g. the phasing-out of market imperfections, fiscal incentives, and so on) in line with paragraph 24 of the annex to decision 15/CMP.1.

195. Bulgaria has developed a number of legislative measures that are connected mainly with the transposing of the corresponding European Union legislation. The Party also has other activities on implementing directives connected with the politics on climate change. Selected actions, identified in paragraph 24 of the annex to decision 15/CMP.1, are presented in table 15.1 of the NIR.

196. The ERT welcomes these efforts and encourages Bulgaria to continue to implement actions according to Article 3, paragraph 14, and to contribute to the capacity-strengthening of developing country Parties.

### III. Conclusions and recommendations

197. Bulgaria made its annual submission on 15 April 2010 and officially resubmitted the NIR and CRF on numerous occasions up until 13 August 2010. 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). In response to questions from the ERT during the review week, Bulgaria submitted revised emission estimates and information, including supplementary information required under Article 7, paragraph 1, of the Kyoto Protocol, on 22 October 2010. This resubmission is generally in line with decision 15/CMP.1.

198. The ERT concludes that the inventory submission of Bulgaria has been generally reported in accordance with the UNFCCC reporting guidelines. The inventory submission is complete and the Party has submitted a set of CRF tables for the years 1988–2008 and an NIR; these are complete in terms of geographical coverage, years and sectors, and complete in terms of categories and gases. Information on recalculations was not reported in CRF tables 8(a) and 8(b), and output from the uncertainty analysis was not included in the 2010 annual submission in the tables provided in the IPCC good practice guidance. Emission estimates for the F-gases are not provided for the years 1988–1994.

199. The submission of information required under Article 7, paragraph 1, of the Kyoto Protocol has generally been prepared and reported in accordance with decision 15/CMP.1. Conclusions on the identified problems in the Party's preparation and reporting of information on KP-LULUCF are provided in paragraph 201 below.

200. The Party'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. Bulgaria has implemented higher-tier methods for some key categories.

201. Bulgaria's 2010 annual submission on KP-LULUCF was generally prepared and reported in line with the requirements of paragraphs 5–9 of the annex to decision 15/CMP.1. However, the ERT concludes that information provided to the ERT during the course of the review to demonstrate that ARD activities began on or after 1 January 1990 and are directly human-induced was not sufficient. The ERT also concludes that the Party has not prepared estimates of emissions from changes in carbon stocks in line with the IPCC good practice guidance for LULUCF, in that it has not reported carbon stock change emissions for each carbon pool.

202. Bulgaria 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.

203. The ERT concludes that the national system of Bulgaria is performing its required general and specific functions, as set out in the annex to decision 19/CMP.1 with respect to the institutional, legal and procedural arrangements to perform these functions; that the institutional, legal and procedural arrangements established and formalized by the "Ordinance on the way and order of organization of the national inventories of hazardous substances from greenhouse gases in the ambient air" (Ordinance No. 215) that entered into

force on 21 September 2010 are fully operational; and that Bulgaria has in place the institutional arrangements and the capacity, including the arrangements for the technical competence of staff involved in the national system, to plan, prepare and manage inventories on an annual basis.

204. 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. However, the ERT reiterates a finding of the SIAR that the national registry does not fulfil the requirements regarding the public availability of information in accordance with section I.E of the annex to decision 13/CMP.1.

205. Bulgaria has reported the information requested in 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 2010 annual submission. The reported information is considered complete and transparent.

206. In the course of the review, the ERT formulated a number of recommendations relating to the completeness of the annual submission (including Article 7.1 information), transparency and sector-specific recommendations with regard to methodologies, AD and/or EFs presented in Bulgaria's annual submission and subsequent resubmissions. The key recommendations are that Bulgaria:

- (a) Improve the transparency of the inventory by including in the NIR additional information on and explanations for the selection of methodologies, identification of EFs, assumptions for choosing parameters and sources of AD;
- (b) Provide quantified uncertainty estimates for all categories (including the LULUCF sector) and include the LULUCF sector in the overall inventory uncertainty analysis;
- (c) Continue to improve the quality of its inventory submission using the output of the key category analysis and uncertainty analysis as drivers for this improvement;
- (d) Report explanations for recalculations in the relevant chapters of the NIR and in CRF table 8(b), including the rationale for each recalculation and its impact on the emission trend, and whether the resulting time series is consistent;
- (e) Improve time-series consistency by using consistent AD and EFs for the whole time series, specifically for the years before 1990;
- (f) Develop and implement internal written guidance on the steps and procedures in the QA/QC system to ensure that all participants have a consistent understanding of the system;
- (g) Undertake further efforts to meet the requirements for reporting information on activities under Article 3, paragraph 3, of the Kyoto Protocol in terms of maintaining conformity with the IPCC good practice guidance for LULUCF and decision 15/CMP.1;
- (h) Prepare and report information on ARD in line with the requirement set out in paragraph 8(a) of the annex to decision 15/CMP.1 in relation to demonstrating that ARD activities began on or after 1 January 1990 and are directly human-induced;
- (i) Prepare and report information changes in carbon stocks in line with the IPCC good practice guidance for LULUCF in that emissions of carbon stock changes are to be reported for each carbon pool;
- (j) Report information on transaction discrepancies as required by paragraph 12 of the annex to decision 15/CMP.1;

(k) Make publicly available information required by paragraph 45 (account information), paragraph 46 (Article 6 JI, project information) and paragraph 47 (holding and transaction information) of the annex to 13/CMP.1. If any part of this information is deemed confidential, the Party should include an explicit statement in its NIR and on its public website indicating exactly which data are confidential, referencing the relevant regulations;

(l) The ERT reiterates a recommendation from both the 2008 and 2009 SIARs that the Party report changes to the national registry system from the previous reporting year as required by paragraph 32 (a-j) of the annex to decision 15/CMP.1.

#### **IV. Questions of implementation**

207. 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>>.

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/gpplulucf/gpplulucf.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>>.

“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>>.

“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>>.

Status report for Bulgaria 2010. Available at  
<<http://unfccc.int/resource/docs/2008/asr/bgr.pdf>>.

Synthesis and assessment report on the greenhouse gas inventories submitted in 2010. Available at <<http://unfccc.int/resource/webdocs/sai/2010.pdf>>.

FCCC/ARR/2009/BGR. Report of the individual review of the greenhouse gas inventory of Bulgaria submitted in 2009. Available at  
<<http://unfccc.int/resource/docs/2010/arr/bgr.pdf>>.

UNFCCC. *Standard Independent Assessment Report*, Parts I and II. Available at  
<[http://unfccc.int/kyoto\\_protocol/registry\\_systems/independent\\_assessment\\_reports/items/4061.php](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 Ms. Evelina Nikolova (Executive Environment Agency), including additional material on the methodology and assumptions used. The following documents<sup>1</sup> were also provided by Bulgaria:

Bulgarian geography society. 2009. Atlas of Bulgaria, Sofia. Available at <http://www.geog.psu.edu>.

Council of Ministers. 2010. *Ordinance on the way and order of organization of the National Inventories of hazardous substances from greenhouse gases in the ambient air, according to Decree № 215/21.09.2010* by the Council of the Ministers [Published in SG 76/2010] Available at: <http://dv.parliament.bg/DVWeb/broeveList.faces>

Denkstatt. 2010. *National study for determining the quantity of actual fluorinated gases (F-gases) (HFCs, PFCs and SF<sub>6</sub>) in Bulgaria and methods for their calculations*. Contract between MOEW and Denkstatt N 1505/28.12.2009. Sofia, 2009.

Ministry of Agriculture and Food. 2001. BANCNIK: Land cover and land use in 2001. Agri-statistical Division.

Ministry of Agriculture and Food. 2001. BANCNIK: nomenclatures. Agri-statistical Division.

Ministry of Environment and Water. 2003. *The National Waste Management Programme, 2003-2007*, Sofia. Available at: [http://www.moew.government.bg/recent\\_doc/waste/NWMP\\_2003-2007EN\\_fin.doc](http://www.moew.government.bg/recent_doc/waste/NWMP_2003-2007EN_fin.doc)

Ministry of Environment and Water. 2003. *Law on Waste*. Sofia SG 86/30, September 2003. Available at: [http://www.moew.government.bg/recent\\_doc/legislation/waste/bg/ZUO.pdf](http://www.moew.government.bg/recent_doc/legislation/waste/bg/ZUO.pdf)

Ministry of Environment and Water. 2007. *Operational Programme Environment 2007-2013*. Sofia. Available at: [http://ope.moew.government.bg/uf/other/OPE\\_FINAL\\_BG.doc](http://ope.moew.government.bg/uf/other/OPE_FINAL_BG.doc)

National Statistical Institute. 2008. *Statistical Yearbook*. Sofia. Available at: <http://www.nsi.bg/publikaciaen.php?n=106&r=7|&PSP=7&P=179&SP=183>

Schwarz W. 2005. *Emissions, Activity Data, and Emission Factors of Fluorinated Greenhouse Gases (F-Gases) in Germany 1995-2002*. Berlin, Germany. Publisher: Federal Environmental Agency (Umweltbundesamt), Berlin. Available at: <http://www.oekorecherche.de/english/berichte/berichteOzonschicht.html>

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<sup>1</sup> Reproduced as received from the Party.

## Annex II

### Acronyms and abbreviations

AD	activity data
ARD	afforestation, reforestation and deforestation
AWMS	animal waste management systems
BOF	basic oxygen furnaces
CH <sub>4</sub>	methane
CaO	calcium oxide
CO <sub>2</sub>	carbon dioxide
CO <sub>2</sub> eq	carbon dioxide equivalent
CRF	common reporting format
DOC	degradable organic carbon
EAF	electric arc furnaces
EF	emission factor
IE	included elsewhere
ITL	international transaction log
ERT	expert review team
EU	European Union
EU ETS	European Union emissions trading scheme
F-gas	fluorinated gas
GHG	greenhouse gas; unless indicated otherwise, GHG emissions are the sum of CO <sub>2</sub> , CH <sub>4</sub> , N <sub>2</sub> O, HFCs, PFCs and SF <sub>6</sub> without GHG emissions and removals from LULUCF
HFCs	hydrofluorocarbons
IEA	International Energy Agency
IPCC	Intergovernmental Panel on Climate Change
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
MCF	methane conversion factor
MgO	magnesium oxide
NA	not applicable
Na <sub>2</sub> CO <sub>3</sub>	sodium carbonate
NE	not estimated
NO	not occurring
N <sub>2</sub> O	nitrous oxide
NIR	national inventory report
OHF	open hearth furnaces
PFCs	perfluorocarbons
QA/QC	quality assurance/quality control
SEF	standard electronic format
SF <sub>6</sub>	sulphur hexafluoride
SIAR	standard independent assessment report
UNFCCC	United Nations Framework Convention on Climate Change