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## **Report of the individual review of the annual submission of Bulgaria submitted in 2012\***

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\* In the symbol for this document, 2012 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 centralized review of the 2012 annual submission of Bulgaria, coordinated by the UNFCCC secretariat, in accordance with decision 22/CMP.1. The review took place from 3 to 8 September 2012 in Bonn, Germany, and was conducted by the following team of nominated experts from the UNFCCC roster of experts: generalists – Mr. Christopher Dore (United Kingdom of Great Britain and Northern Ireland) and Ms. Jolanta Merkeliene (Lithuania); energy – Ms. Carmen Teresa Meneses López (Venezuela (Bolivarian Republic of)), Mr. Ioannis Sempas (Greece) and Ms. Inga Valuntiene (Lithuania); industrial processes – Ms. Laura Dawidowski (Argentina) and Ms. Valentina Idrissova (Kazakhstan); agriculture – Mr. Chang Liang (Canada) and Mr. Yuriy Pyrozhenko (Ukraine); land use, land-use change and forestry (LULUCF) – Ms. Marina Shvangiradze (Georgia) and Mr. Richard Volz (Switzerland); and waste – Mr. Chart Chiemchaisri (Thailand), Ms. Baasansuren Jamsranjav (Mongolia) and Mr. Mikael Szudy (Sweden). Ms. Dawidowski and Mr. Dore were the lead reviewers. The review was coordinated by Ms. Kyoko Miwa (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 2010, the main greenhouse gas (GHG) in Bulgaria was carbon dioxide (CO<sub>2</sub>), accounting for 78.0 per cent of total GHG emissions<sup>1</sup> expressed in carbon dioxide equivalent (CO<sub>2</sub> eq), followed by methane (CH<sub>4</sub>) (13.8 per cent) and nitrous oxide (N<sub>2</sub>O) (7.7 per cent). Hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF<sub>6</sub>) collectively accounted for 0.5 per cent of the overall GHG emissions in the country. The energy sector accounted for 75.7 per cent of total GHG emissions, followed by the agriculture sector (10.4 per cent), the waste sector (7.6 per cent), the industrial processes sector (6.2 per cent) and the solvent and other product use sector (0.1 per cent). Total GHG emissions amounted to 61,704.06 Gg CO<sub>2</sub> eq and decreased by 52.0 per cent between the base year<sup>2</sup> and 2010. The emission trends are reasonable, and similar to many other Eastern European countries, reflecting the structural and economic changes towards a market economy that have taken place in the region over the past two decades.

4. Tables 1 and 2 show GHG emissions from Annex A sources, emissions and removals from the LULUCF sector under the Convention and emissions and removals from activities under Article 3, paragraph 3, and, if any, Article 3, paragraph 4, of the Kyoto Protocol (KP-LULUCF), by gas and by sector and activity, respectively. In table 1, CO<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. Tables 3–5 provide 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<sup>a</sup> to 2010

		Gg CO <sub>2</sub> eq								Change (%)	
Greenhouse gas		Base year <sup>a</sup>	1990	1995	2000	2005	2008	2009	2010	2010	Base year–2010
Annex A sources	CO <sub>2</sub>	95 129.72	83 386.24	62 084.89	47 642.63	51 918.26	54 467.06	45 730.55	48 107.90		–49.4
	CH <sub>4</sub>	19 216.45	19 123.56	13 112.51	10 292.70	9 411.90	9 020.04	8 609.12	8 529.11		–55.6
	N <sub>2</sub> O	14 206.66	11 937.26	6 495.55	5 107.30	5 098.53	4 998.33	4 570.77	4 773.00		–66.4
	HFCs	2.39	IE, NA, NO	2.39	17.95	101.02	300.72	268.52	280.94		11 662.1
	IE, NA, NE, NO	IE, NA, NE, NO	IE, NA, NE, NO	IE, NA, NE, NO	IE, NA, NE, NO	IE, NA, NE, NO	0.0005	0.01	0.04		NA
	PFCs	5.13	3.87	5.13	6.80	8.56	9.60	9.97	13.07		154.6
KP-LULUCF	SF <sub>6</sub>										
	CO <sub>2</sub>						–788.22	–1 063.31	–1 187.72		
	CH <sub>4</sub>						NO	NO	NO		
	N <sub>2</sub> O						NO	NO	NO		
	CO <sub>2</sub>	NA	NA	NA	NA	NA	NA	NA	NA		NA
	CH <sub>4</sub>	NA	NA	NA	NA	NA	NA	NA	NA		NA
	N <sub>2</sub> O	NA	NA	NA	NA	NA	NA	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, IE = included elsewhere, 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.

<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 2

Greenhouse gas emissions by sector and activity, base year<sup>a</sup> to 2010

Sector	Base year <sup>a</sup>	Gg CO <sub>2</sub> eq								Change (%)	
		1990	1995	2000	2005	2008	2009	2010	2010	Base year-2010	Base year-2010
Energy	87 475.35	76 583.37	56 251.50	44 011.00	48 007.54	51 270.83	44 572.04	46 714.64	46 714.64	-46.6	-46.6
Industrial processes	12 408.23	10 740.72	10 060.95	6 475.54	6 656.68	6 074.58	3 438.26	3 852.01	3 852.01	-69.0	-69.0
Solvent and other product use	899.79	897.75	95.61	68.40	50.68	51.10	47.84	45.91	45.91	-94.9	-94.9
Agriculture	20 833.04	18 768.38	8 529.54	6 482.83	6 485.32	6 398.32	6 252.12	6 405.90	6 405.90	-69.3	-69.3
Waste	6 943.94	7 460.72	6 762.87	6 029.62	5 338.03	5 000.94	4 878.69	4 685.59	4 685.59	-32.5	-32.5
LULUCF	NA	-13 892.94	-12 963.51	-8 867.84	-9 078.34	-8 644.90	-8 816.29	-8 631.27	-8 631.27	NA	NA
<b>Total (with LULUCF)</b>	<b>NA</b>	<b>100 558.00</b>	<b>68 736.97</b>	<b>54 199.54</b>	<b>57 459.92</b>	<b>60 150.86</b>	<b>50 372.65</b>	<b>53 072.79</b>	<b>53 072.79</b>	<b>NA</b>	<b>NA</b>
<b>Total (without LULUCF)</b>	<b>128 560.35</b>	<b>114 450.94</b>	<b>81 700.48</b>	<b>63 067.38</b>	<b>66 538.26</b>	<b>68 795.76</b>	<b>59 188.95</b>	<b>61 704.06</b>	<b>61 704.06</b>	<b>-52.0</b>	<b>-52.0</b>
Other <sup>b</sup>	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Afforestation and reforestation						-1 077.56	-1 222.72	-1 393.25	-1 393.25		
Deforestation						289.34	159.41	205.53	205.53		
<b>Total (3.3)</b>						<b>-788.22</b>	<b>-1 063.31</b>	<b>-1 187.72</b>	<b>-1 187.72</b>		
Forest management						NA	NA	NA	NA		
Cropland management	NA					NA	NA	NA	NA		NA
Grazing land management	NA					NA	NA	NA	NA		NA
Revegetation	NA					NA	NA	NA	NA		NA
<b>Total (3.4)</b>	<b>NA</b>	<b>NA</b>				<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>

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.

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

<sup>c</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>d</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 t CO<sub>2</sub> eq for the year 2010, including the commitment period reserve

	<i>As reported</i>	<i>Revised estimates</i>	<i>Adjustment<sup>a</sup></i>	<i>Final<sup>b</sup></i>
<b>Commitment period reserve</b>	307 135 300	308 520 300		308 520 300
<b>Annex A emissions for current inventory year</b>				
CO <sub>2</sub>	48 016 353	48 107 895		48 107 895
CH <sub>4</sub>	8 343 705	8 529 106		8 529 106
N <sub>2</sub> O	4 772 942	4 773 004		4 773 004
HFCs	280 944			280 944
PFCs	41			41
SF <sub>6</sub>	13 069			13 069
<b>Total Annex A sources</b>	<b>61 427 055</b>	<b>61 704 060</b>		<b>61 704 060</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	-1 393 251			-1 393 251
3.3 Afforestation and reforestation on harvested land for current year of commitment period as reported	NO			NO
3.3 Deforestation for current year of commitment period as reported	205 529			205 529
<b>Activities under Article 3, paragraph 4, for current inventory year<sup>c</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:* NO = not occurring.

<sup>a</sup> "Adjustment" is relevant only for Parties for which the expert review team has calculated one or more adjustment(s).

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

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

Table 4  
**Information to be included in the compilation and accounting database in t CO<sub>2</sub> eq for  
the year 2009**

	<i>As reported</i>	<i>Revised estimates</i>	<i>Adjustment<sup>a</sup></i>	<i>Final<sup>b</sup></i>
<b>Annex A emissions for 2009</b>				
CO <sub>2</sub>	45 613 153	45 730 546		45 730 546
CH <sub>4</sub>	8 432 797	8 609 118		8 609 118
N <sub>2</sub> O	4 570 674	4 570 769		4 570 769
HFCs	268 525			268 525
PFCs	13			13
SF <sub>6</sub>	9 974			9 974
<b>Total Annex A sources</b>	<b>58 895 136</b>	<b>59 188 946</b>		<b>59 188 946</b>
<b>Activities under Article 3, paragraph 3, for 2009</b>				
3.3 Afforestation and reforestation on non-harvested land for 2009 as reported	-1 222 719			-1 222 719
3.3 Afforestation and reforestation on harvested land for 2009 as reported	NO			NO
3.3 Deforestation for 2009 as reported	159 411			159 411
<b>Activities under Article 3, paragraph 4, for 2009<sup>c</sup></b>				
3.4 Forest management for 2009				
3.4 Cropland management for 2009				
3.4 Cropland management for base year				
3.4 Grazing land management for 2009				
3.4 Grazing land management for base year				
3.4 Revegetation for 2009				
3.4 Revegetation in base year				

*Abbreviation:* NO = not occurring.

<sup>a</sup> "Adjustment" is relevant only for Parties for which the expert review team has calculated one or more adjustment(s).

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

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

Table 5  
**Information to be included in the compilation and accounting database in t CO<sub>2</sub> eq for the year 2008**

	<i>As reported</i>	<i>Revised estimates</i>	<i>Adjustment<sup>a</sup></i>	<i>Final<sup>b</sup></i>
<b>Annex A emissions for 2008</b>				
CO <sub>2</sub>	54 458 664	54 467 063		54 467 063
CH <sub>4</sub>	8 836 421	9 020 041		9 020 041
N <sub>2</sub> O	4 998 262	4 998 332		4 998 332
HFCs	300 721			300 721
PFCs	0			0
SF <sub>6</sub>	9 600			9 600
<b>Total Annex A sources</b>	<b>68 603 668</b>	<b>68 795 758</b>		<b>68 795 758</b>
<b>Activities under Article 3, paragraph 3, for 2008</b>				
3.3 Afforestation and reforestation on non-harvested land for 2008 as reported	-1 077 560			-1 077 560
3.3 Afforestation and reforestation on harvested land for 2008 as reported	NO			NO
3.3 Deforestation for 2008 as reported	289 342			289 342
<b>Activities under Article 3, paragraph 4, for 2008<sup>c</sup></b>				
3.4 Forest management for 2008				
3.4 Cropland management for 2008				
3.4 Cropland management for base year				
3.4 Grazing land management for 2008				
3.4 Grazing land management for base year				
3.4 Revegetation for 2008				
3.4 Revegetation in base year				

*Abbreviation:* NO = not occurring.

<sup>a</sup> “Adjustment” is relevant only for Parties for which the expert review team has calculated one or more adjustment(s).

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

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



## II. Technical assessment of the annual submission

### A. Overview

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

6. The 2012 annual inventory submission, containing a complete set of the common reporting format (CRF) tables for the period 1988–2010 and a national inventory report (NIR), was submitted on 12 April 2012. Bulgaria also submitted information required under Article 7, paragraph 1, of the Kyoto Protocol, including information on KP-LULUCF activities, the accounting of Kyoto Protocol units, changes in the national system and in the national registry, and the minimization of adverse impacts in accordance with Article 3, paragraph 14, of the Kyoto Protocol. The standard electronic format (SEF) tables were submitted on 12 April 2012. The annual submission was submitted in accordance with decision 15/CMP.1.

7. Bulgaria officially submitted revised emission estimates on 18 October 2012 in response to questions raised by the expert review team (ERT) during the review. The overall impact of these revised estimates was an increase in the estimated total GHG emissions of 277.00 Gg CO<sub>2</sub> eq (0.5 per cent) for 2010 and an increase of 156.90 Gg CO<sub>2</sub> eq (0.1 per cent) for 1988. The values in this report are based on those from the submission of 18 October 2012.

8. The ERT also used the previous year's submission during the review. In addition, the ERT used the standard independent assessment report (SIAR), parts I and II, to review information on the accounting of Kyoto Protocol units (including the SEF tables and their comparison report) and on the national registry.<sup>3</sup>

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

#### Completeness of inventory

10. The inventory is complete in terms of gases, geographical coverage, and mandatory<sup>4</sup> source and sink categories, and generally complete in terms of years. The ERT identified some issues concerning the completeness of the inventory, which are explained in paragraphs 11 and 12 below, as well as in the sectoral chapters of this report (see paras. 48, 97 and 117 below).

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

<sup>4</sup> Mandatory source and sink categories under the Kyoto Protocol are all source and sink categories for which the Intergovernmental Panel on Climate Change (IPCC) *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories*, the IPCC *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* and the IPCC *Good Practice Guidance for Land Use, Land-Use Change and Forestry* provide methodologies and/or emission factors to estimate GHG emissions.

11. The ERT noted that Bulgaria reported emissions of CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O from gas/diesel oil under navigation as “NO” (not occurring) for the periods 1988–1989 and 2000–2010. In response to a question raised by the ERT during the review, Bulgaria confirmed that domestic navigation occurs in the country, and submitted revised estimates for the period 2000–2010 during the review week (see para. 69 below). The ERT agreed with these revised estimates; however, it recommends that Bulgaria also collect the necessary data for the period 1988–1999 (emissions of CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O are currently reported as “NA” (not applicable), “NO”), estimate and report the associated emissions, and include this information in its next annual submission for the entire time series, ensuring its consistency and completeness.

12. The ERT also noted that Bulgaria did not include CO<sub>2</sub> emissions from hydrogen production in refineries in its inventory since there is no methodology for estimation available (see para. 48 below). The ERT encourages Bulgaria to estimate and report these emissions, although it recognizes that neither the Intergovernmental Panel on Climate Change (IPCC) *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the Revised 1996 IPCC Guidelines) nor the IPCC *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (hereinafter referred to as the IPCC good practice guidance) provide a methodology for their estimation.

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

Overview

13. The ERT concluded that the national system continues to perform its required functions.

14. Bulgaria described in its NIR a minor change of the national system since the previous annual submission. The Emissions Inventory Unit within the Executive Environmental Agency (ExEA), which is responsible for the GHG emissions inventory preparation, has been promoted from a unit to a department since 1 January 2012 and is hence now called the Emissions Inventory Department. The issue is further discussed in chapter II.G.3.

Inventory planning

15. The national system for the preparation of the inventory is described in the NIR. The Ministry of Environment and Water (MoEW) has overall responsibility for the national inventory, and ExEA, which is under MoEW, is the designated single national entity with overall responsibility for the national inventory. ExEA has managed the Bulgarian national system since 2008, and its specific responsibilities include: choice of methodology; collection of activity data (AD) and emission factors (EFs); inventory preparation, including the calculation of emission estimates; the preparation of the CRF tables and the NIR and the coordination of the supporting activities of external consultants; coordinating quality assurance/quality control (QA/QC) activities; and archiving. Other government departments and agencies, institutions and organizations, including the Ministry of Agriculture and Food (MAF), the Ministry of Economy and Energy, the Ministry of Interior/Road Control Department and the Ministry of Environment and Water, are also involved in the planning and preparation of the inventory.

16. Agreements were signed in 2010 between MoEW and other governmental organizations regarding data acquisition. These agreements aim to ensure that data are received from the main data providers, which include MAF and its relevant services

(Agrostatistic Directorate and Executive Forestry Agency); the Ministry of Economy and Energy; the Ministry of Interior; the Ministry of Transport, Information Technologies and Communications; and the National Statistics Institute (NSI). In the NIR, Bulgaria provided information regarding the contracts with external consultants, which include: Denkstatt Ltd. (for the preparation of the parts of the inventory concerning the energy sector and fluorinated gases (F-gases) from the industrial processes sector), the University of Chemical Technology and Metallurgy (for the preparation of the parts of the inventory concerning wastewater handling under the waste sector) and the University of Forestry (for the provision of KP-LULUCF AD). These contracts were signed in October 2011.

17. The NIR also includes information on the numerous training workshops being delivered to the staff in the Emissions Inventory Department of ExEA, MoEW and NSI, as well as the external contractors. The ERT commends Bulgaria for taking significant actions in order to develop the technical knowledge of the inventory team within ExEA, and encourages the Party to continue such efforts.

18. The ERT noted that the NIR does not include information on how the process of data collection is managed. In responding to a question raised by the ERT during the review, Bulgaria explained that the National Inventory Coordinator and the Quality Manager within ExEA are responsible for data collection. They ensure that all information (data requests and incoming data) is managed appropriately and stored in a well-structured storage system (electronic and hard copy). The ERT recommends that Bulgaria include this information in the NIR of its next annual submission.

19. The ERT noted that there was no information in the NIR on how the members of the Emissions Inventory Department are able to contribute to the ongoing improvement of the inventory. In response to a question raised by the ERT during the review, Bulgaria explained that members of the Emissions Inventory Department contribute to the development of the annual improvement plan for the inventory. It provided the ERT with copies of the annual improvement plans for 2011 and 2012 in Bulgarian. The ERT recommends that Bulgaria describe the involvement of the members of the Emissions Inventory Department in the development of the annual improvement plan in the NIR of its next annual submission.

### Inventory preparation

#### *Key Categories*

20. Bulgaria has reported its key category analyses in annex 1 to the NIR as part of its 2012 annual submission. Complete analyses have been conducted, and results are presented for both tier 1 and tier 2 analyses, with and without the LULUCF sector, and both level and trend assessments. The key category analyses were performed by Bulgaria in accordance with 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). The tier 1 key category analysis performed by Bulgaria and that performed by the secretariat<sup>5</sup> produced similar results.

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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.

21. The ERT noted that annex 1 to the NIR, which includes the key category analyses, does not include a summary table similar to table 7.A3 of the IPCC good practice guidance, as was encouraged in the previous review report.<sup>6</sup> The ERT encourages Bulgaria to include this summary information in the NIR of its next annual submission.

22. The ERT also noted that, while improvements are included in the improvement plan for LULUCF, Bulgaria does not provide information in the NIR on how the key category analysis is used to prioritize the development and improvement of the emission estimates in the LULUCF sector. The ERT recommends that Bulgaria use the results of the key category analysis as a tool to help to select estimation methods (and hence EFs and AD) in the LULUCF sector in line with the IPCC good practice guidance for LULUCF and report thereon in its next annual submission.

23. In its NIR, Bulgaria has presented a full key category analysis for emissions with and without LULUCF categories. Bulgaria has also presented, in a separate part of the NIR, the key categories under Article 3, paragraphs 3 and 4, of the Kyoto Protocol. However, the ERT noted that Bulgaria has not assessed the relationship between the key category analysis and the key categories under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, as outlined in chapter 5.4.4 of the IPCC good practice guidance. The ERT recommends that Bulgaria assess the relationship between the results from the key category analyses and the key categories identified under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, and report the results in its next annual submission.

#### *Uncertainties*

24. Bulgaria has used both tier 1 and tier 2 methods to assess uncertainties in its inventory, with and without LULUCF, for both 1988 and 2010. The Party has provided comprehensive information on its uncertainty analysis in the NIR, which is in accordance with the IPCC good practice guidance. For the tier 1 analysis in 2010, with and without LULUCF, the resulting uncertainties are 34.2 per cent and 14.6 per cent, respectively. For the tier 2 analysis in 2010, with and without LULUCF, the resulting uncertainties are 31.3 per cent and 9.6 per cent, respectively. Bulgaria also reported in the NIR an uncertainty analysis for the afforestation, reforestation and deforestation activities under Article 3, paragraph 3, of the Kyoto Protocol.

25. The ERT noted that Bulgaria does not provide information on the use of the results of the uncertainty analysis to prioritize the development and improvement of the inventory, and recommends that Bulgaria use the uncertainty analysis as a tool to choose the estimation methods, and hence the EFs and AD, and provide this information in the NIR of its next annual submission.

#### *Recalculations and time series consistency*

26. Recalculations have been performed and reported in accordance with the IPCC good practice guidance. The ERT noted that recalculations reported by Bulgaria of the time series from 1988 to 2010 have been undertaken to take into account improvements to the detail, and hence accuracy, of AD, and the use of higher-tier methodologies. Examples are provided in chapters II.B–II.G below. The magnitude of the impact of the recalculations includes the following: an increase in estimated total GHG emissions in 1988 (3.3 per cent), an increase in 1990 (2.7 per cent) and a decrease in 2009 (0.5 per cent). The ERT commends Bulgaria for improving the emission estimates in the inventory as a result of the

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<sup>6</sup> The ERT recognizes that the 2011 annual review report was not finalized prior to the submission of Bulgaria's 2012 annual submission and therefore it may not have been possible for the Party to take into account the recommendations made in the 2011 annual review report in the compilation of its 2012 annual submission.

recalculations. However, the ERT noted that the rationale for these recalculations and the resulting impacts are not consistently provided throughout the NIR. For example, there are chapters in the NIR on recalculations in the energy sector which do not provide an assessment of the impacts of recalculations, although the rationale and an overview of the change are presented. Some chapters in the NIR on recalculations in the industrial processes sector provide only brief explanations of the recalculations, and do not include information that explains the reasons for the recalculation, or the resulting impact (e.g. chapter 4.6.4.1 in the NIR). In addition, these sections on recalculations are not included in the report index, and are hence difficult to locate. Furthermore, the ERT noted that CRF table 8(b) (explanatory information for recalculations) have not been completed. The ERT recommends that Bulgaria include in the NIR a more thorough explanation of all recalculations, including information that explains why the new methodology or input data are considered to make an improvement to the emissions inventory, and information on the resulting impact of the change. In addition, the ERT recommends that Bulgaria follow the recommended NIR structure in 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), which includes a specific section on recalculations for each of the sectors. The ERT also recommends that Bulgaria complete CRF table 8(b) in time for its next annual submission.

27. The largest percentage recalculation in 2009 occurred for net CO<sub>2</sub> removals on forest land (2,861.1 Gg CO<sub>2</sub> eq, or 20.7 per cent) in the LULUCF sector (see para. 96 below). This recalculation is due to the availability of more accurate AD. The following main recalculations have also been made:

(a) In the energy sector: CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O emissions from a number of categories including fugitive emissions from fuels. These recalculations were primarily due to updates in AD and the replacement of default EFs by country-specific EFs (see para. 43 below);

(b) In the industrial processes sector: HFC and SF<sub>6</sub> emissions from refrigeration and air-conditioning equipment and from electrical equipment, respectively, for 1988 and 2009 due to improvements in the accuracy of AD (see para. 72 below);

(c) In the agriculture sector: CH<sub>4</sub> and N<sub>2</sub>O emissions from manure management and N<sub>2</sub>O emissions from agricultural soils, due to newly available AD and the improvement of parameters in the EFs estimation for the category (see para. 85 below);

(d) In the waste sector: CH<sub>4</sub> emissions from solid waste disposal on land and wastewater handling, due to the use of revised AD and country-specific EFs, respectively (see para. 105 below).

28. The ERT noted that chapter 2 of the NIR (emission trends) did not provide enough, or sufficiently transparent, information explaining the trends of GHG emissions and removals within each sector to allow the ERT to understand the emission trends across the time series. In addition, the ERT considered it difficult to visualize the data presented in the tables in the NIR. During the review, Bulgaria provided plots of the tabulated data and text that provided an overview of the main trends. The ERT considers this to be helpful material for understanding the reasons behind the trends, and encourages Bulgaria to include this information in the NIR of its next annual submission.

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

29. ExEA is responsible for the coordination and implementation of QA/QC activities for the national inventory. The NIR provides a detailed description of the QA/QC plan and

its implementation in the context of the inventory preparation process. Bulgaria reports in the NIR that the QA/QC plan was updated in 2010 to reflect the newly established legal, institutional and procedural arrangements within the Bulgarian national system, which covers all participants in the system. Roles and responsibilities of the ExEA staff relating to the compilation of the emissions inventory are clearly presented.

30. In its NIR, Bulgaria has included an overview of the QC and QA experts involved in QA/QC procedures and clearly presents their responsibilities and the management of information relating to QA/QC activities (tables 7 and 8 of the NIR). However, the ERT noted that Bulgaria has not implemented the recommendation made in the previous review report to include in the NIR the checklists themselves for general and specific QC procedures and QA activities. The ERT recommends that Bulgaria provide an example of the contents of the checklists used for QA/QC procedures in its next annual submission. The ERT welcomed the information that is provided in the NIR at the sector and subsector levels on verification procedures.

31. Bulgaria has reported on the use of European Union (EU) emissions trading scheme (EU ETS) data for making emission estimates in section 3.3.9.2.2 of the NIR. The specific QA activities associated with the use of these data are described in the NIR. The ERT commends Bulgaria for including this information and undertaking EU ETS specific QA activities.

32. As with previous annual review reports (ARRs), the ERT noted some inconsistencies between the information provided in the NIR and the CRF tables. For example, the AD for CO<sub>2</sub> emissions from biomass burning (see para. 45 below) and non-energy use of fuels and feedstocks (see para. 53 below) in the energy sector, CO<sub>2</sub> emissions from ferroalloys production in the industrial processes sector (see para. 73 below) and N<sub>2</sub>O emissions from manure management in the agriculture sector (see para. 87 below). The ERT recommends that, for its next annual submission, Bulgaria improve its QC procedures that aim to ensure the consistency of the information provided in the NIR and the CRF tables.

#### *Transparency*

33. The ERT noted significant improvements in the transparency of Bulgaria's 2012 annual submission compared with its previous annual submissions. Improvements are particularly evident in the NIR, most notably the more comprehensive key category analysis and the addition of a tier 2 uncertainty analysis, as well as numerous improvements to the agriculture chapter (see para. 86 below). The ERT commends Bulgaria for making substantial improvements in the level of detail that is provided in the NIR.

34. The ERT noted that some of the recommendations made in previous review reports have not been addressed. In response to a question raised by the ERT during the review, Bulgaria explained that it received the final version of the previous review report after the official annual submission had been made on 12 April 2012, and therefore it was not possible to address all of the recommendations. The ERT understands that Bulgaria did not have time to address the recommendations made in the 2011 ARR, but considers that it had time to explain whether recommendations made in the 2010 ARR were addressed in the previous (2011) or in the current (2012) annual submission. While noting that substantial progress has been made in the NIR, the ERT recommends that Bulgaria present in the NIR clear descriptions of all of the improvements that have been made to address recommendations from previous review reports. Furthermore, the ERT recommends that Bulgaria include in the NIR of its next annual submission a description of any recommendations that have not been addressed in the current submission, including the actions that are planned to address the recommendation in future annual submissions.

35. The ERT noted that further improvements are needed throughout the NIR with regard to the current levels of transparency. Specifically, more detailed information is required in the NIR to explain the rationale behind method selection, input data selection and assumptions made, and, in particular, the decisions that have been made regarding the use of IPCC default or country-specific EFs. The ERT recommends that Bulgaria address this issue in time for its next annual submission.

36. During the review, the ERT noted that a text was missing from section 1.2.5 of the NIR on a large industrial plant and business associations. During the review, in response to a question raised by the ERT, Bulgaria confirmed that a text was missing from this section of the NIR, and noted that this would be addressed in its next annual submission. The ERT recommends that Bulgaria include in the NIR of its next annual submission, in order to improve transparency, the indicated text explaining the roles of business associations and the use of datasets from a large industrial plant in the inventory calculations.

#### Inventory management

37. The NIR reports that 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 NIR indicates that the archived information also includes internal documentation on QA/QC procedures, external and internal reviews, and documentation on annual key categories and key category identification and planned inventory improvements. The archive is managed by ExEA, and has back-up and disaster recovery systems in place for the electronic file storage to ensure robustness and continuity. During the review, the ERT was provided with the requested additional archived information.

### **3. Follow-up to previous reviews**

38. While recognizing the challenges associated with implementing recommendations made in previous review reports, the ERT recognized that Bulgaria has made substantial efforts to implement the recommendations of earlier review reports, and commends Bulgaria for the good progress that has been made. The ERT has identified improvements in a number of cross-cutting areas, including:

- (a) The reporting of detailed key category analyses for emissions and removals, both with and without the LULUCF sector;
- (b) The reporting of both tier 1 and tier 2 uncertainty analyses, as well as reporting an uncertainty analysis for the afforestation, reforestation and deforestation activities under Article 3, paragraph 3, of the Kyoto Protocol (see para. 121 below);
- (c) The use of notation keys has been substantially improved, and gaps in the inventory have been addressed to the point that no issues associated with the use of the notation key “NE” (not estimated) remain;
- (d) The information in the NIR on inventory management and the quality management system that is in place is now detailed and comprehensive (see paras. 15 and 16 above);
- (e) The development of the capabilities of the Emissions Inventory Department through training of staff and securing ongoing contributions from external consultants to the compilation of the emissions inventory (see para. 17 above);
- (f) The reporting of information on data obtained through EU ETS demonstrating how its use is in line with the IPCC good practice guidance (see para. 31 above).

39. The ERT noted that there are some pending recommendations from the 2011 ARR that have not been addressed by Bulgaria in its 2012 annual submission. Pending issues include:

(a) Improvement of transparency, regarding: (i) documentation of methods, AD, recalculations and uncertainty estimates; (ii) underlying information for the selection and estimation of country-specific EFs; and (iii) procedures used for expert judgment relating to EFs and gap filling;

(b) Improvement of consistency in relation to discrepancies between the NIR and the CRF tables.

#### **4. Areas for further improvement identified by the expert review team**

40. During the review, the ERT identified a number of areas for improvement. These are listed in table 6 below.

41. Recommended improvements relating to specific categories are presented in the relevant sector chapters of this report and in table 6 below.

## **B. Energy**

### **1. Sector overview**

42. The energy sector is the main sector of the GHG inventory of Bulgaria. In 2010, emissions from the energy sector amounted to 46,714.64 CO<sub>2</sub> eq, or 75.7 per cent of total GHG emissions. Since 1988 GHG emissions have decreased by 46.6 per cent. The key driver for the fall in emissions is the shift from a planned to a market economy in 1988–1989. This led to a sharp drop in electricity demand from thermal generation and a correspondingly large emission reduction. An internal political crisis in 1996–1997, resulting in an economic downturn, caused emissions to fall further in the late 1990s, but not to as large an extent. These changes were largely reflected in stationary combustion, particularly in the energy industries and manufacturing industries and construction categories. Within the sector, 67.5 per cent of the emissions were from energy industries, followed by 17.0 per cent from transport, 8.1 per cent from manufacturing industries and construction and 4.3 per cent from other sectors. The remaining 3.0 per cent were from fugitive emissions from fuels, with 1.8 per cent contribution from solid fuels and 1.1 per cent from oil and natural gas.

43. Bulgaria has made recalculations for the energy sector between the 2011 and 2012 annual submissions, both in the initial 2012 annual submission (CRF table v1.3) and for the revised emission estimates that the Party provided in response to the list of potential problems and further questions raised by the ERT during the review week (CRF table v3.1). The recalculations referred to in this paragraph are those that resulted in the revised emission estimates. The impact of these recalculations on the energy sector is a decrease in emissions of 1.1 per cent for 2009 and 2.5 per cent for 1988. The main recalculations took place in the following categories:

(a) A decrease in CH<sub>4</sub> emissions from coal mining and handling: solid fuels of 559.17 Gg CO<sub>2</sub> eq (or 41.3 per cent of the category emissions) for 2009, due to the use of newly acquired AD replacing the previous extrapolation of historical data (see para. 65 below);

(b) An increase in CH<sub>4</sub> emissions from oil and natural gas under fugitive emissions from fuels of 72.18 Gg CO<sub>2</sub> eq (or 20.4 per cent of the category emissions) for 2009, due to changes of the EFs;



(c) A decrease in CO<sub>2</sub> emissions from stationary combustion (from energy industries and manufacturing industries and construction) of 34.89 Gg CO<sub>2</sub> eq (or 0.11 per cent of the category emissions) for 2009, mainly due to the revision of EFs (see para. 54 below);

(d) A decrease in CO<sub>2</sub> emissions from road transportation of 41.35 Gg CO<sub>2</sub> eq (or 0.50 per cent of the category emissions) for 2009, due to the use of an updated version of the COPERT IV model (version 9) for emissions from road transportation (transport) and a minor (less than 0.25 kt CO<sub>2</sub> eq) revision of emissions from pipeline transport (other transportation).

44. Bulgaria reported GHG emissions for all categories of the energy sector for which the Revised 1996 IPCC Guidelines and the IPCC good practice guidance provide methodologies for emission estimates, with the exception of GHG emissions from navigation, which were reported as “NO” for the periods 1988–1989 and 2000–2010. During the review, the ERT identified three other issues of potential underestimation of CH<sub>4</sub> emissions from surface mines (coal mining and handling) and natural gas transmission, due to a deviation from the IPCC good practice guidance (see paras. 64 and 66 below), and CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O emissions from combustion of refinery gas in petroleum refining and chemicals, due to the use of AD without providing the rationale for their selection. During the review week, Bulgaria made an official resubmission of its national GHG inventory for all years, which contained revised estimates of CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O emissions from navigation (an increase in the emissions of the energy sector of 2.38 Gg CO<sub>2</sub> eq, or 0.01 per cent, for 2010) and of CH<sub>4</sub> emissions from surface mines and natural gas transmission (an increase in the emissions of the energy sector of 120.93 and 64.43 Gg CO<sub>2</sub> eq, or 0.3 per cent and 0.1 per cent, respectively, for 2010). The ERT reviewed these revised estimates and considered that they had been calculated consistent with the IPCC good practice guidance. The ERT commends Bulgaria for its efforts to increase the completeness of its inventory and its prompt action during the review week. In addition, Bulgaria also officially submitted revised estimates of CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O emissions from combustion of refinery gas for 2009 and 2010 under petroleum refining (energy industries) and chemicals (manufacturing industries and construction). However, Bulgaria could not justify the rationale behind the selection of the AD for these emission estimates, and this issue was included in the list of potential problems and further questions raised by the ERT during the review week (see paras. 56–58 below). On 18 October 2012, in response to the list of potential problems and further questions raised by the ERT during the review week, Bulgaria submitted a complete set of revised CRF tables for 1988–2010 which included revised CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O emission estimates from refinery gas combustion for the years 2009 and 2010. The impact of these revised estimates was an increase of 89.27 Gg CO<sub>2</sub> eq (0.2 per cent) in 2010 of the total GHG emissions of the sector. The ERT concluded that the refinery gas combustion issue has been resolved by Bulgaria by providing new emission estimates, which are in line with the IPCC good practice guidance.

45. The ERT noted that the NIR is generally transparent. However, the ERT identified that there is a room for improvement of the transparency of the NIR, including in the following areas: the description of the trends of CO<sub>2</sub> emissions from the residential (other sectors) category (see para. 60 below); the correction of some inconsistencies between the information provided in the NIR and the CRF tables (e.g. CO<sub>2</sub> emissions from biomass burning in table 28 of the NIR compared with CRF table 1A(a)); the provision of disaggregated data on the subcategory other (manufacturing industries and construction) in the NIR; the reporting in the NIR of the CH<sub>4</sub> and N<sub>2</sub>O EFs of all fuel types (e.g. the EFs for petroleum coke, liquefied petroleum gas, refinery gas and alternative fuels were not included in tables 39 and 40 of the NIR); the description of the non-energy use of fuels and allocation of associated emissions (see para. 51 below); the description of the methodology and EFs followed for the estimation of emissions from fugitive emissions from oil, natural

gas and other sources (see para. 66 below). The ERT recommends that Bulgaria improve transparency in the above-mentioned areas in its next annual submission.

## 2. Reference and sectoral approaches

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

46. CO<sub>2</sub> emissions from fuel combustion were calculated using the reference approach and the sectoral approach. For 2010, CO<sub>2</sub> emissions estimated using the reference approach (46,076.02 Gg) were 2.9 per cent higher than the emissions estimated using the sectoral approach (44,774.07 Gg). The ERT noted that the explanation for this difference is not provided in the documentation box of CRF table 1.A(c). Moreover, the ERT noted that the CO<sub>2</sub> emissions estimated using the reference approach for liquid fuels and gaseous fuels were 3.3 and 12.4 per cent, respectively, higher than emissions estimated using the sectoral approach. The ERT noted that for all years of the time series (1988–2010), differences in CO<sub>2</sub> emission estimates using the reference approach and the sectoral approach are always greater than 2.0 per cent and within the range 2.2 per cent (1989) to 10.9 per cent (1995).

47. The ERT noted that Bulgaria has included in the NIR tables summarizing the estimates of overall fuel consumption and CO<sub>2</sub> emissions under the reference and sectoral approaches for all years of the time series as well as for liquid, solid and gaseous fuel consumption together with their associated CO<sub>2</sub> emissions. The reasons for the differences in the estimates of fuel consumption and CO<sub>2</sub> emissions between the reference and the sectoral approaches are incompletely described in the NIR.

48. The ERT is of the view that the difference in CO<sub>2</sub> emissions between the reference and the sectoral approach for gaseous fuels is mainly explained by the CO<sub>2</sub> emissions from the non-energy use of natural gas, which are not reported under the sectoral approach. In response to questions raised by the ERT during the review, Bulgaria provided information which allowed the ERT to infer that the difference between the two approaches is related to the associated CO<sub>2</sub> emissions of natural gas used as feedstock for ammonia and hydrogen production. CO<sub>2</sub> emissions associated with ammonia production were reported under the industrial processes sector, while CO<sub>2</sub> emissions associated with hydrogen production were not reported, owing to the lack of a relevant methodology in the Revised 1996 IPCC Guidelines and the IPCC good practice guidance. In order for Bulgaria to strengthen its verification by eliminating the causes of the difference between the sectoral and the reference approaches, the ERT recommends that the Party revise the estimation and reporting of the amount of carbon (C) stored to include the use of natural gas as a feedstock in ammonia and refinery hydrogen production in the sectoral approach for its next annual submission.

49. For liquid fuels, the difference in fuel consumption between the reference and the sectoral approach amounts to 19.42 PJ, or 13.8 per cent. From CRF table 1.A(d), the ERT noted that the amount of liquid fuels used as feedstock and for non-energy purposes is 6.21 PJ. In response to questions raised by the ERT during the review, Bulgaria provided the ERT with information about the statistical differences and refinery losses reported in its national energy balance. These losses amount to 176 kt, equivalent to 7.49 PJ. Therefore, the ERT noted that the quantity of liquid fuels that are not combusted amount to 13.70 PJ (6.21 PJ + 7.49 PJ). This makes the difference in liquid fuel consumption between the reference and the sectoral approaches 5.72 PJ, or 4.1 per cent. Furthermore, the ERT noted that the amount of non-combusted carbon associated with the refinery losses is 148.24 Gg C, equivalent to 543.53 Gg CO<sub>2</sub> eq. When this amount is subtracted from the actual CO<sub>2</sub> emissions reported in the reference approach (11,278.85 Gg CO<sub>2</sub> eq), the difference between the reference approach and the sectoral approach becomes –184.47 Gg CO<sub>2</sub> eq, or –1.7 per cent. The ERT noted that the absolute value of this percentage difference is

smaller than the reference 2.0 per cent bound indicated in CRF table 1.A(c) and consequently smaller than the value reported by Bulgaria (13.8 per cent). The ERT recommends that Bulgaria include in its next NIR an analysis that justifies the difference in the CO<sub>2</sub> and overall fuel consumption of liquid fuels estimates using the two approaches for the entire time series.

#### *International bunker fuels*

50. Previous review reports have indicated a number of issues regarding the split of fuel consumption between civil aviation and aviation bunkers. The ERT noted that the time series of fuel consumption of civil aviation and aviation bunkers still exhibits significant variability. The inter-annual change of fuel consumption ranges from –70.0 per cent (in 2008) to +145.0 per cent (in 1999) and from –46.0 per cent (in 1999) to +80.0 per cent (in 1992) for civil aviation and aviation bunkers, respectively. During the previous annual review, Bulgaria informed the ERT of its plans to improve fuel-use estimates for domestic and international aviation for the next annual submission and apply a higher-tier method to estimate emissions from aviation, based on landing/take-off cycles and fuel-use data. However, these improvements were not implemented for the 2012 annual submission. In response to a question raised by the ERT during the review, Bulgaria informed the ERT that it plans to implement these actions for the 2013 annual submission. The ERT encourages Bulgaria to undertake its plan for improving fuel-use estimates for domestic and international aviation, while ensuring time-series consistency of the associated emissions in accordance with the IPCC good practice guidance and report accordingly in its next annual submission.

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

51. Bulgaria reported in the NIR and in CRF table 1.A(d) that seven types of fuel are used for non-energy purposes. The ERT noted that Bulgaria did not report in the NIR under which categories the emissions associated with the non-energy use of fuels are allocated. In response to questions raised by the ERT during the review, Bulgaria provided information that clarified the non-energy use of each fuel. The ERT recommends that Bulgaria include this information in the NIR and in CRF table 1.A(d) of its next annual submission, in order to increase the transparency of reporting.

52. The ERT noted that for reference approach calculations, Bulgaria used default values from the Revised 1996 IPCC Guidelines to estimate the fraction of carbon stored in the non-energy use of fuels. In response to a question raised by the ERT during the review, Bulgaria provided information concerning the actual non-energy use of fuels. The ERT encourages Bulgaria to use this country-specific information and improve the estimation of the parameters of the fraction of carbon stored that are used in the reference approach calculations. The ERT is of the view that by taking this into account the amounts of fuels used in calculations for the reference approach will be more accurate and the difference between the reference and sectoral approaches will decrease.

53. In response to a question raised by the ERT during the review, Bulgaria confirmed to the ERT that CRF table 1.A(c) has a reporting error: the reported value for “Apparent energy consumption (excluding non-energy use and feedstocks)” is actually the value including the fuel quantities used for non-energy uses and feedstocks. In addition, the ERT identified another reporting error in the additional information of table 1.A(d), where CO<sub>2</sub> emissions associated with non-energy use of natural gas are reported under the agricultural soils category, instead of the correct category of ammonia production. The ERT recommends that Bulgaria correct these reporting errors in its next annual submission.

### 3. Key categories

#### Stationary combustion: solid, liquid and gaseous fuels – CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O<sup>7</sup>

54. The ERT noted that Bulgaria, in its previous annual submission, used for the entire time series (1988–2009) constant country-specific CO<sub>2</sub> EFs for each of the following solid fuels: anthracite, lignite, other bituminous coal and petroleum coke. These constant country-specific EFs were calculated as a weighted average of the values from the EU ETS, reported by more than 150 operators for the period 2007–2009. In its 2012 annual submission, for the same fuels and for each year of the period 2007–2010, Bulgaria used annual country-specific CO<sub>2</sub> EFs, based on the corresponding verified EU ETS annual reports. In the 2012 annual submission each annual country-specific CO<sub>2</sub> EF was derived as a weighted average of the values reported by all operators that have declared the use of plant-specific EFs in their reports (i.e. tier 2b or 3 as specified in the European Commission guidelines for the monitoring and reporting of greenhouse gas emissions under EU ETS).<sup>8</sup> For the years 1988–2006, the weighted-average CO<sub>2</sub> EFs of the years 2007–2010 is applied for each fuel. The ERT commends Bulgaria for estimating these country-specific EFs and having enhanced the accuracy of the inventory in line with the IPCC good practice guidance.

55. In the previous review report the ERT noted that, for the period 1998–2006, the time series of the calorific values reported in the Bulgarian energy balance exhibit significant variability. The ERT recommended that Bulgaria explore the possibility of obtaining a correlation between the carbon content and the net calorific value of each fuel reported by the selected facilities that have used higher-tier methods to estimate and report plant-specific carbon content under EU ETS, taking into account the recent scientific literature (e.g. Fott, 1999; Mazumdar, 2000; Mesroghli et al., 2009). In the previous review report it was also recommended that, if a satisfactory correlation were obtained, Bulgaria use this correlation to generate the time series 1988–2006 of CO<sub>2</sub> EFs and recalculate the corresponding emissions. In response to a question raised by the ERT during the review, Bulgaria informed the ERT that it did not address these recommendations, because the 2011 ARR was finalized after the annual submission of Bulgaria to the UNFCCC in 2012. However, the Party indicated that it will address this recommendation in its next annual submission. The ERT reiterates the recommendation that Bulgaria perform such a correlation assessment and use the results in order to improve the quality of the inventory of its next annual submission.

56. According to Bulgaria's national energy balance and the 2010 energy questionnaire for oil of the International Energy Agency, Eurostat (the statistical office of the EU) and the United Nations Economic Commission for Europe (UNECE), which was provided to the ERT during the review, the total amount of refinery gas combusted in combined heat and power plants, refineries and chemical manufacturing activities was 177 kt for 2010. In response to a question raised by the ERT during the review, Bulgaria explained that for 2010 the associated CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O emissions from refinery gas combustion reported in the following categories were calculated based on this 177 kt of fuel: public electricity and heat production, and petroleum refining (energy industries); and chemicals (manufacturing industries and construction). However, in responding to another question raised by the ERT

<sup>7</sup> Not all emissions related to all gases under this category are key categories, particularly CH<sub>4</sub> and N<sub>2</sub>O emissions. However, since the calculation procedures for issues related to this category are discussed as a whole, the individual gases are not assessed in separate sections.

<sup>8</sup> Guidance Document no 1 on the harmonized free allocation methodology for the EU ETS post 2012. Available at [http://ec.europa.eu/clima/policies/ets/cap/allocation/docs/gd1\\_general\\_guidance\\_en.pdf](http://ec.europa.eu/clima/policies/ets/cap/allocation/docs/gd1_general_guidance_en.pdf).

during the review, Bulgaria stated that according to plant-specific data contained in the EU ETS reports, the refinery gas consumption was 181.173 kt in 2010.

57. During the review week, the ERT requested Bulgaria to examine the reliability of the EU ETS plant-specific data of refinery gas consumption for 2010. In particular, the ERT requested the Party to examine whether the AD were reported according to the IPCC good practice guidance and the tier used was in accordance with the European Commission guidelines for the monitoring and reporting of CO<sub>2</sub> under EU ETS. Bulgaria informed the ERT that it was not possible to complete this examination before the end of the review week. Therefore, the ERT concluded that Bulgaria was not able to justify the rationale behind the selection of national statistics as a source of AD concerning refinery gas combustion instead of the plant-specific AD from EU ETS.

58. During the review, the ERT recommended, in the list of potential problems and further questions raised by the ERT during the review week, that Bulgaria justify the rationale behind the selection of national statistics as a source of AD concerning refinery gas combustion instead of the respective plant-specific AD from EU ETS reporting, or revise the CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O emission estimates of the corresponding categories based on plant-specific data from EU ETS reporting. In its response, Bulgaria submitted a complete set of revised CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O emission estimates from refinery gas combustion for the years 2009 and 2010 for the categories referred to in paragraph 57 above. The ERT concluded that the issue has been resolved by Bulgaria by providing revised estimates in line with the IPCC good practice guidance. The revised estimates were prepared based on updated AD provided by plant operators, which showed national statistics for fuel consumption of refinery gas for 2009 and 2010 that differed from the estimates that were originally submitted. Emissions increased by 89.27 Gg CO<sub>2</sub> eq (8.1 per cent and 1.0 per cent increase in GHG emissions from petroleum refining (energy industries) and chemicals (manufacturing industries and construction), respectively) for 2010. The ERT commends Bulgaria for its efforts to increase the accuracy of its inventory for the years 2009 and 2010 and recommends that Bulgaria update the AD for the rest of the time series.

59. The ERT noted that Bulgaria did not include in the NIR AD and CO<sub>2</sub> EFs for the different types of fuel used in industrial activities reported under other (manufacturing industries and construction). As this subcategory is the biggest source of CO<sub>2</sub> emissions from manufacturing industries and construction (57.4 per cent in 2010), the ERT recommends that Bulgaria provide this information in its next annual submission, in order to increase the transparency of the reporting of this category.

60. In the previous review report, the ERT recommended that Bulgaria provide an explanation of the underlying causes of the sharp decrease in CO<sub>2</sub> emissions for the residential (other sectors) category. CO<sub>2</sub> emissions decreased by 79.5 per cent in 2010 compared with in 1988. However, Bulgaria did not provide an explanation for this in the NIR of its 2012 annual submission. In response to a question raised by the ERT during the review, Bulgaria explained that the decreasing trend in the CO<sub>2</sub> emissions is due to the change in recent years from the use of liquid and solid fuels to the use of biomass, electricity and gaseous fuels for heating purposes in houses and to the decrease in the living standards of the population, especially of elderly people, most of whom cannot afford to purchase enough fuel for heating. The ERT recommends that Bulgaria include this explanation in the NIR of its next annual submission, along with supporting quantitative historical data.

#### Road transportation: liquid fuels – CO<sub>2</sub>

61. In the previous review report the ERT recommended that Bulgaria report in the NIR how the total fuel consumption of road transportation reported in the national energy balance and the total fuel consumption calculated by the COPERT model used for

calculating the CO<sub>2</sub> emission estimates have been reconciled. However, this information was not included in the NIR of the 2012 annual submission. In response to a question raised by the ERT during the review, Bulgaria informed the ERT that the CO<sub>2</sub> emissions associated with road transportation were estimated based on the amount of fuels sold reported in the energy balance. For that reason, the COPERT model run has been performed twice. The first run of the model was done with the actual vehicle numbers and mean European mileage per vehicle type. The resulting fuel consumption for each type of fuel was compared with that reported in the energy balance and then the mileage was corrected with an appropriate factor to reconcile the two estimates of fuel consumption. With the corrected mileage, the COPERT model CO<sub>2</sub> emission estimates are the same as those emissions calculated on the basis of fuel consumption. The ERT recommends that Bulgaria include this detailed information in the NIR of its next annual submission.

62. The ERT noted that Bulgaria reported in the NIR that a comparison of tier 3 with tier 1 estimations of road transportation CO<sub>2</sub> emissions was performed as a verification procedure. During the review, in response to a question raised by the ERT, Bulgaria stated that the comparison of the entire time series showed that the CO<sub>2</sub> emissions calculated by the COPERT model, before reconciling the fuel consumption, are between 0.8 and 2.9 per cent lower than the emissions calculated using the tier 1 approach. The main reason for this difference is that the COPERT model takes fuel evaporation into account. The ERT encourages Bulgaria to include this information in the NIR of its next annual submission, along with explanations for the differences.

#### Coal mining and handling – CH<sub>4</sub>

63. The ERT noted that Bulgaria estimated CH<sub>4</sub> emissions from coal mining using a tier 1 approach and applying default EFs. Coal in Bulgaria is mainly extracted from surface mines (97.4 per cent of coal production in 2011). The ERT noted that coal mining is a key category and, therefore, it is good practice to use a tier 2 method (estimate emissions using national EFs) for estimating CH<sub>4</sub> emissions from surface coal mining. In response to a question raised by the ERT during the review, Bulgaria informed it that the application of a higher-tier method for this category is not part of its short-term improvement plan, owing to lack of resources and the need to proceed with other priorities. The ERT is mindful that the current methodology is not considered to be underestimating emissions and also recognizes that this improvement is of considerably lower priority than many other inventory developments. The ERT therefore recommends that Bulgaria include the use of a higher-tier method for estimating CH<sub>4</sub> emissions from surface coal mining in Bulgaria's prioritized improvement programme and implement this improvement in its future annual submissions.

64. The ERT noted that Bulgaria used the average (1.2 m<sup>3</sup>/t) of the proposed range of CH<sub>4</sub> EFs from the *2006 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the 2006 IPCC Guidelines) (0.3–2.0 m<sup>3</sup>/t) to estimate CH<sub>4</sub> emissions from surface mines (coal mining and handling under fugitive emissions from fuels). The ERT also noted that for surface mines the EF from the IPCC good practice guidance (1.5 m<sup>3</sup>/t) is higher than the EF used by the Party from the 2006 IPCC Guidelines; however, the justification for the use of this EF is not provided in the NIR. The ERT concluded that the CH<sub>4</sub> emission estimates are not in line with the IPCC good practice guidance, and identified this issue as a potential underestimation of CH<sub>4</sub> emissions. During the review week, Bulgaria made an official submission of revised CH<sub>4</sub> emission estimates for surface mines for the entire time series (1988–2010). The revised estimates were prepared using the EF from the IPCC good practice guidance (1.5 m<sup>3</sup>/ton) and led to an increase in emissions of 5.76 Gg CH<sub>4</sub>, or 120.93 Gg CO<sub>2</sub> eq, for 2010 (16.3 per cent increase) and a 0.3 per cent increase in emissions of the energy sector. The ERT agreed with these revised estimates.

65. Bulgaria indicated in the NIR that in the 2011 annual submission, owing to lack of accurate AD and in order to avoid an underestimation of emissions associated with coal mining, CH<sub>4</sub> emissions were intentionally overestimated. In response to a question raised by the ERT during the review, Bulgaria explained that the overestimation of the previous annual submission was related to the methodology applied to split the production of lignite between surface and underground mining, which was based on historical data and extrapolation. Bulgaria also informed the ERT during the review that in its 2012 annual submission AD were obtained from the national energy balance, which was checked by mine operators and relevant national ministries. The ERT noted that these updated AD represent a significant reduction in the emissions for the category for the entire time series (i.e. a reduction of 559.17 Gg CO<sub>2</sub> eq for 2009, or 41.3 per cent of the category). The ERT recommends that Bulgaria improve the transparency of the NIR by including the underlying rationale for the change in the method applied to split the production of lignite between surface and underground mining in its next annual submission.

#### Oil and natural gas – CH<sub>4</sub>

66. The ERT noted that to estimate CH<sub>4</sub> emissions from natural gas transmission, Bulgaria uses a value of 1,340 kg/km as the EF. However, this EF does not lie within the range proposed by the IPCC good practice guidance of 2,100–2,900 kg CH<sub>4</sub>/km in table 2.16. In response to a question raised by the ERT during the review, Bulgaria stated that the source of the EF used is table 4.2.8 from the 2006 IPCC Guidelines. The ERT noted that this table contains the same values as table 2.18 of the IPCC good practice guidance. However, it noted that both of these tables have been included in the IPCC good practice guidance and the 2006 IPCC Guidelines for verification purposes and may be used to assess completeness and to qualify specific CH<sub>4</sub> losses as low, medium or high. The ERT concluded that Bulgaria has applied an EF that is lower than the recommended range in the IPCC good practice guidance, and therefore the Party has underestimated CH<sub>4</sub> emissions from natural gas transmission. During the review week, Bulgaria submitted revised estimates for the entire time series, using an EF of 2,500 kg CH<sub>4</sub>/km, which is within the recommended range of EFs from the IPCC good practice guidance. This led to an increase in emissions of 3.07 Gg CH<sub>4</sub> or 64.43 Gg CO<sub>2</sub> eq, or 13.7 per cent, for 2010 and a 0.1 per cent increase in the emissions of the energy sector. The ERT agreed with these revised estimates.

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

##### Road transportation: liquid fuels – CH<sub>4</sub>

67. In the previous review report, Bulgaria was encouraged to provide an explanation for the significant decrease in the CH<sub>4</sub> implied emission factor (IEF) for gasoline between 2003 and 2004 (–22.1 per cent). However, Bulgaria did not provide such an explanation in the NIR of its 2012 annual submission. In response to a question raised by the ERT during the review, Bulgaria indicated that the main cause of the decrease was the significant increase in the number of vehicles that meet the standards set out in the EU directive on emissions from motor vehicles<sup>9</sup> (mostly Euro 2 and Euro 3), which was introduced in the country and contributed to replace the older technologies. The ERT encourages Bulgaria to include this explanation in the NIR of its next annual submission.

##### Railways: liquid fuels – CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O

68. During the review, the ERT noted that the associated emissions of residual fuel oil that is used for heating railway buildings (stationary combustion) are reported in the

<sup>9</sup> See <<http://ec.europa.eu/environment/air/transport/road.htm>>.

railways category for the entire time series 1988–2010. According to the Revised 1996 IPCC Guidelines, these emissions are to be reported in the subcategory of commercial/institutional under other sectors. The ERT recommends that Bulgaria reallocate these emissions to the commercial/institutional category in its next annual submission, in order to improve the comparability of its inventory.

#### Navigation: liquid fuels – CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O

69. The ERT noted that emissions from liquid fuels used in navigation (transport) are reported as “NO” for the periods 1988–1989 and 2000–2010. However, in response to a question raised by the ERT during the review, Bulgaria explained that domestic naval transport is often included as part of an international route. According to table 2.8 of the IPCC good practice guidance, the route of a ship that “departs in one country, stops in the same country and drops and picks up passengers or freight, then departs finally arriving in another country” is considered a “domestic segment”. Therefore, the ERT concluded that the CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O emissions from navigation reported by Bulgaria were underestimated. During the review week, Bulgaria submitted estimates of CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O emissions from navigation for the period 2000–2010. Estimated emissions from this category were 2.38 Gg CO<sub>2</sub> eq for 2010, which corresponds to an increase of 0.03 per cent of the GHG emissions from the transport sector. The emissions reported were prepared based on AD from the Danube Commission (Danube, 2012) taking into account the total amount of goods carried between the Danube ports within a national territory, average distances travelled, fuel consumption per tonne of freight and kilometre travelled. The ERT commends Bulgaria for its efforts to increase the completeness of its inventory and agreed with the new estimates. The ERT recommends that Bulgaria provide a description of the methodology used for the emission estimates in the NIR of its next annual submission. Further, the ERT recommends that Bulgaria collect AD, and estimate and report CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O emissions from navigation for the missing years, (1988–1999) in its next annual submission.

#### Mobile (other): liquid fuels – CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O

70. During the review, the ERT identified that CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O emissions associated with the military consumption of gasoline and diesel oil was reported under road transportation, and the consumption of jet kerosene was reported under civil aviation. According to the Revised 1996 IPCC Guidelines, these emissions should be reported under the mobile (other) category, under which CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O emissions for all fuels are reported currently as “NO”. The ERT therefore recommends that Bulgaria reallocate these emissions to the mobile (other) category in its next annual submission, in order to improve the comparability of its inventory.

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

### **1. Sector overview**

71. In 2010, emissions from the industrial processes sector amounted to 3,852.01 Gg CO<sub>2</sub> eq, or 6.2 per cent of total GHG emissions, and emissions from the solvent and other product use sector amounted to 45.91 Gg CO<sub>2</sub> eq, or 0.1 per cent of total GHG emissions. Since the base year, emissions have decreased by 69.0 per cent in the industrial processes sector, and decreased by 94.9 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 industrial activities across all categories (except for consumption of halocarbons and SF<sub>6</sub>) resulting from the economic crises of 1989–1990, 1997–1998 and 2009. In 1988 the emissions from the industrial processes sector were dominated by chemical industry,



followed by mineral products and metal production, but this situation changed over time owing to: the closure of two ammonia production plants in 2000 and 2002, the closure of the only pig iron producing plant in the country in 2008 and the steady increase in the consumption of halocarbons and SF<sub>6</sub>. During 2010, the market activity recovered and the emissions from the industrial processes sector increased by 12.0 per cent. Within the industrial processes sector in 2010, 64.4 per cent of the emissions were from mineral products, followed by 26.5 per cent from chemical industry and 7.6 per cent from consumption of halocarbons and SF<sub>6</sub>. The remaining 1.4 per cent were from metal production.

72. Bulgaria has made recalculations for the industrial processes sector between the 2011 and 2012 annual submissions for the entire time series following an update of the AD for consumption of halocarbons and SF<sub>6</sub>, which were recalculated on the basis of the application of a new model. The impact of these recalculations is an increase in emissions of 0.43 Gg CO<sub>2</sub> eq for 2009 (0.01 per cent of the emissions of the sector) and a decrease of 6.98 Gg CO<sub>2</sub> eq for 1995 (0.1 per cent of the emissions of the sector). The main recalculations for 2009 took place in the category consumption of halocarbons and SF<sub>6</sub> and were due to a modification of the extrapolation model used to estimate AD (see para. 81 below) and resulted in:

- (a) An increase in HFC emissions of 0.52 Gg CO<sub>2</sub> eq (or 0.2 per cent of the category);
- (b) A decrease in SF<sub>6</sub> emissions of 0.10 Gg CO<sub>2</sub> eq (or 0.04 per cent of the category).

73. Bulgaria's estimation methods for the industrial processes sector are in line with the Revised 1996 IPCC Guidelines and the IPCC good practice guidance. Following a recommendation made in previous review reports that Bulgaria strengthen its routine QC checks of the CRF tables to ensure that they are correct, the Party has improved the CRF tables, for example, allocating the emissions from flue gas desulphurization under the category limestone and dolomite use. Nevertheless, the ERT notes that there is still room for improvement of the consistency between the NIR and the CRF tables. For example, in the CRF sectoral background table 2(I)A-G, AD and the IEF for CO<sub>2</sub> emissions from ferroalloys production are reported as "C" (confidential), but this category was not included in the NIR. The ERT recommends that Bulgaria, in its next annual submission, strengthen its routine checking of the completeness of the NIR as part of QC activities to ensure that the information included in the NIR is consistent with the data reported in the CRF tables.

## 2. Key categories

### Lime production – CO<sub>2</sub>

74. The ERT noted that in the NIR Bulgaria included the total amount of lime produced for the entire time series using data from national statistics, but it did not include disaggregated data on the quantity of quicklime and dolomitic lime produced. In response to a question raised by the ERT during the review, Bulgaria provided the ERT with the spreadsheets containing the data used to estimate CO<sub>2</sub> emissions from lime production. These spreadsheets indicated that Bulgaria used AD of quicklime and dolomitic lime produced from national statistics for the period 1988–1997, and for the years 1998–2008 Bulgaria used a ratio of 1:10.387 for the proportion of dolomitic lime to quicklime to disaggregate the total amount of lime produced from national statistics, without specifying the source of these data. The ERT recommends that Bulgaria provide in the NIR of its next annual submission the data source used for defining the ratio of calcium quicklime to dolomitic lime production.

Other (mineral products) – CO<sub>2</sub>

75. Bulgaria estimated CO<sub>2</sub> emissions from glass production using plant-specific emissions and production data, based on data reported by the operators under EU ETS. In the NIR, it is stated that double counting is avoided by reporting the soda ash use in glass production under the subcategory soda ash use. However, the ERT noted that Bulgaria did not include information in the NIR on how CO<sub>2</sub> emissions from the use of soda ash were subtracted from plant-specific data. The ERT reiterates the recommendation in the previous review report that Bulgaria verify the plant-specific data for glass production for inclusion of the emissions from the use of all carbonate raw materials, except soda ash, in order to ensure that double counting is avoided, and clearly indicate this information in the NIR of its next annual submission.

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

76. Bulgaria estimated CO<sub>2</sub> emissions from iron and steel produced in basic oxygen furnaces (BOFs) and open hearth furnaces (OHFs) using the volume of steel and iron produced as AD. The ERT notes that this is not consistent with the IPCC good practice guidance, which indicates the use of a tier 2 approach, with the mass of reducing agent used as AD, when iron and steel production is a key category. This issue has also been raised in the two previous review reports. Bulgaria followed a mass balance approach for the calculation of EFs for EAFs (electric arc furnaces) using data reported by the companies in EU ETS for the years 2007–2010, using a constant value for the rest of the time series, without indicating in the NIR the source of these data. Bulgaria produced steel by OHFs in the period 1988–2001, and by BOFs in the period 1988–2008. For these BOFs and OHFs, Bulgaria used default EFs from the 2006 IPCC Guidelines to estimate emissions, without providing a justification of how these EFs improve the quality of the estimates and better represent national circumstances in comparison with the IPCC good practice guidance.

77. The ERT also noted that the EFs for BOFs and OHFs in the 2006 IPCC Guidelines take into account CO<sub>2</sub> emissions from the use of reducing agents that also serve as energy sources in iron production, and therefore Bulgaria's emission estimates double count some of the CO<sub>2</sub> emissions from iron production which are accounted for in the energy sector. In response to questions raised by the ERT during the review, Bulgaria informed the ERT that the industrial processes and energy experts in the inventory team had also detected this issue and are in the process of implementing changes to the way data are compiled to avoid double counting, and that these changes will be included in the next annual submission. Bulgaria stated that, to avoid double counting, the Party is considering removing the coke consumed as a reducing agent in steel production from the coke consumption in the energy sector. The ERT noted that this will improve the accuracy of emission estimates by solving the problem of double counting in iron and steel production. However, Bulgaria also informed the ERT of a plan to remove the blast furnace gas consumption from the energy sector. The ERT noted that the use of blast furnace gas is not included in the EFs for the tier 2 method in the IPCC good practice guidance. The ERT therefore recommends that Bulgaria remove the coke consumed as a reducing agent in steel production in its CO<sub>2</sub> emission estimates in the energy sector, but do not remove the consumption of blast furnace gas, in its next annual submission. The ERT reiterates the recommendation in the previous review report that Bulgaria:

- (a) Estimate emissions from BOFs and OHFs using a tier 2 method based on the iron and steel carbon contents;
- (b) Ensure that any carbon retained in the steel and estimated from the steelmaking processes (EAFs, BOFs, OHFs) are balanced with the estimates for iron production to minimize double counting of CO<sub>2</sub> emissions;

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

Consumption of halocarbons and SF<sub>6</sub> – HFCs and SF<sub>6</sub><sup>10</sup>

78. Bulgaria's methods for estimating emissions from this category are in line with the IPCC good practice guidance. The Party uses a country-specific method based on the tier 2 approach of the 2006 IPCC Guidelines.

79. The ERT noted that, in the NIR, Bulgaria reported on improvements that have been made to the AD used for the estimates under this category by:

(a) Collecting more accurate AD on HFCs for calculating emissions from domestic refrigeration for the entire time series;

(b) Replacing AD that were previously obtained by extrapolation with the actual amount of HFC-134a consumed for the period 1998–2010. The new values were obtained from the only company in Bulgaria that uses F-gases (HFC-134a) in the production of metered dose inhalers;

(c) Incorporating a new finding that indicates the absence of HFC use in commercial and industrial refrigeration equipment before 2000 based on new expert judgment;

(d) Incorporating a new finding from the literature that indicates that in transport refrigeration 25.0 per cent of the gases used by this activity in 2010 were not HFCs, as chlorofluorocarbons continued to be used.

80. The ERT commends Bulgaria for this effort and encourages the Party to continue the collection of more accurate AD, particularly for mobile air conditioning (noting that this activity accounted for 36.6 per cent of the total sectoral F-gas emissions in 2010), domestic air conditioning, the manufacturing and use of foams and commercial and industrial refrigeration.

81. The ERT noted that in the NIR, Bulgaria indicated that it has introduced some relevant changes for all the subcategories under refrigeration and air conditioning. As part of these changes Bulgaria has modified the extrapolation models for domestic refrigeration, stationary air conditioning and mobile air conditioning, fire extinguishers and electrical equipment, for the emission estimates of the years prior to 2010, and performed recalculations. In the NIR, Bulgaria explained that for fire extinguishers and electrical equipment, linear models to estimate the AD for HFC-125, HFC-227ea and SF<sub>6</sub> were built, taking into account Regional Inspectorate of Environment and Water (RIEW) reports and data collected from operators and importers by questionnaires. Based on this information, Bulgaria could identify that the use of HFCs in fire extinguishers started in 2001 and could also obtain real data for the period 2008–2010. For the years before 2008, the Party assumed a linear growth of 25.0 per cent, but did not include a justification of this assumption in the NIR. The ERT also noted that for the other subcategories, domestic refrigeration, stationary air conditioning, mobile air conditioning and electrical equipment, Bulgaria did not include details of the extrapolation models applied. The ERT recommends that, in its next annual submission, Bulgaria improve the transparency of the NIR by providing a description of the extrapolation models, including assumptions made and associated parameters used, to ensure that all estimates can be reviewed and verified.

82. Bulgaria reported HFC-134a and HFC-152a emissions from foam blowing, based on the use of these gases in the manufacture of foams. However, Bulgaria does not subtract the gases contained in exported products. This issue was raised in the review report of the 2010

<sup>10</sup> Bulgaria did not identify SF<sub>6</sub> emissions from SF<sub>6</sub> consumption as a key category.

annual submission. Bulgaria recognized that this is a pending issue, and has included it in its list of category-specific planned improvements in the NIR as an issue that requires to be addressed. The ERT welcomes this planned improvement, and recommends that Bulgaria take actions to improve the accuracy of the emission estimates of the foam blowing category in its next annual submission.

## **D. Agriculture**

### **1. Sector overview**

83. In 2010, emissions from the agriculture sector amounted to 6,405.90 Gg CO<sub>2</sub> eq, or 10.8 per cent of total GHG emissions. Since 1988, emissions have decreased by 69.3 per cent. The key driver for the fall in emissions is a decrease in crop production and also a decrease in livestock populations due to the structural changes of the national economy that have happened since 1988, including the transfer of land back to private owners. Within the sector, 56.1 per cent of the emissions were from agricultural soils, followed by 21.4 per cent from manure management, 20.4 per cent from enteric fermentation and 1.6 per cent from rice cultivation. The remaining 0.6 per cent were from burning of agricultural residues. Agricultural emissions consisted of 36.7 and 63.3 per cent of CH<sub>4</sub> and N<sub>2</sub>O emissions, respectively.

84. The ERT noted that the documentation on recalculations is not transparently presented in the NIR. CRF table 8(a) reported recalculations carried out for a number of categories including manure management (CH<sub>4</sub> and N<sub>2</sub>O), agricultural soils (N<sub>2</sub>O) and field burning of agricultural residues (CH<sub>4</sub> and N<sub>2</sub>O) (see para. 85 below). However, Bulgaria has provided only very limited information on recalculations in the NIR. The ERT reiterates recommendations in the previous review reports that Bulgaria improve its documentation relating to recalculations, including clear explanations of its rationale and, in particular, provide more information on recalculations in the category-specific sections in the NIR of its next annual submission.

85. Bulgaria has made recalculations for the agriculture sector between the 2011 and 2012 annual submissions following changes in the AD related to the percentage of crop residue burning and the distribution of animal waste management systems (AWMS). The overall impact of these recalculations on the agriculture sector is an increase in emissions of 1.2 per cent for 2009 and a decrease of 0.7 per cent for 1988. The main recalculations took place in the following categories for 2009:

(a) An increase in CH<sub>4</sub> and N<sub>2</sub>O emissions from manure management of 243.28 Gg CO<sub>2</sub> eq (or 20.4 per cent of the category), due to the use of national actual data for the distribution of AWMS (see para. 89 below);

(b) A decrease in N<sub>2</sub>O emissions from agricultural soils of 99.80 Gg CO<sub>2</sub> eq (or 2.9 per cent of the category), due to a change in the distribution of AWMS, affecting the amount of manure nitrogen applied to agricultural soils (see para. 89 below);

(c) A decrease in CH<sub>4</sub> and N<sub>2</sub>O emissions from field burning of agricultural residues of 71.95 Gg CO<sub>2</sub> eq (or 69.4 per cent of this category), due to the revision of the amount of agricultural residues burned (see para. 93 below).

86. The ERT noted that Bulgaria has improved the transparency and accuracy of the inventory for the 2012 annual submission by providing a more detailed explanation in the NIR of the methods used and using a greater number of country-specific parameters, particularly for estimating amounts of nitrogen from biological nitrogen fixation and crop residue nitrogen. The ERT commends Bulgaria for these improvements.

87. During the review the ERT identified some inconsistencies between the CRF tables and the NIR; for example, the information relating to live weight of farm animals (table 165 of the NIR) and the incorrect values reported in CRF table 4.B(b) for N<sub>2</sub>O emissions from manure management due to transcription errors. The ERT recommends that Bulgaria improve its QC procedures to ensure that these inconsistencies do not occur in its next annual submission.

## 2. Key categories

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

88. Bulgaria used a tier 2 method to estimate CH<sub>4</sub> emissions from cattle and sheep and a tier 1 method for all other livestock categories, in line with the Revised 1996 IPCC Guidelines and the IPCC good practice guidance. The ERT noted that Bulgaria has collected data on the milk yield of dairy cows since 2000 (table 164 of the NIR), but has assumed a constant milk yield of 11.9 kg/head/day from 1988 to 1999. During the review, in response to the ERT request for more information on the source of these data, Bulgaria indicated that an average of milk production from 2000 to 2010 was applied. The ERT recommends that Bulgaria provide transparent information, including the details of the extrapolation methodology used, in the NIR of its next annual submission, to ensure that all estimates can be reviewed and verified.

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

89. The ERT noted that Bulgaria has used country-specific data on the distribution of AWMS collected from a survey, rather than the IPCC default, following the recommendation in the previous review report. The ERT welcomes these efforts and the improvement brought about by obtaining and using more precise data on the distribution of AWMS.

90. The ERT noted that Bulgaria used the default values of the IPCC good practice guidance to estimate nitrogen excreted by livestock. Bulgaria indicated in the NIR that a project between ExEA and the Agrarian University of Plovdiv would provide equations to estimate the nitrogen excretion based on animal weight. Bulgaria also indicated that these equations and the respective data would be available by the end of 2011. However, the ERT noted that this information was not included in the 2012 annual submission. The ERT encourages Bulgaria to use country-specific data for nitrogen excretion calculations in its next annual submission.

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

91. Bulgaria used the IPCC tier 1 method for estimating N<sub>2</sub>O emissions from crop residue decomposition using the default IPCC EF and national crop production data. The ERT noted that the amount of nitrogen contained in the burned crop residues reported under the field burning of agricultural residues category has not been subtracted from the amount of nitrogen that is used for calculating N<sub>2</sub>O emissions from crop residue decomposition. The ERT considers that this situation represents a double counting of N<sub>2</sub>O emissions and encourages Bulgaria to solve this issue in its next annual submission.

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

92. Bulgaria estimated indirect N<sub>2</sub>O emissions from atmospheric deposition and nitrogen leaching and runoff using the IPCC tier 1a method and default IPCC EFs and parameters. However, as indicated in the previous review report, more detailed data on ammonia volatilization are available from Bulgaria's submission under the Convention on Long-range Transboundary Air Pollution of UNECE. In order to improve the accuracy of

emission estimates from ammonia volatilization and consistency of reporting between UNFCCC and UNECE, the ERT reiterates the recommendations in the previous review report that Bulgaria use country-specific parameters to estimate N<sub>2</sub>O emissions from ammonia volatilization and report it under the indirect soil emissions category.

### 3. Non-key categories

#### Field burning of agricultural residues – CH<sub>4</sub> and N<sub>2</sub>O

93. The ERT noted that Bulgaria followed a recommendation in the previous review report and estimated CH<sub>4</sub> and N<sub>2</sub>O emissions from field burning of agricultural residues by applying the IPCC default EFs and using country-specific information. The ERT commends Bulgaria for this improvement.

94. The ERT noted, however, that the CH<sub>4</sub> and N<sub>2</sub>O IEFs varied considerably between crop types (for instance, the CH<sub>4</sub> IEF for 2009 was 3.24 kg/t dry matter (dm) for wheat, and 6 kg/t dm for barley), but no explanation of these variations in the IEFs between crop types was given in the NIR. It is unclear why the IEFs differ from the default values and vary among crop types. The ERT recommends that Bulgaria include, in the next annual submission, background information that supports the variations of the IEFs between crop types.

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

### 1. Sector overview

95. In 2010, net removals from the LULUCF sector amounted to 8,631.27 Gg CO<sub>2</sub> eq. Since 1988, net removals have decreased by 39.1 per cent. The key driver for this fall is a decrease in the net removals in forest land due to a smaller increase in carbon stocks in living biomass of forests than that in 1988. Furthermore, an increase in net emissions from cropland, mainly caused by conversions from grassland to cropland and from land to settlements due to increased infrastructural work, contributed to the reduction of the overall net removals. Within the sector, net removals of 10,864.00 Gg CO<sub>2</sub> eq were from forest land, followed by net emissions of 2,290.17 Gg CO<sub>2</sub> eq from cropland and net removals of 786.64 Gg CO<sub>2</sub> eq from grassland. Settlements accounted for net emissions of 528.24 Gg CO<sub>2</sub> eq. The remaining net emissions of 200.94 Gg CO<sub>2</sub> eq were from wetlands. The sector offsets 14.0 per cent of the total GHG emissions.

96. Bulgaria has made recalculations for the LULUCF sector between the 2011 and 2012 annual submissions for all inventory years following an update of the AD and the inclusion of 2010 data on the stock of living biomass in the forest from the national forest inventory (NFI). The impact of the recalculations on the LULUCF sector is a decrease in net removals of 25.2 per cent for 2009 and an increase of 0.03 per cent for 1988. The main recalculations took place in the following categories:

(a) Decrease in net CO<sub>2</sub> eq removals of forest land of 2,861.05 Gg CO<sub>2</sub> eq (20.8 per cent of the category) for 2009, mainly due to the revised area of forest land remaining forest land taking into account the results of a project implemented in 2011, and newly available EFs for carbon stock change in living biomass in forest land remaining forest land and land converted to forest land;

(b) Increase in net CO<sub>2</sub> eq emissions from cropland of 116.65 Gg CO<sub>2</sub> eq (5.7 per cent of the category), due to changes in the area of cropland remaining cropland and respective subcategories, taking into account the changes that took place in forest land and land converted to forest land;

(c) Decrease in net CO<sub>2</sub> eq emissions from wetlands and settlements, by 5.8 Gg CO<sub>2</sub> eq, or 3.0 per cent, and by 6.3 Gg CO<sub>2</sub> eq, or 1.6 per cent, respectively, mainly due to a revised value for areas of land converted to wetlands and to settlements, and biomass loss in forest land converted to wetlands, as well as settlements.

97. Bulgaria has reported all mandatory reporting categories in the LULUCF sector. The ERT noted that the estimations are in line with the IPCC good practice guidance for LULUCF. The ERT also noted that small areas of land conversion to other land are reported in the NIR, but they are reported as “NO” in the CRF tables. Bulgaria explained that it is rather unlikely that these conversions took place, and the reported conversions could be due to inconsistencies between different data sources of land use (see para. 98 below). The ERT further noted that transparent information is provided in the NIR with the exception of missing additional information on underlying data for new country-specific coefficients used to calculate carbon stock change in living biomass in forests. This information was provided in response to a request from the ERT during the review. The ERT recommends that Bulgaria improve the transparency and completeness of the information in the NIR by providing underlying data in its next annual submission.

98. Bulgaria used several data sources for representing land use and land-use changes. It applied interpolation and extrapolation methods to get a time series for the whole period since 1988 for all land-use categories. The Party provided a land-use change matrix for every year from 1988 to 2010. A constraint noted by the ERT is that Bulgaria does not have specific data on the previous land use for land converted to another land use. Bulgaria applied practical assumptions to estimate the original land use of converted land and explained in the NIR, and during the review in response to questions raised by the ERT, that in order to ensure that the sum of all land categories tallies with the total territory of Bulgaria, the difference between the total land area of all land-use categories documented by the different data sources and the total territory were allocated to the other land category. This led to unlikely annual variations in the area and conversions from and to other land. Bulgaria provided information in the NIR and during the review on its continuing efforts to improve the quality of the land-use matrix. In addition, Bulgaria indicated that the NFI will provide annually updated AD and that in 2012 new data from aerial photographs will become available. The ERT welcomes the efforts made by Bulgaria and its plans, but strongly reiterates the recommendation in the previous review report that Bulgaria further improve the consistency of AD, particularly for land converted to other land, and report on its progress in its next annual submission, in order to ensure accuracy for all categories.

99. In response to a recommendation in the previous review report, Bulgaria provided in the NIR reference values for carbon stocks in soils of all categories. Those reference values were applied to estimate emissions or removals from conversions between categories. Bulgaria noted in the NIR that it plans to revise soil data, including archived soil material, and provide updated values for reference soil carbon stocks in its 2013 annual submission. The ERT welcomes such efforts to improve the soil database and recommends that Bulgaria report new soil reference data in its next annual submission.

100. Responding to a recommendation in the previous review report, Bulgaria reported for the first time detailed uncertainty estimates for forest land and cropland and for land-use changes to other categories. The uncertainty of the LULUCF sector calculated using the tier 1 method increased the total uncertainty of the Bulgarian inventory from 14.6 to 34.2 per cent. The ERT commends Bulgaria for this improvement.

## 2. Key categories

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

101. Bulgaria applies the stock change method to estimate emissions and removals from living biomass of forests. Bulgaria re-examined the forest management plans (FMPs). This resulted in an increase in the area of forest land remaining forest land, because areas were identified that became forest land before 1 January 1990 but were reported as land converted to forest land in previous annual submissions (see para. 102 below). New data from the ongoing NFI resulted in a small change of some coefficients for the estimation of living biomass, leading to a reduction of growth of living biomass by 3.4 and 2.5 per cent for the first and second age class, respectively. Bulgaria applied a tier 1 method for carbon stock change in dead wood, litter and soil pools. It reported in its NIR data on average carbon stocks in mineral soils in forests from ICP Forests<sup>11</sup> plots. These data show a decrease in carbon stocks in forest soils, which is not significant, from the average of the period 1986–1997 to the average of the period 1998–2007. As forest land remaining forest land is a key category, Bulgaria should apply a higher tier for these estimations. The ERT recommends that Bulgaria evaluate soil data and use new findings from the NFI to apply a higher tier in estimating emissions and removals from dead wood, litter and soils in its next annual submission.

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

102. In accordance with a recommendation in the previous review report, Bulgaria revised and updated the area of land converted to forest land. The area decreased from 304.21 to 227.41 kha and the net removals from this category decreased from 1,672.81 to 1,278.66 Gg CO<sub>2</sub> eq for 2009. This decrease is mainly due to a re-evaluation of FMPs, which resulted in better distinction between the conversions that happened before and after 1990 and which are now reported under forest land remaining forest land. The ERT welcomes this update and recommends that Bulgaria report in its next annual submission the results of the expected new land-use data on the conversions to forest land and the land use before the conversion.

## 3. Non-key categories

### Forest land converted to wetlands, settlements and other land – CO<sub>2</sub>

103. For the estimation of emissions and removals, Bulgaria applies an average value of carbon stocks in living biomass on forest land of 45.1 t C/ha for the whole time series. It is based on the tree volumes assessed by the NFIs of the years 1995, 2000, 2005 and, for the first time, 2010. Noting that the biomass stock per hectare exhibits a continuously increasing trend since 1990, the ERT considers that the use of one average value of carbon stock may cause an overestimation of emissions from losses of biomass in the early 1990s and an underestimation of emissions in recent years. The ERT strongly reiterates the recommendation in the previous review report that Bulgaria analyse the adequacy of using an average value of carbon stock for the whole time series since 1988, and report the results of its analysis and a justification of this issue in its next annual submission.

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<sup>11</sup> The database in the monitoring system of the forest ecosystems.



## F. Waste

### 1. Sector overview

104. In 2010, emissions from the waste sector amounted to 4,685.59 Gg CO<sub>2</sub> eq, or 7.6 per cent of total GHG emissions. Since 1988 emissions have decreased by 32.5 per cent. The key drivers for the fall in emissions are a reduction in the per capita solid waste generation, and a reduction in the organic industrial wastewater that is treated on-site as a result of the adoption of a waste management policy and increasing the capacity of recycling facilities. Within the sector, 81.1 per cent of the emissions were from solid waste disposal on land, followed by 18.5 per cent from wastewater handling. The remaining 0.4 per cent were from waste incineration.

105. Bulgaria has made recalculations for the waste sector between the 2011 and 2012 annual submissions following a change in AD in the category solid waste disposal on land during the years 2000–2009 and a change in EFs based on new country-specific data for the entire time series. The impact of these recalculations on the waste sector is an increase in CH<sub>4</sub> emissions of 2.4 per cent for 2009 and 1.3 per cent for 1988. The main recalculations took place in the following categories:

(a) The revised annual municipal solid waste at solid waste disposal sites (SWDS) for 2000, 2001, 2002 and 2006 resulted in a decrease in CH<sub>4</sub> emissions in the period 2000–2008 by 0.30–0.77 Gg CO<sub>2</sub> eq, or 0.01–0.02 per cent. For this category an increase in CH<sub>4</sub> emissions from solid waste disposal on land of 128.55 Gg CO<sub>2</sub> eq, or 3.3 per cent, for 2009 took place;

(b) A decrease in CH<sub>4</sub> emissions from wastewater handling of 18.44 Gg CO<sub>2</sub> eq, or 2.7 per cent, for 2009, due to the use of a new country-specific EF for the entire time series.

106. Bulgaria has reported CH<sub>4</sub> emissions from managed and unmanaged deep solid waste disposal on land, CH<sub>4</sub> emissions from domestic, commercial and industrial wastewater handling, including N<sub>2</sub>O from human sewage, and CO<sub>2</sub> and CH<sub>4</sub> emissions from non-biogenic hazardous and hospital waste incineration. The methodologies used by Bulgaria for its estimates follow the Revised 1996 IPCC Guidelines and the IPCC good practice guidance for the entire time series. Planned improvements include estimation of emissions from waste composting activities and CH<sub>4</sub> recovery from wastewater treatment facilities.

107. In general the descriptions of the estimation of emissions in the NIR are transparent. However, the ERT considers that the explanations in the NIR of the AD used are not sufficiently detailed (see also paras. 110, 111, 112 and 115 below). The ERT recommends that Bulgaria improve the transparency of the reporting by providing additional information to justify the selection of AD in the NIR of its next annual submission.

### 2. Key categories

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

108. The emissions from solid waste disposal on land have been calculated using the first order decay method of the IPCC good practice guidance. The ERT noted that CH<sub>4</sub> emissions from this category have decreased from 3,998.68 Gg CO<sub>2</sub> eq in 2009 to 3,801.59 Gg CO<sub>2</sub> eq in 2010 (a reduction of 197.09 Gg CO<sub>2</sub> eq, or 4.9 per cent of the category). This reduction in emissions was the largest since the decreasing trend of CH<sub>4</sub> emissions from this category started in 1997. The average reduction was about 1.1 per cent per year during 1997–2009. In response to questions raised by the ERT during the review,

Bulgaria provided additional background information which included the AD and EFs used in estimating CH<sub>4</sub> emissions for the time series 1950–2010. The ERT noted that this information showed the detailed calculation of emissions using actual AD and EFs on an annual basis, which could justify the decrease between 2009 and 2010, and recommends that Bulgaria include all the information used in estimating the emissions across the time series in the NIR of its next annual submission.

109. In response to a recommendation in the previous review report, Bulgaria has included in the NIR information on population and the per capita waste generation rate from 1988 to 2010, which were the main influencing factors affecting the decrease in CH<sub>4</sub> emission from solid waste disposal on land. The distribution between managed and unmanaged SWDS was also included. The ERT welcomes the efforts made by Bulgaria in this respect.

110. In the information mentioned in paragraph 108 above, Bulgaria reported a reduction of the per capita waste generation rate from 1.290 kg/day in 2009 to 1.129 kg/day in 2010 (a 12.5 per cent decrease), which is considered a large decrease compared with the changes in the previous years. However, no reason for this reduction in the per capita solid waste generation rate was given in the NIR. In response to a question raised by the ERT during the review, Bulgaria explained that the per capita waste generation estimate was derived from the total quantity of municipal waste from the National Statistical Institute and the average population; it also explained that the waste amount was provided by municipalities. The ERT encourages Bulgaria to include in the NIR of its next annual submission the rationality behind the reduction of the per capita solid waste generation between 2009 and 2010.

111. Bulgaria has reported CH<sub>4</sub> recovery from solid waste disposal on land in 2010 (0.25 Gg) for the first time, in response to a recommendation in the previous review report. Data were obtained from RIEW. Bulgaria indicated in the NIR that most of the managed landfills are equipped with gas collection systems, except two landfills which flare and do not collect landfill gas. The amount of gas collected and utilized was measured at SWDS and reported to RIEW. The ERT noted that the corresponding emissions are reported under the energy sector. The ERT encourages Bulgaria to include more information in the NIR on CH<sub>4</sub> recovery from this category, for example, AD for each of the landfill sites collecting and utilizing or flaring landfill gas.

112. In the previous review report, the ERT recommended that Bulgaria include in its NIR information on industrial waste included in municipal waste. However, the ERT noted that no information on this issue is included in the NIR of the 2012 annual submission. The ERT reiterates the recommendation in the previous review report that Bulgaria include information on industrial waste disposal in the NIR of its next annual submission.

#### Wastewater handling – CH<sub>4</sub>

113. Bulgaria used the IPCC default methodology from the IPCC good practice guidance for the estimation of CH<sub>4</sub> emissions from domestic and industrial wastewater. The ERT noted that the trend in CH<sub>4</sub> emissions is decreasing throughout the time series. However, the CH<sub>4</sub> IEF in 2010 (0.04 kg/kg degradable organic component (DC) is 89.1 per cent higher than in 2009 (0.02 kg/kg DC). Bulgaria indicated in CRF table 6.B that the difference between the total industrial wastewater generated in 2009 and that in 2010 is around 0.15 per cent, but the wastewater generated by the pulp and paper industry in 2010 is 55.5 per cent higher than that generated in 2009. The ERT noted that value of the DOC of industrial wastewater for paper and pulp industries reported in CRF table 6.B is high (9.00 kg chemical oxygen demand (COD/m<sup>3</sup>) relative to wastewater streams from other reported industries (2.00–3.00 kg COD/m<sup>3</sup>), resulting in a higher IEF for 2010. The ERT

encourages Bulgaria to include this information in its next annual submission in order to improve the transparency of the CH<sub>4</sub> emission estimates and trend.

114. In response to a recommendation in the previous review report, Bulgaria has provided information on the wastewater management systems in the country and potential CH<sub>4</sub> sources, but not on the distribution and treatment of wastewater among those systems. The ERT reiterates the recommendation in the previous review report that Bulgaria include the quantification of wastewater distribution among the different wastewater treatment systems in the NIR of its next annual submission.

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

#### Waste incineration – CO<sub>2</sub> and N<sub>2</sub>O

115. Bulgaria reported CO<sub>2</sub> and N<sub>2</sub>O emissions from hazardous and clinical waste incineration using plant-specific data on the amount of incinerated waste for the entire time series. The ERT noted that the quantity of waste sent to the incinerators in 2010 has reduced by 57.9 per cent compared with that reported for 2009. The ERT also notes that in the NIR there is no supporting explanation related to this reduction. In response to a question raised by the ERT during the review, Bulgaria explained that this was mainly a result of reduced amounts of waste being sent to the largest operating incinerator, and provided the ERT with the corresponding data. Bulgaria also explained that the number of operating incinerators has been reduced from 49 in 2009 to 3 in 2010 following the adoption of more stringent requirements to cease the operation of small incinerators under EU directive 2000/76/EC transposed into Regulation No. 6/28.04.2004. The ERT concluded that Bulgaria has estimated the amounts of waste processed in all the operating plants, on the basis of the plant-specific data. Nevertheless, the ERT recommends that Bulgaria report these data in the NIR of its next annual submission in order to ensure that all estimates can be reviewed and verified.

116. The ERT noted that CO<sub>2</sub> emissions reported from waste incineration for the year 2010 shown in table 227 of the NIR (page 411) were inconsistent with those reported in the GHG emissions trend shown in table 208 of the NIR (page 384). In response to a question raised by the ERT during the review, Bulgaria confirmed that the correct emission value was 14.17 Gg, as specified in CRF table 6.C. The ERT recommends that Bulgaria ensure the consistency of the reporting in the NIR and the CRF tables by enhancing QC procedures and checking all the data of the inventory before its submission to the secretariat.

## **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

117. Bulgaria submitted estimates for afforestation and reforestation and for deforestation activities under Article 3, paragraph 3, of the Kyoto Protocol, for which it chose commitment period accounting. Bulgaria did not elect any activities under Article 3, paragraph 4, of the Kyoto Protocol for the first commitment period. The Party generally provided supplementary information as required under paragraphs 5–8 of the annex to decision 15/CMP.1. All pools are reported except dead wood under afforestation and reforestation (“NR” (not reported) is reported in the KP-LULUCF CRF table NIR-1) as Bulgaria assumes that this pool is not a net source of emissions (see para. 126 below).

Bulgaria noted in its NIR that it did not factor out removals from effects caused by the increased CO<sub>2</sub> concentration or nitrogen deposition.

118. Bulgaria has made recalculations for the KP-LULUCF activities between the 2011 and 2012 annual submissions in response to recommendations in the 2011 ARR and following an update of the AD. The impact of these recalculations on each KP-LULUCF activity for 2009 is as follows:

(a) A decrease in CO<sub>2</sub> removals from afforestation/reforestation of 450.09 Gg (or 26.9 per cent), due to better distinction between the areas that were converted to forest land before and after 1 January 1990, leading to a reduction of the afforestation/reforestation area;

(b) An increase in CO<sub>2</sub> emissions from deforestation by 6.60 Gg (or 4.3 per cent), due to a small increase in the area.

119. Bulgaria uses the databases of the NFI, FMPs, the Forestry Fund Reporting and forest maps to derive AD for activities under Article 3, paragraph 3, of the Kyoto Protocol. It explains in the NIR that revisions will be made until its 2014 annual submission to include data of the full period from 1990 to 2012. A constraint is that the specific land use of a unit of land before or after conversion is not available, with the exception of forest land that was converted to settlements. The ERT is of the view that Bulgaria applied assumptions to determine the share of the different land uses before afforestation and reforestation and after deforestation (see para. 98 above). Bulgaria indicated in the NIR that it plans to include new annual data from the NFI and from FMPs as well as a new series of aerial photographs to determine the land uses before afforestation and reforestation or after deforestation. The ERT welcomes these efforts and recommends that Bulgaria provide updated information on land use before afforestation and reforestation and after deforestation in its next annual submission and complete the data for the period 1990 to 2012 in its 2014 annual submission at the latest (see paras. 122 and 123 below).

120. The ERT identified that the information provided in the NIR to demonstrate that activities under Article 3, paragraph 3, of the Kyoto Protocol began on or after 1 January 1990 are directly human-induced, as required by paragraph 8(a) of the annex to decision 15/CMP.1, is not fully in line with the IPCC good practice guidance for LULUCF, which could lead to an overestimation of the area of afforestation and relevant removals by sinks. In response to the list of potential problems and further questions raised by the ERT during the review week, Bulgaria submitted information about a plan that includes further examination of AD data sets, which would address the concern of the ERT. The ERT concluded that Bulgaria is making the arrangements to address this issue. However, the ERT considers that the improvement plan of Bulgaria would not fully satisfy the requirement by the IPCC good practice guidance for LULUCF, for example, documentation of a decision that had been taken to replant or to allow forest regeneration by other means and the information on any activities or decisions that should have happened before a forest has been developed, and strongly recommends that Bulgaria include the required mandatory information in its next annual submission (see paras. 123 and 124 below).

121. As recommended in the previous review report, Bulgaria provided for the first time uncertainty estimates using a Monte Carlo analysis for all reported pools. The total uncertainty of activities under Article 3, paragraph 3, of the Kyoto Protocol is -192/+212 per cent in 2008 and -139/+154 per cent in 2010 (total uncertainties). The ERT welcomes the uncertainty estimates and encourages Bulgaria to estimate how much the uncertainty of Article 3, paragraph 3, activities affects the total uncertainty of the Bulgarian inventory.

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

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

122. Bulgaria considers all conversions to forest as afforestation and reforestation since it considers that all such land-use changes are directly human induced. It argues that in all cases the conversion of the land use was subject to the decision of the landowner, who was aware that the converted land falls under the regulation of the Forest Act and therefore it is considered as managed forest. Bulgaria provided data in the NIR on the area planted or seeded and on the area of regrowth of forests. It also indicated that 64.0 per cent of the area converted to forest was cropland before conversion, 28.0 per cent grassland and 9.0 per cent other land. The ERT concluded from this information that all of the land converted to forests does not necessarily meet the criteria of direct human-induced activity as described in decision 16/CMP.1 and in the IPCC good practice guidance for LULUCF. In particular, the ERT considers that regrowth of forests on other land should not be considered as the effect of a direct human-induced activity. In addition, the ERT is of the view that the inclusion of new-forested areas in FMPs is not of itself proof of an afforestation and reforestation activity as stated by Bulgaria because those FMPs apply only when the forest has developed, that is, minimum parameters of forest definition are reached. Parties are required to report on activities such as planting, seeding or other means promoting a land-use change to forest. Therefore, the ERT considers that the accounting of all land-use change to forest as afforestation and reforestation may lead to an overestimation of removals.

123. In response to the list of potential problems and further questions raised by the ERT during the review week, Bulgaria explained its plans to further improve the estimation of units of land under afforestation and reforestation activities. It explained that regrowth on other land cannot happen because of poor site conditions and stated that it will further examine FMPs for all state forest enterprises in order to trace and identify all land-use changes to forest since 1990. According to the plan, experts will interpret former land use based on ecological site conditions. Also, Bulgaria assured the ERT that it will report the primary results of these improvement efforts in its next annual submission and provide information that transparently demonstrates that all reported afforestation and reforestation units of land are direct human induced at the latest in its 2014 annual submission. The ERT welcomes these continuing efforts and recommends that Bulgaria use the potential of all its data sources such as aerial photographs or FMPs to demonstrate that the conversion of a unit of land complies with the requirements of decisions 15/CMP.1 and 16/CMP.1. The ERT strongly reiterates the recommendation in the previous review report that Bulgaria apply good practice procedures according to the IPCC good practice guidance for LULUCF and provide “documentation that demonstrates that a decision had been taken to replant or to allow forest regeneration by other means” (IPCC good practice guidance for LULUCF, p.4.52). The ERT also reiterates the recommendation in the previous review report that Bulgaria provide transparent information that accounting of afforestation and reforestation starts only after a relevant decision was taken by the landowner. The ERT further recommends that Bulgaria report on all progress made on these issues in its next annual submission and provide complete and transparent information in accordance with the requirements of decisions 15/CMP.1 and 16/CMP.1 at the latest in its 2014 annual submission.

124. In response to recommendations in the previous review report, Bulgaria analysed available FMPs (which exist for all forested land), and traced back information to identify the land-use changes from other land uses to forest. This enabled Bulgaria to distinguish between areas that were converted before and after 1 January 1990. This more accurate distinction led to recalculations, which resulted in a decrease of removals from afforestation and an increase in emissions from deforestation (see para. 118 above). In addition, Bulgaria

provided in the NIR geographical boundaries in the form of districts and state forest enterprises that encompass the units of land subject to afforestation and reforestation to meet the requirements of paragraph 6 of the annex to decision 15/CMP.1. The ERT commends Bulgaria for these improvements in the quality of its reporting of afforestation and reforestation under the Kyoto Protocol.

125. In the previous review report, it was noted that Bulgaria reported incorrect information on the annual increment in afforestation and reforestation land. In the current annual submission, an average annual increment of 2.25 Mg C/ha for the first age class (0–20 years old) and of 4.28 Mg C/ha for the second age class (21–40 years) is reported. These increments are rather high compared with the default value of 1.5 Mg C/ha of the IPCC good practice guidance for LULUCF for coniferous trees until the age of 20 (table 3A.1.5). There is a further discrepancy between these increments and the average standing volumes of these age classes of 6.28 and 11.85 m<sup>3</sup>/ha for the first and the second age class, respectively, information, which was provided in response to a question by the ERT during the review. An increase of 2.25 Mg C/ha means that afforestation already reaches the average carbon stock of 45.1 t C/ha in living biomass of Bulgarian forests after 20 years from the start of the afforestation or reforestation. This is almost as high as the average living biomass that is lost per ha through deforestation. The ERT considers these increases as rather unlikely. The ERT strongly reiterates the recommendation in previous review reports that Bulgaria check increment values for young forests, report on any findings on this issue and provide corrected increment values or sound data that support the reported high increments in its next annual submission.

126. Bulgaria reported carbon stock changes in dead wood as “NO”, explaining that this pool is not a net source of emissions because dead wood in non-forest land prior to the conversion can be assumed to be zero and the dead wood pool in afforestation and reforestation land must only increase. As afforestation and reforestation is a key category, the ERT reiterates the recommendation made in the previous review report that Bulgaria, in its next annual submission, provide tier 2 estimates or other verifiable relevant information that demonstrates the validity of the “NO” assumption, especially for regrowth on perennial cropland and for possible changes in forest types or management regimes which have the potential to decrease carbon stock in dead wood during the first commitment period.

#### *Deforestation – CO<sub>2</sub>*

127. Following a recommendation in the previous review report, Bulgaria adapted the estimation of carbon stock changes from living biomass due to deforestation. In line with the IPCC good practice guidance for LULUCF, the carbon stock changes have been estimated in the year of deforestation instead of applying a transition period of 20 years. The ERT commends Bulgaria for this improvement.

128. Bulgaria applies an average value of carbon stock in the living biomass of forests to estimate emissions from deforestation for the whole time series since 1990. As the standing volume in Bulgarian forests has increased, the ERT considers that the emissions from the living biomass of forests have been underestimated for the years 2008–2010 (see para. 103 above). The ERT strongly recommends that Bulgaria use data from NFI 2005 and 2010 to derive appropriate carbon stocks of living biomass to estimate emissions from deforestation and that it report the results in its next annual submission.

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

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

129. 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 their comparison report.<sup>12</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.

130. Information on the accounting of Kyoto Protocol units has been prepared and reported in accordance with decision 15/CMP.1, annex, chapter I.E, and reported in accordance with decision 14/CMP.1 using the SEF tables. This information is consistent with that contained in the national registry and with the records of the international transaction log (ITL) and the clean development mechanism registry and meets the requirements referred to in decision 22/CMP.1, annex, paragraph 88(a–j). The transactions of Kyoto Protocol units initiated by the national registry are in accordance with the requirements of the annex to decision 5/CMP.1 and the annex to decision 13/CMP.1. However, the ERT noted that the SIAR identified that the information reported by Bulgaria on records of any discrepancies was not consistent with information provided to the secretariat by the ITL (discrepancy type 5061); therefore, the ERT recommends that Bulgaria fully report on discrepant transactions in its next annual submission and take corrective actions and measures to ensure that discrepancies do not keep reoccurring or elaborate on the root cause of the discrepancies if Bulgaria considers that they are not caused by its national registry.

#### National registry

131. The ERT took note of the SIAR and its finding that the reported information on the national registry is complete and has been submitted in accordance with the annex to decision 15/CMP.1. The ERT further noted from the SIAR and its finding that the national registry continues to perform the functions set out in the annex to decision 13/CMP.1 and the annex to decision 5/CMP.1, and continues to adhere to the technical standards for data exchange between registry systems in accordance with decisions 16/CP.10 and 12/CMP.1. The national registry also has adequate security, data safeguard and disaster recovery measures in place and its operational performance is adequate. However, the SIAR identified that the national registry has not fulfilled the requirements regarding the public availability of information in accordance with paragraph 47 (a–l) of the annex to decision 13/CMP.1. If any part of the information currently not made publicly available is deemed confidential, the ERT recommends that Bulgaria include an explicit statement in the NIR of its next annual submission and on its public website indicating exactly which data are confidential with reference to the relevant national regulations. Bulgaria has provided the web address of the registry in the NIR. During the review week the ERT tried to access this website, but all attempts were unsuccessful. The website became available later in the course of the review. The ERT recommends that Bulgaria ensure the accessibility of this site on a more permanent basis, making publicly available the information required in accordance with paragraph 47 of the annex to decision 13/CMP.1 on holding and transaction information.

#### Calculation of the commitment period reserve

132. Bulgaria has reported its commitment period reserve in its 2012 annual submission. Bulgaria reported its commitment period reserve to be 307,135,300 t CO<sub>2</sub> eq based on the national emissions in its most recently reviewed inventory (61,427,055 Gg CO<sub>2</sub> eq). The ERT disagreed with this figure as it was not correctly calculated. In response to the list of potential problems and further questions raised by the ERT during the review week,

<sup>12</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.

Bulgaria reported a revised commitment period reserve of 308,520,300 t CO<sub>2</sub> eq based on the national emissions in its most recently reviewed inventory (61,704,060 Gg CO<sub>2</sub> eq). The ERT agrees with this figure.

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

133. Bulgaria reported that there are no changes in its national system since the previous annual submission. However, the ERT noted that Bulgaria reported in its NIR a change in its national system, namely, that the Emissions Inventory Unit within ExEA, which is responsible for the GHG emissions inventory preparation, has been promoted from a unit to a department since 1 January 2012, and is hence now called the Emissions Inventory Department. The ERT concluded that, taking into account the confirmed change in the national system, Bulgaria's national system continues to be in accordance with the requirements of national systems set out in decision 19/CMP.1. The ERT recommends that Bulgaria report in its next annual submission any change in its national system in accordance with decision 15/CMP.1, annex, chapter I.F.

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

134. Bulgaria reported in the NIR that there are changes in its national registry since the previous annual submission. The changes reported are related to the implementation of security measures to prevent unauthorized manipulations and to prevent operator error through the application of a revised Ordinance of the Council of Ministers of Bulgaria adopted on 30 December 2010, which included additional requirements for the package of documents submitted for user registration and when carrying out a transaction. In addition, ExEA, in its capacity as administrator of the national registry, has undertaken additional security measures such as the implementation of an additional software module that monitors and records unauthorized attempts to penetrate the system and sends these data to the security authorities. As a consequence, the registry administrator undertakes active measures to avoid repetition of such unauthorized attempts by duly blocking the addresses suspected of malicious access. The ERT concluded that, taking into account the confirmed changes in the national registry, Bulgaria's national registry continues to perform the functions set out in the annex to decision 13/CMP.1 and the annex to decision 5/CMP.1 and continues to adhere to the technical standards for data exchange between registry systems in accordance with relevant decisions of the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol (CMP). The ERT recommends that Bulgaria report in its next annual submission, in a clear and concise way, any change in its national registry in accordance with decision 15/CMP.1, annex, chapter I.G.

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

135. Bulgaria did not provide information on changes in its reporting of the minimization of adverse impacts in accordance with Article 3, paragraph 14, in its annual submission. The ERT noted that the reported information in the 2012 annual submission is identical to that reported in the 2010 and 2011 annual submissions. The ERT concluded that the information provided continues to be complete and transparent. The ERT recommends that Bulgaria, in its next annual submission, report clearly whether it introduced any changes in its information provided under Article 3, paragraph 14, in accordance with chapter I.H of the annex to decision 15/CMP.1.

136. Bulgaria has developed a number of legislative measures that are connected mainly with the transposing of the corresponding EU legislation. The Party also carries out other activities in implementing directives connected with the policies on climate change.



Selected actions, identified in paragraph 24 of the annex to decision 15/CMP.1, are presented in table 249 of the NIR.

### III. Conclusions and recommendations

#### A. Conclusions

137. Bulgaria made its annual submission on 12 April 2012. The Party resubmitted its CRF tables on 8 September 2012 and on 18 October 2012. 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 minimization of adverse impacts in accordance with Article 3, paragraph 14, of the Kyoto Protocol). This is in line with decision 15/CMP.1.

138. The ERT concludes that the inventory submission of Bulgaria has been prepared and reported in accordance with the UNFCCC reporting guidelines. The inventory submission is complete and Bulgaria has submitted a complete set of CRF tables for the years 1988–2010 and an NIR; these are complete in terms of geographical coverage, gases and sectors and generally complete in terms of years. CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O emissions from navigation were reported as “NO” (see para. 69 above). Bulgaria submitted emission estimates of CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O from navigation for the period 2000–2010; however, CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O emissions from navigation for the years 1988–1999 were not reported.

139. 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. However, the ERT noted some issues regarding accuracy of the submission of information on changes in the national system, in the national registry and on minimization of adverse impacts under Article 3, paragraph 14, of the Kyoto Protocol.

140. Bulgaria’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. The ERT considers that there is room for improvement, for example, regarding the rationale for selecting a methodology, regarding AD and EFs and demonstrating how the use of EU ETS data is line with IPCC good practice guidance.

141. Bulgaria has made recalculations for the inventory between the 2011 and 2012 annual submissions following changes in AD, EFs and parameters and in order to rectify identified errors in all sectors for the period 1998–2009. The impact of these recalculations on the national totals is an increase in emissions of 5.6 per cent for 2009 and an increase in emissions of 3.6 per cent in 1988. The main recalculations took place in the following sectors/categories:

(a) Energy sector: CO<sub>2</sub> emissions from energy industry and manufacturing industries and construction, CO<sub>2</sub> emissions from road transportation, CH<sub>4</sub> emissions from oil and natural gas, and CH<sub>4</sub> emissions from coal mining and handling (see para. 43 above);

(b) Industrial processes sector: HFC and SF<sub>6</sub> emissions from the consumption of halocarbons and SF<sub>6</sub> (see para. 72 above);

(c) Agriculture sector: CH<sub>4</sub> and N<sub>2</sub>O in emissions from manure management, N<sub>2</sub>O in emissions from agricultural soils and CH<sub>4</sub> and N<sub>2</sub>O in emissions from field burning of agricultural residues (see para. 85 above);

(d) LULUCF sector: CO<sub>2</sub> emissions from cropland, wetlands and settlements and CO<sub>2</sub> removals from forest land (see para. 96 above);

(e) Waste sector: CH<sub>4</sub> emissions from solid waste disposal on land and wastewater handling (see para. 105 above).

142. Bulgaria generally provided the information related to activities under Article 3, paragraph 3, of the Kyoto Protocol as required in paragraphs 5–8 of the annex to decision 15/CMP.1 and consistent with decision 16/CMP.1. The ERT noted that Bulgaria does not have specific information about the land use before afforestation and reforestation and after deforestation and that all land accounted for under afforestation and reforestation is directly human induced, as required in paragraph 8(a) of the annex to decision 15/CMP.1. In this regard, the ERT identified that Bulgaria accounted as afforested and reforested areas all new areas that meet the minimum parameters of forest definition included in FMPs. The ERT considers that this alone is not a proof that the activity was directly human induced (see paras. 122 and 123 above). In response to the list of potential problems and further questions formulated by the ERT in the course of the review, Bulgaria has indicated that it plans to address this issue in its next annual submission and will provide the necessary information in its 2014 submission at the latest. The ERT further noted that Bulgaria should verify growth factors for living biomass in afforestation and reforestation land and that it did not provide sufficient verifiable information to demonstrate that the dead wood pool under afforestation is not a net source.

143. Bulgaria has made recalculations for the KP-LULUCF activities between the 2011 and 2012 annual submissions in response to the 2011 ARR and following changes in AD and EFs. The impact of these recalculations on each KP-LULUCF activity for 2009 is as follows:

(a) A decrease in CO<sub>2</sub> removals from afforestation/reforestation of 450.09 Gg, or 26.9 per cent;

(b) An increase in CO<sub>2</sub> emissions from deforestations of 6.60 Gg, or 4.3 per cent.

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

145. The national system continues to perform its required functions as set out in the annex to decision 19/CMP.1.

146. 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 SIAR identified that the national registry has not fulfilled the requirements regarding the public availability of information in accordance with paragraph 47(a–l) of the annex to decision 13/CMP.1.

147. Bulgaria has reported information under decision 15/CMP.1, annex, chapter I.H, “Minimization of adverse impacts in accordance with Article 3, paragraph 14” as part of its 2012 annual submission. The information is considered complete and transparent.

## **B. Recommendations**

148. The ERT identifies issues for improvement as listed in table 6 below.

Table 6  
Recommendations identified by the expert review team

<i>Sector</i>	<i>Category</i>	<i>Recommendation</i>	<i>Paragraph reference</i>
Overview	Completeness	Collect AD for the period 1988–1999 for navigation, estimate and report the associated emissions, and include this information in the next annual submission for the entire time series	11
	Inventory planning	Describe in the NIR the involvement of the members of the Emissions Inventory Department in the development of the annual improvement plan	19
		Include information on how the key category analysis is used to prioritize the development and improvement of the emission estimates in the LULUCF sector	22
		Assess the relationship between the activities under the Kyoto Protocol and the associated key categories in the GHG inventory	23
	Uncertainties	Provide information on the use of the results of the uncertainty analysis to prioritize the development and improvement of the inventory	25
	Recalculations and time-series consistency	Improve the reporting of the rationale behind the changes in recalculations	26
		Includes a specific section on recalculations for each of the sectors	26
		Complete CRF table 8(b)	26
	Verification and quality assurance/quality control approaches	Include in the NIR examples of the content of checklists for general and specific QA/QC activities	30
		Improve its QC procedures to ensure consistency between the NIR and the CRF tables	32
	Transparency	Present a clear description about the recommendations that have been effectively addressed and those that have not been addressed, including the actions planned	34
		Improve the information about the rationale behind the methods, input data and assumptions applied	35
		Include in the NIR information about a large industrial plant and business associations	36
Energy	Overview	Improve transparency	45
	Reference and sectoral approaches	Revise the estimation and reporting of the amount of carbon stored reported from the use of fuels as feedstocks	48, 49

<i>Sector</i>	<i>Category</i>	<i>Recommendation</i>	<i>Paragraph reference</i>
	Feedstocks and non-energy use of fuels	Include in the NIR and CRF table 1.A(d) the information that clarifies the non-energy use of each fuel	51
		Correct reporting error in CRF table 1.A(c), excluding the non-energy use of fuels and feedstocks in apparent energy consumption	53
	Stationary combustion: solid, liquid and gaseous fuels – CO <sub>2</sub> , CH <sub>4</sub> and N <sub>2</sub> O	Assess the correlation between carbon content and net calorific value of each fuel and explore the possibility of using this correlation to generate CO <sub>2</sub> EFs for the entire time series	55
		Revise AD of refinery gas combustion for the period 1988–2008	58
		Include in the NIR information about AD and CO <sub>2</sub> EFs for the different fuels used in industrial activities	59
		Include an explanation of the sharp decrease in CO <sub>2</sub> emissions in the residential sector	60
	Road transportation: liquid fuels – CO <sub>2</sub>	Include information to adjust vehicle mileages to estimate CO <sub>2</sub> emissions	61
	Coal mining and handling – CH <sub>4</sub>	Include the use of a higher-tier method for estimating CH <sub>4</sub> emissions from surface coal mining in the prioritized improvement programme, and implement the improvement	63
		Include the underlying rationale for the change in the method applied to split production of lignite coal between surface and underground mining	65
	Railways: liquid fuels – CO <sub>2</sub> , CH <sub>4</sub> and N <sub>2</sub> O	Reallocate emissions in accordance with the IPCC guidelines	68
	Navigation: liquid fuels – CO <sub>2</sub> , CH <sub>4</sub> and N <sub>2</sub> O	Provide in the NIR a description of the methodology used for emission estimates	69
		Estimate CO <sub>2</sub> , CH <sub>4</sub> and N <sub>2</sub> O emissions for period 1988–1999	69
	Mobile (other): liquid fuels – CO <sub>2</sub> , CH <sub>4</sub> and N <sub>2</sub> O	Reallocate emissions in accordance with the IPCC guidelines	70
Industrial processes and solvent and other	General	Strengthen routine checking of CRF tables to ensure that the CRF tables are consistent with the data included in the NIR	73

<i>Sector</i>	<i>Category</i>	<i>Recommendation</i>	<i>Paragraph reference</i>
product use	Lime production – CO <sub>2</sub>	Provide data sources used for the ratio of calcium/dolomitic lime	74
	Other (mineral products – glass production) – CO <sub>2</sub>	Verify plant-specific EFs to avoid double counting	75
	Iron and steel production – CO <sub>2</sub>	Apply a mass balance approach for BOFs and OHFs for the entire time series, and report the parameters and data sources used. Remove coke consumed as reducing agent in the energy sector. Do not remove consumption of blast furnace gas in the energy sector	76, 77
	Consumptions of halocarbons and SF <sub>6</sub> – HFCs and SF <sub>6</sub>	Describe the extrapolation models (the assumptions and the associated parameters) to ensure that all estimates can be independently verified	81
		Subtract the gases contained in exported products from foam blowing	82
Agriculture	General	Solve inconsistencies between the NIR and the CRF tables	87
	Enteric fermentation – CH <sub>4</sub>	Describe the extrapolation model (the assumptions and the associated parameters) to ensure that all estimates can be independently verified	88
	Indirect soil emissions – N <sub>2</sub> O	Use country-specific parameters to estimate N <sub>2</sub> O emissions from ammonia volatilization	92
	Field burning of agricultural residues – CH <sub>4</sub> and N <sub>2</sub> O	Include background information that supports the variations of the IEFs between the crop types	94
LULUCF	General	Provide background information for carbon stock changes from land conversion to and from wetlands and other land	97
		Improve the consistency of AD in the construction of land-use matrix	98
		Report updated reference values for carbon stocks	99
	Forest land remaining forest land – CO <sub>2</sub>	Use a higher-tier methodology for estimates of soil and dead organic matter	101
	Land converted to forest land – CO <sub>2</sub>	Report the results of expected new land-use data of the conversions to forest land and the land use before the conversion	102
	Forest land converted to wetlands, settlements and	Check the representativeness of the use of an average value for carbon stock for national circumstances	103

<i>Sector</i>	<i>Category</i>	<i>Recommendation</i>	<i>Paragraph reference</i>
	other land – CO <sub>2</sub>		
Waste	General	Improve the transparency of the reporting to justify the selection of AD	107
	Solid waste disposal on land – CH <sub>4</sub>	Include background information to justify the emission trend	108
		Include information about industrial waste disposal	112
	Wastewater handling – CH <sub>4</sub>	Include the quantification of wastewater distribution among the different wastewater treatment systems	114
	Waste incineration – CO <sub>2</sub> and N <sub>2</sub> O	Report AD of each operating plant	115
		Ensure consistency of the reporting between the NIR and the CRF tables	116
Supplementary information required under Article 7 paragraph 1 of the Kyoto Protocol	Overview	Improve information on land use before the land-use conversion to forests	119, 120
		Include the information that supports the assertion that the activities under Article 3, paragraph 3, that began on or after 1 January 1990 are directly human induced, and include the timeline and steps to fulfil this task	120
	Afforestation and reforestation – CO <sub>2</sub>	Examine Forest Management Plans to identify all land-use changes to forest since 1990. Provide information confirming that accounting started after a relevant decision was taken by the landowner	122, 123
		Check increment values for young forest. Report the results of this analysis	125
		Provide tier 2 estimates for dead organic matter or transparent information that this pool cannot become a net source	126
	Deforestation	Apply data from the 2005 and 2010 national forest inventories to estimate emissions from living biomass	128
	National registry	Report on discrepant transactions, and take steps to ensure that discrepancies do not keep recurring	129, 130
		Include in the next NIR a web address that makes holding and transaction information publicly available	129, 130
	National system	Report any changes in the national system	133
	Changes to national registry	Report any changes in the national registry	134
	Minimization of adverse impacts	Report any changes in the information provided	135

*Abbreviations:* AD = activity data, BOFs = basic oxygen furnaces, CRF = common reporting format, EF = emission factor, GHG = greenhouse gas, IEF = implied emission factor, IPCC = Intergovernmental Panel on Climate Change, KP-LULUCF = land use, land-use change and forestry emissions and removals from activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, LULUCF = land use, land-use change and forestry, NA = not applicable, NIR = national inventory report, OHFs = open hearth furnaces, QA/QC = quality assurance/quality control.

## **IV. Questions of implementation**

149. 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/gpglulucf/gpglulucf.htm>>.

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

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

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

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

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

Status report for Bulgaria 2012. Available at  
<<http://unfccc.int/resource/docs/2012/asr/bgr.pdf>>.

Synthesis and assessment report on the greenhouse gas inventories submitted in 2012. Available at <<http://unfccc.int/resource/webdocs/sai/2012.pdf>>.

FCCC/ARR/2011/BGR. Report of the individual review of the annual submission of Bulgaria submitted in 2011. Available at  
<<http://unfccc.int/resource/docs/2012/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. Detelina Petrova (Executive Environment Agency), including additional material on the methodologies and assumptions used. The following documents were also provided by Bulgaria:

Danube, 2012.<sup>1</sup> Available at  
<[http://www.danubecommission.org/index.php/en\\_US/statistics](http://www.danubecommission.org/index.php/en_US/statistics)>

European Commission. 2007. *Commission Decision of 18 July 2007 Establishing Guidelines for the Monitoring and Reporting of Greenhouse Gas Emissions Pursuant to Directive 2003/87/EC of the European Parliament and of the Council*. Brussels. The Commission of the European Communities. Available at <[http://ec.europa.eu/environment/climat/emission/implementation\\_en.htm](http://ec.europa.eu/environment/climat/emission/implementation_en.htm)>

Fott P. 1999. Carbon emission factors of coal and lignite: analysis of Czech coal data and comparison to European values. *Environmental Science and Policy*. 2: 347–354.

“Improvement plan for GHG inventory 2010 – submission 2012” (IP\_GHG\_2010\_2012.pdf);

“Improvement plan for GHG inventory 2011 – submission 2013” (IP\_GHG\_2011\_2013.pdf).

Response from No.1 incinerator is lukoil Neftochim to the Questionnaire

Mazumdar BK. 2000. Theoretical oxygen requirements for coal combustion: relationship with its calorific value. *Fuel*. 79: 1413–1419.

Mesroghli Sh, Jorjani E and Chehreh Chelgani S. 2009. Estimation of gross calorific value based on coal analysis using regression and artificial neural networks. *International Journal of Coal Geology*. 79: 49–54.

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

## Annex II

### Acronyms and abbreviations

AD	activity data
ARR	annual review report
AWMS	animal waste management systems
BOF	basic oxygen furnaces
C	carbon
CH <sub>4</sub>	methane
CMP	Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol
CO <sub>2</sub>	carbon dioxide
CO <sub>2</sub> eq	carbon dioxide equivalent
CRF	common reporting format
EF	emission factor
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
IEF	implied emission factor
IPCC	Intergovernmental Panel on Climate Change
ITL	international transaction log
kg	kilogram (1 kg = 1,000 grams)
LULUCF	land use, land-use change and forestry
m <sup>3</sup>	cubic metre
N <sub>2</sub> O	nitrous oxide
NA	not applicable
NE	not estimated
NFI	national forest inventory
NIR	national inventory report
NO	not occurring
OHFs	open hearth furnaces
PFCs	perfluorocarbons
PJ	petajoule (1 PJ = 10 <sup>15</sup> joule)
QA/QC	quality assurance/quality control
SEF	standard electronic format
SF <sub>6</sub>	sulphur hexafluoride
SIAR	standard independent assessment report
SWDS	solid waste disposal sites
UNFCCC	United Nations Framework Convention on Climate Change