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

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

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I. Introduction and summary

A. Overview

1. This report covers the centralized review of the 2011 annual submission of Bulgaria, coordinated by the UNFCCC secretariat, in accordance with decision 22/CMP.1. The review took place from 29 August to 3 September 2011 in Bonn, Germany, and was conducted by the following team of nominated experts from the UNFCCC roster of experts: generalist – Mr. Paul Duffy (Ireland) and Mr. Dario Gomez (Argentina); energy – Ms. Ana Carolina Avzaradel (Brazil) and Ms. Songli Zhu (China); industrial processes – Ms. Elsa Hatanaka (Japan) and Ms. Deborah Ottinger Schaefer (United States of America); agriculture – Mr. Daniel Bretscher (Switzerland) and Mr. Kohei Sakai (Japan); land use, land-use change and forestry (LULUCF) – Mr. Atsushi Sato (Japan) and Mr. Harry Vreuls (Netherlands); and waste – Mr. Keith Brown (United Kingdom of Great Britain and Northern Ireland) and Mr. Sabin Guendehou (Benin). Mr. Duffy and Mr. Gomez were the lead reviewers. The review was coordinated by Mr. Tomoyuki Aizawa (UNFCCC secretariat).

2. In accordance with the “Guidelines for review under Article 8 of the Kyoto Protocol” (decision 22/CMP.1) (hereinafter referred to as Article 8 review guidelines), 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.

B. Emission profiles and trends

3. In 2009, the main greenhouse gas (GHG) in Bulgaria was carbon dioxide (CO₂), accounting for 77.0 per cent of total GHG emissions¹ expressed in carbon dioxide equivalent (CO₂ eq), followed by methane (CH₄) (14.7 per cent) and nitrous oxide (N₂O) (7.8 per cent). Hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF₆) collectively accounted for 0.5 per cent of the overall GHG emissions in the country. The energy sector accounted for 75.8 per cent of total GHG emissions, followed by the agriculture sector (10.4 per cent), the waste sector (8.0 per cent), the industrial processes sector (5.8 per cent) and the solvent and other product use sector (0.1 per cent). Total GHG emissions amounted to 59,496.49 Gg CO₂ eq and decreased by 52.2 per cent between the base year² and 2009.

4. Tables 1 and 2 show GHG emissions from Annex A sources, emissions and removals from the LULUCF sector under the Convention and emissions and removals from activities under Article 3, paragraph 3, and, if any, Article 3, paragraph 4, of the Kyoto Protocol (KP-LULUCF), by gas and by sector, respectively. In table 1, CO₂, CH₄ and N₂O emissions included in the rows under Annex A sources do not include emissions and removals from the LULUCF sector

¹ In this report, the term “total GHG emissions” refers to the aggregated national GHG emissions expressed in terms of CO₂ eq excluding LULUCF, unless otherwise specified.

² “Base year” refers to the base year under the Kyoto Protocol, which is 1988 for CO₂, CH₄ and N₂O, and 1995 for HFCs, PFCs and SF₆. The base year emissions include emissions from Annex A sources only.

Table 1
Greenhouse gas emissions, by gas from Annex A sources and emissions/removals from activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, base year to 2009^a

	Greenhouse gas	Base year ^a	Gg CO ₂ eq							Change	
			1990	1995	2000	2005	2007	2008	2009	Base year–2009	(%)
Annex A sources	CO ₂	93 317.47	83 378.50	62 148.87	47 608.57	52 081.40	57 126.34	54 315.27	45 802.22	–50.9	
	CH ₄	16 349.16	15 435.86	12 058.92	10 620.58	9 740.13	9 593.25	9 350.64	8 758.51	–46.4	
	N ₂ O	14 840.36	12 612.45	6 618.96	5 087.75	5 170.84	4 830.09	5 047.36	4 657.67	–68.6	
	HFCs	9.34	IE, NA, NO	9.34	27.73	113.81	208.57	310.00	268.00	2 770.4	
	PFCs	IE, NA, NO, NE	IE, NA, NO, NE	IE, NA, NO, NE	IE, NA, NO, NE	IE, NA, NO	IE, NA, NO	0.00	0.01	NA	
	SF ₆	5.18	3.91	5.18	6.87	8.64	9.33	9.70	10.07	94.3	
KP-LULUCF	Article 3.3 ^b	CO ₂						–1 219.75	–1 519.99		
		CH ₄						NO	NO		
		N ₂ O						NO	NO		
	Article 3.4 ^c	CO ₂	NA						NA	NA	NA
		CH ₄	NA						NA	NA	NA
		N ₂ O	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, NO = not occurring, NE = not estimated.

^a “Base year” for Annex A sources refers to the base year under the Kyoto Protocol, which is 1988 for CO₂, CH₄ and N₂O, and 1995 for HFCs, PFCs and SF₆. The “base year” for activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol is 1988.

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

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

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

	Sector	Gg CO ₂ eq								Change	
		Base year ^a	1990	1995	2000	2005	2007	2008	2009	Base year–2009 (%)	
Annex A	Energy	85 348.80	76 329.89	55 931.57	44 032.49	48 563.44	53 562.24	51 632.15	45 075.23	–47.2	
	Industrial processes	12 415.23	10 740.75	10 067.95	6 485.39	6 669.56	6 935.01	6 083.95	3 437.84	–72.3	
	Solvent and other product use	899.79	897.75	95.61	68.40	50.68	50.13	51.10	47.84	–94.7	
	Agriculture	19 011.65	16 819.00	8 105.64	6 796.45	6 537.61	6 114.73	6 315.06	6 180.59	–67.5	
	Waste	6 846.03	6 643.33	6 640.49	5 968.77	5 293.53	5 105.48	4 950.71	4 755.00	–30.5	
	LULUCF	NA	–13 805.75	–12 885.64	–10 276.31	–11 336.15	–10 254.71	–11 565.81	–11 781.88	NA	
	Total (with LULUCF)	NA	97 595.50	67 928.10	53 067.94	55 773.78	61 508.57	57 463.00	47 711.16	NA	
	Total (without LULUCF)	124	488.50	111 401.25	80 813.75	63 344.25	67 109.92	71 763.28	69 028.81	59 493.04	–52.2
	Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	
KP-LULUCF	Article 3.3 ^b	Afforestation and reforestation						–1 491.38	–1 672.81		
		Deforestation						271.63	152.82		
		Total (3.3)						–1 219.75	–1 519.99		
	Article 3.4 ^c	Forest management						NA	NA		
		Cropland management	NA					NA	NA	NA	
		Grazing land management	NA					NA	NA	NA	
		Revegetation	NA					NA	NA	NA	
Total (3.4)	NA						NA	NA	NA		

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

^a “Base year” for Annex A sources refers to the base year under the Kyoto Protocol, which is 1988 for CO₂, CH₄ and N₂O, and 1995 for HFCs, PFCs and SF₆. The “base year” for activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol is 1988.

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

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

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

Table 3

Information to be included in the compilation and accounting database in t CO₂ eq

	<i>As reported</i>	<i>Revised estimates</i>	<i>Adjustment^a</i>	<i>Final^b</i>	<i>Accounting quantity^c</i>
Commitment period reserve	29 595 155	24 748 247		297 482 467	
Annex A emissions for current inventory year					
CO ₂	45 802 222			45 802 222	
CH ₄	8 758 510			8 758 510	
N ₂ O	4 654 221	4 657 675		4 657 675	
HFCs	268 000			268 000	
PFCs	13			13	
SF ₆	10 074			10 074	
Total Annex A sources	59 493 040	59 496 493		59 496 493	
Activities under Article 3, paragraph 3, for current inventory year					
3.3 Afforestation and reforestation on non-harvested land for current year of commitment period as reported	-1 672 808			-1 672 808	
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	152 815			152 815	
Activities under Article 3, paragraph 4, for current inventory year^d					
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					

Abbreviations: NO = not occurring.

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

^b “Final” includes revised estimates, if any, and/or adjustments, if any.

^c “Accounting quantity” is included in this table only for Parties that chose annual accounting for activities under Article 3, paragraph 3, and elected activities under Article 3, paragraph 4, if any.

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

II. Technical assessment of the annual submission

A. Overview

1. Annual submission and other sources of information

6. The 2011 annual inventory submission was submitted on 14 April 2011; it contains a complete set of common reporting format (CRF) tables for the period 1988–2009 and a national inventory report (NIR). Bulgaria also submitted information required under Article 7, paragraph 1, of the Kyoto Protocol, including information on: activities under Article 3, paragraph 3 and 4, of the Kyoto Protocol, accounting of Kyoto Protocol units, changes in the national system and in the national registry, and minimization of adverse impacts under Article 3, paragraph 14, of the Kyoto Protocol. The standard electronic format (SEF) tables were submitted on 14 April 2011. The annual submission was submitted in accordance with decision 15/CMP.1.

7. Bulgaria officially submitted revised emission estimates on 17 October 2011 in response to questions raised by the expert review team (ERT) during the course of the review. Bulgaria also submitted, on 17 October 2011, revised information on the calculation of the commitment period reserve. The values in this report are those submitted by the Party on 17 October 2011.

8. Where necessary, 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.³

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

Completeness of inventory

10. The inventory covers all sectors and most source and sink categories for the period 1988–2009 and is generally complete in terms of years and geographical coverage, except for the use of fluorinated gases (F-gases) (see paras. 84–87; 88–89). The previous ERT identified gaps in the inventory associated with categories reported as not estimated (“NE”) in the energy, industrial processes and solvent and other product use sectors. Bulgaria has addressed these gaps in its revised estimates on 22 October 2010, and also in its 2011 submission by:

(a) Estimating the emissions from the identified categories in the energy sector (all GHGs from waste fuel combustion in cement kilns; CH₄ and N₂O from biofuels in road transportation);

(b) Estimating the emissions of HFCs from refrigeration and air-conditioning equipment and foam blowing;

³ The SIAR, parts I and II, is prepared by an independent assessor in line with decision 16/CP.10 (paras. 5(a), 6(c) and 6(k)), under the auspices of the international transaction log 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.

(c) Reporting as not occurring (“NO”) the following categories: PFCs from fire extinguishers; PFCs from aerosols/metered dose inhalers; HFCs and PFCs from solvents; HFCs and PFCs from semiconductor manufacture; HFCs and PFCs from electrical equipment; HFCs, PFCs and SF₆ from other (consumption of halocarbons and SF₆); and N₂O from other (direct emissions).

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

Overview

11. The ERT concluded that the national system continued to perform its required functions.

12. Bulgaria reported that there are no changes in its national system since the previous annual submission.

Inventory planning

13. The NIR described the national system for the preparation of the inventory. The Ministry of Environment and Water (MoEW) has overall ministerial responsibility for the national inventory, and the Executive Environmental Agency (ExEA), which is under the MoEW, is the single national entity. Other government departments and agencies, institutions and organizations are also involved in the planning and preparation of the inventory.

14. The 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) from statistical services and other institutions; inventory preparation, including the calculation of emission estimates and 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.

15. New agreements were signed in 2010 between the MoEW and other governmental organizations regarding data acquisition. These agreements are aimed at ensuring that data are received from the main data providers, which include the Ministry of Agriculture and Food (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).

16. In the NIR, Bulgaria summarizes the information regarding the contracts signed with the external consultants: Denkstatt Ltd., the Geophysical Institute of the Bulgarian Academy of Science, the University of Chemical Technology and Metallurgy and the University of Forestry, to prepare its inventory for some sectors. The ERT noted with concern that most of these contracts were completed in December 2010 and the NIR does not report information on the extension of the agreements, particularly considering that Bulgaria has expressed to the Compliance Committee (CC-2010-1-17/Bulgaria/EB) its plans of contracting external consultants for a two-year term. During the review week, Bulgaria informed the ERT that:

(a) The technical specifications for contracting external consultants were in the process of finalization and the contracts were expected to be signed by the end of September 2011, which is 70 days earlier than had been achieved in the previous year;

(b) The two-year term contracts with the external consultants were to be signed by the end of September 2011 for the Energy sector and the LULUCF sector.

17. The ERT welcomes this development. The ERT recommends that Bulgaria report on the status of those contracts in its NIR in the next annual submission.

18. The previous ERT had indicated some concern regarding the allocation of resources within ExEA to each sector of the inventory. The current NIR reports that the number of experts in the ExEA in charge of the national GHG inventory has been increased. During the review week, Bulgaria confirmed to the ERT that the number of staff at ExEA who had been dedicated to the Bulgarian national system for the 2011 submission was 11, which almost doubled the number of staff that had been dedicated to the national system for the 2009 submission, which amounted to six. The ERT welcomes this development.

19. Bulgaria has continued with training activities aimed at strengthening the technical competence of the inventory team. These activities include: a training programme with the Federal Environment Agency of Austria, which covered all inventory sectors, in a series of workshops held between December 2009 and September 2010; four experts from ExEA participated in the online UNFCCC training courses for expert reviewers; two experts from ExEA participated in the European Environment Agency training course on estimation of emissions from road transportation using the COPERT model. The ERT welcomes this development and encourages Bulgaria to support the continuous improvement of the technical competence of the inventory team.

Inventory preparation

Key categories

20. Bulgaria has reported a key category tier 1 analysis, both level and trend assessment, as part of its 2011 submission. The key category analysis performed by the Party and that performed by the secretariat⁴ produced similar results. Bulgaria has included the LULUCF sector in its key category analysis, which was performed in accordance with the Intergovernmental Panel on Climate Change (IPCC) *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (hereinafter referred to as the IPCC good practice guidance) and the IPCC *Good Practice Guidance for Land Use, Land-Use Change and Forestry* (hereinafter referred to as the IPCC good practice guidance for LULUCF). Bulgaria is planning to implement a tier 2 analysis for its 2012 submission. The ERT encourages Bulgaria to continue with this planned improvement.

21. Annex 1 to the NIR includes tables with the results of the level and trend assessment. The ERT noted that this annex does not include a summary table similar to table 7.A3 of the IPCC good practice guidance. To improve transparency, the ERT encourages Bulgaria to include this summary information in the NIR of its next annual submission.

22. Bulgaria has not identified key categories for activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol. In its NIR, there is a chapter heading for key category analysis for those activities, however there is no main body for that chapter of the NIR. The

⁴ The secretariat identified, for each Party, the categories that are key categories in terms of their absolute level of emissions, applying the tier 1 level assessment as described in the Intergovernmental Panel on Climate Change *Good Practice Guidance for Land Use, Land-Use Change and Forestry*. 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.

ERT recommends that Bulgaria include this information in its next annual submission under the Kyoto Protocol, following the guidance on establishing the relationship between the activities under the Kyoto Protocol and the associated key categories in the UNFCCC inventory as provided in chapter 5.4.4 of the IPCC good practice guidance for LULUCF.

23. The ERT noted that there is room for improvement in the reporting of the key category analysis. The ERT commends Bulgaria for having addressed previous recommendations and encourages the Party to continue improving its reporting.

Uncertainties

24. An uncertainty analysis applying a tier 1 approach has been prepared and reported. During the review week, Bulgaria informed the ERT about its plans to perform a tier 2 uncertainty analysis in its next annual submission. The ERT welcomes this development.

25. The NIR reports that the overall uncertainty in GHG emissions in the 2009 inventory of the 2011 submissions is 15.2 per cent and uncertainty in trends is 3.9 per cent, while that in the 2008 inventory of the 2010 submission was 13.2 per cent and uncertainty in trends was 3.6 per cent. Bulgaria does not provide an explanation for this increase in uncertainty, although it is reported that the Party has made several improvements in the accuracy of the estimation of the emissions from several categories in the different sectors. The ERT recommends that Bulgaria addresses this issue in its next annual submission.

26. The LULUCF sector was not included in the uncertainty analysis. The NIR indicates that a project for assessing the uncertainties for the LULUCF sector is planned and that the results will be included in the 2012 annual submission. During the review week, Bulgaria informed the ERT that:

(a) It is expected that the project will be carried out between October 2011 and February 2012;

(b) The main project components include: undertaking a tier 1 uncertainty analysis for most categories; assessing the opportunity to implement a tier 2 analysis to estimate uncertainty for the key categories of the LULUCF sector, or at least for forest land; training the sectoral experts to use the specific software if Monte Carlo analysis is applied;

(c) The staff in charge of this project will be a statistician (external consultant) and a LULUCF expert from the ExEA who will provide the external consultant with the necessary sectoral information.

27. The ERT welcomes this development, encourages Bulgaria to undertake the project and recommends that Bulgaria report the results in its next annual submission and use them to prioritize further improvements in the inventory.

28. Bulgaria has not identified uncertainties for activities under Article 3, paragraph 3, of the Kyoto Protocol. Bulgaria indicates in the NIR that an assessment of the uncertainties of emissions/removals of the afforestation, reforestation and deforestation activities is planned for its next annual submission. The ERT reiterates previous recommendations that Bulgaria report its uncertainty analysis for both LULUCF under the Convention and under the Kyoto Protocol in its next annual submission.

29. The ERT noted that there is room for improvement in the reporting of the uncertainty analysis. The ERT commends Bulgaria for having addressed previous recommendations and encourages the Party to continue improving its reporting.

Recalculations and time-series consistency

30. The ERT noted that recalculations reported by the Party of the time series 1988 to 2008 have been undertaken to take into account changes/improvements in AD in all sectors, EFs (energy, industrial processes) or parameters (agriculture). The major changes, and the magnitude of the impact, include: a decrease in the estimated total GHG emissions in 2008 of 6,715.97 Gg CO₂ eq (a 10.5 per cent decrease). This decrease is dominated by a decrease in the waste sector of 5,484.57 Gg CO₂ eq (a 52.6 per cent decrease), followed by a decrease in energy of 1,026.28 Gg CO₂ eq (a 1.9 per cent decrease).

31. The previous ERT identified a number of gaps in the Party's reporting. The ERT noted the improvement in the reporting of cross-cutting issues, particularly regarding improved information on recalculations, both in the NIR and in CRF tables 8(a) and (b).

32. In response to a question raised by the ERT during the review week, Bulgaria provided the ERT with a table summarizing the rationale for each of the categories for which recalculations were made. The bases of the main changes include:

(a) Previous recommendations regarding: waste fuel combustion in cement production; the estimation of F-gases for categories previously reported as "NE"; the improvement of QC checks in the LULUCF sector; and the improvement of time-series consistency in the waste sector (solid waste disposal on land, wastewater handling and waste incineration);

(b) Application of a higher tier method to estimate emissions from road transportation;

(c) Revision of AD by data suppliers or cross-checking of AD with alternative information sources (coal mining, chemical industry, metal production, solvent and other product use, enteric fermentation, manure management, agriculture soils and field burning of agricultural residues);

(d) Revision of EFs (natural gas).

33. The ERT noted that this summary information is very useful to improve transparency and encourages Bulgaria to include it, when appropriate, in future submissions. The ERT also noted that there is room for improvement in the reporting of recalculations by providing category-specific information on recalculation including change of uncertainty estimates and encourages Bulgaria to continue to improve the reporting of the bases for recalculations in future NIRs.

Verification and quality assurance/quality control approaches

34. ExEA is responsible for the coordination and implementation of QA/QC activities for the national inventory. The NIR provides a 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 implement the newly established legal, institutional and procedural arrangements within the Bulgarian national system. The system covers all participants in the Bulgarian national system and uses specific checklists. During the review week, Bulgaria provided the ERT with the checklists for general and specific procedures used for QC (for AD and EFs) and QA activities. These checklists enable the outcomes of the QA/QC checks to be recorded together with the name of the expert/institution in charge, the date and the finding of each QA/QC check and the recording of the same information in case a correction has been detected both for expert and institution, as necessary. The ERT commends Bulgaria for the improvements and recommends that the Party include in an annex to the NIR its elaborated QA/QC plan along with these checklists in its next annual submission.

35. In response to questions raised by the ERT during the review, Bulgaria provided the ERT with a list summarizing the main findings of the QC checks for the 2011 submission that were used to identify further improvements to the inventory. The main findings of the QC checks for each sector included:

- (a) Energy: lack of detailed AD for navigation and civil aviation;
- (b) Industrial processes and solvent and other product use: more information is necessary to improve the AD for limestone and dolomite use, consumption of F-gases and for most categories of solvent and other product use;
- (c) Agriculture: the amount of animal manure should be calculated based on animal waste management systems (AWMS) instead of using the data from the national service for plant protection;
- (d) LULUCF: additional information for land-use change from the MAF is required to improve the quality of reporting for agriculture areas, and an error was detected in the worksheets for the arable land subcategory;
- (e) Waste: both a country-specific EF and a computing model for wastewater need to be developed.

36. The QA is conducted in two stages: a review of the initial set of emission estimates and a review of the estimates and text of the NIR. The QA checklist includes provisions for checking consistency between the NIR and the CRF tables. During the review week, Bulgaria provided the ERT with a list of the experts who were responsible for the QA process for the 2011 submission. Five experts from the MoEW reviewed the energy and industrial processes sector; two from the MAF the agriculture and LULUCF sectors; and one from the ExEA reviewed the waste sector. The ERT commends Bulgaria for its efforts in implementing the QA process.

Transparency

37. Bulgaria has made improvements on the transparency in the NIR and CRF tables, since the last annual submission, by providing some explanation on methods. However, the ERT noted that there is still room to improve transparency in the NIR in aspects regarding the underlying information for the selection and estimation of country-specific data and the rationale for recalculations and that were identified in the previous review report, which include:

- (a) Methodologies, AD and EFs and other parameters at the category level and the rationale for their selection;
- (b) Trend analysis;
- (c) Recalculations;
- (d) Key category analysis;
- (e) Uncertainty analysis;
- (f) Information demonstrating that activities under Article 3, paragraph 3, are directly human-induced.

38. In its responses to questions raised by the ERT during the review week, Bulgaria provided the ERT with additional explanations that help to clarify several issues. The ERT recommends that Bulgaria review the information it provided to the ERT during the review week, assess which parts of the information helped to provide clarifications on the question raised and include this information in the NIR of its next annual submission (see paras. 134, 135, 136 and 139).

39. The NIR includes information on how the recommendations from the previous review report were addressed, which the ERT considers useful. However, the ERT considers that in most cases the information provided needs to be integrated into the main NIR discussion for clarity and for use in future NIRs. The ERT encourages Bulgaria to reconsider its approach of reporting the follow up of recommendations in the previous review reports in future annual submissions.

Inventory management

40. Bulgaria has a centralized archiving system, which includes the archiving of disaggregated EFs and AD, and documentation on how these factors and data have been generated and aggregated for the preparation of the inventory. The archived information also includes internal documentation on QA/QC procedures, external and internal reviews, and documentation on annual key categories and key category identification and planned inventory improvements. During the review, the ERT was provided with the requested additional archived information.

3. Follow-up to previous reviews

41. The ERT notes that Bulgaria has made efforts to implement the recommendations in the previous review report. Improvements to cross-cutting issues include:

- (a) Addressing the gaps in the inventory associated with categories that were reported as “NE”;
- (b) Minimizing the number of resubmissions, as no resubmission was done in 2011;
- (c) Defining the roles and responsibilities of the different actors in the QA/QC system;
- (d) Including provisions in the QA system for checking consistency between the NIR and CRF tables;
- (e) Reporting information on recalculations in CRF tables 8(a) and 8(b).

42. Bulgaria has also implemented most of the recommendations of the previous review report for different categories in the agriculture and waste sectors.

43. However, there are a number of pending issues that were not addressed by the Party in its 2011 annual submissions including:

- (a) Transparency in relation to: (i) improvements to the documentation of category-level methodologies, AD, EFs and other parameters used to estimate emissions, references to sources of AD and the rationale for selecting a methodology; (ii) the use of European Union Emission Trading Scheme (EU ETS) data in the inventory, in particular demonstrating how its use is in line with the IPCC good practice guidance;
- (b) Consistency between the information reported in the NIR and the CRF tables, in spite of the Party having included a specific QA check;
- (c) Improvement in the preparation and reporting of the uncertainty analysis by including the LULUCF sector in the analysis;
- (d) Improvements in the allocation of fuels used for national and international aviation and navigation;
- (e) Preparation of emission estimates for iron production using data on the amount of reducing agent (coke) collected or derived from national statistics and/or from industry.

4. Areas for further improvement

Identified by the Party

44. The 2011 NIR identifies several areas for improvement, including:
- (a) Further improving the national system by:
 - (i) Continuing the capacity-building of the inventory team;
 - (ii) Advancing the signing of contracts with external consultants;
 - (iii) Improving the quality management system;
 - (b) Developing uncertainty estimates for the LULUCF sector;
 - (c) Implementing a tier 2 uncertainty and key category analyses;
 - (d) Improving the development of country-specific EFs;
 - (e) Improving the allocation of fuels used for national and international transportation;
 - (f) Completing the revision of AD for solvent and other product use;
 - (g) Undertaking specific surveys and studies to improve AD and to move to higher tier emission estimates for several categories of the agriculture sector.

Identified by the expert review team

45. During the review, the ERT identified cross-cutting issues for improvement. These are listed in paragraph 163 below.
46. Recommended improvements relating to specific categories are presented in the relevant sector chapters of this report.

B. Energy

1. Sector overview

47. The energy sector is the main sector in the GHG inventory of Bulgaria. In 2009, emissions from the energy sector amounted to 45,075.23 CO₂ eq, or 75.8 per cent of total GHG emissions. Since 1988, emissions have decreased by 47.2 per cent. The key driver for the fall in emissions is stationary combustion, particularly in the energy industries and manufacturing industries and construction. Percentage decreases between 1988 and 2009 in relevant stationary combustion categories were, in order: manufacturing industries and construction (82.2 per cent), other sectors (71.8 per cent), energy industries (26.3 per cent). Fugitive emissions decreased by 36.6 per cent, while emissions from transport increased by 13.6 per cent. Within the sector, 65.8 per cent of the emissions were from energy industries, followed by 18.2 per cent from transport, 8.0 per cent from manufacturing industries and construction and 4.1 per cent from other sectors. Fugitive emissions from solid fuels accounted for 3.0 per cent and oil and natural gas accounted for 0.8 per cent.

48. Bulgaria provides information in the NIR on the reasons explaining the trend of emissions. The main reasons include:

- (a) The main underlying cause of the sharp decrease in emissions is the shift from a planned to a market economy, which occurred in the country after 1990;
- (b) Emissions decreased until 1999 and exhibit a slow increase after 2000 with the growth in the national economy;

(c) Emissions in 2008 and 2009 exhibit a decrease, approaching the 2000 levels, because of the economic crisis; and

(d) The significant decrease in 2009 in manufacturing industries and construction is largely related to the restructuring of the iron and steel industry, with the closure of the largest integrated steel mill in Bulgaria.

49. The Party has made recalculations for the energy sector between the 2010 and 2011 submissions following changes in AD in order to update the latest statistical information. The impact of these recalculations on the energy sector is a decrease in emissions of 1.9 per cent for 2008. The main recalculations took place in the following categories:

(a) Decrease in emissions from manufacturing industries and construction of 1,646.02 Gg CO₂ eq (or 19.1 per cent);

(b) Increase in emissions from solid fuels of 763.57 Gg CO₂ eq (or 112.7 per cent).

50. Bulgaria has reported GHG emissions for all categories of the energy sector for which the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the Revised 1996 IPCC Guidelines) and the IPCC good practice guidance provide methodologies for estimation. The previous review report indicated gaps in the inventory associated with the following categories, which have been reported as “NE” in the 2010 submission: CO₂, CH₄ and N₂O from waste fuel combustion in manufacturing industries and construction (cement); and CH₄ and N₂O from biofuels in road transportation. Those emissions were submitted officially on 22 October 2010 in response to the list of potential problems and further question raised by the ERT during the review week. Bulgaria is commended for estimating GHG emissions for these two categories for the whole time series 1988–2009 and reporting them in its 2011 annual submission.

51. Following recommendations in previous review reports, Bulgaria estimated CO₂ emissions from the combustion of biofuels in transport, but did not include these emissions in the CRF tables under memo items. During the review, Bulgaria informed the ERT that it had not included these emissions under the memo item in its 2011 annual submission because of the transition of responsibility for this calculation from the internal expert to external consultants, and stated that these emissions will be reported in the CRF tables as memo item in the next annual submission. The ERT recommends that Bulgaria implement this improvement in the reporting in its next annual submission.

52. The inventory is generally transparent. The ERT appreciates the inclusion of annex 8 to the NIR, which provides detailed information on the vehicle fleet and mileage data used to estimate emissions for road transportation. However, the ERT notes that there is room for improvement and recommends that Bulgaria:

(a) Provide the underlying reasons for the decreasing trend in the emissions of the residential sector;

(b) Improve the discussion on the use of data compiled under the EU ETS data;

(c) Improve the description of the criteria used for the split between navigation and maritime international bunkers.

53. Bulgaria uses information reported under the EU ETS to estimate country-specific CO₂ EFs for anthracite, lignite, other bituminous coal, sub-bituminous coal and petroleum coke. Bulgaria states in the NIR that reports of CO₂ emissions under the EU ETS are available from 153 operators and indicates that these data have been included in the inventory as far as possible and that they have also been used for QA/QC checks. During

the review, Bulgaria provided the ERT with additional information, which is summarized below:

(a) All reports under the EU ETS for the period 2007–2009 were available to the inventory team;

(b) From the complete set of data, only those estimated using tier 2b or tier 3, as specified in the European Commission guidelines for the monitoring and reporting of GHG emissions under the EU ETS (European Commission, 2007) were selected, and this process resulted in 64 records reported by about 22 operators;

(c) Net calorific values (NCVs) and CO₂ EFs were calculated from all the selected records. NCVs were compared with the values reported in the national energy balance and the CO₂ EFs were compared with the IPCC default values.

54. To improve transparency, the ERT recommends that Bulgaria include this information in its next annual submission.

2. Reference and sectoral approaches

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

55. CO₂ emissions from fuel combustion were calculated using the reference approach and the sectoral approach. For 2009, CO₂ emissions estimated by the reference approach (44,315.80 Gg) were 3.4 per cent higher than emissions estimated by the sectoral approach (42,854.10 Gg). The explanation for this difference is not provided in the documentation box of CRF table 1.A(c). For the time series 1988–2009, differences in CO₂ emissions are always higher than 2 per cent and within the range 2.5 per cent (2004) and 10.8 per cent (1995). The ERT recommends that Bulgaria include an explanation of the differences in CRF table 1.A(c) in its next annual submission.

56. The NIR includes tables summarizing the estimates of overall fuel consumption and CO₂ emissions under the reference and sectoral approaches for all years of the time series 1988–2009 as well as the time series of estimates for liquid, solid and gaseous fuel consumption together with the corresponding CO₂ emissions. Bulgaria discusses in the NIR the reasons for the differences in the estimates of fuel consumption and CO₂ emissions between the reference and the sectoral approaches and attributes them to:

(a) The limited information on the non-energy use of fuels that is reported in the national energy balance;

(b) The fact that the reference approach does not estimate the fuel delivered for international bunkers consumption; and

(c) Significant statistical differences reported in the Bulgarian energy balance for some years.

57. During the review, Bulgaria acknowledged that the statement in the NIR that the reference approach does not consider international bunkers was erroneous. The ERT recommends that Bulgaria correct this statement in the NIR of its next annual submission.

58. In addition, Bulgaria informed the ERT that some attempts were made to check whether there is a correlation between the reported statistical differences in the energy balance and the difference between the sectoral and the reference approaches, but the large annual variability meant that it was not possible to explain the differences by fuel or other factors. The ERT noted that, in general, the largest differences in CO₂ emissions between the reference approach and the sectoral approach are associated with gaseous fuel consumption and that Bulgaria has not reported any assessment on this fuel type. The ERT recommends that Bulgaria address this issue in its next annual submission.

International bunker fuels

59. Previous review reports have indicated a number of issues regarding the split of fuel consumption between civil aviation and aviation bunkers, and between navigation and marine bunkers. The specific issues for each category are summarized below (see paras. 60 and 61). Bulgaria has not been able to address these issues in the 2011 annual submission and the time series of fuel consumption for these categories continues to exhibit significant variability. Bulgaria reports in the NIR its plan to address this issue as part of its planned improvements.

60. Regarding aviation, during the review, Bulgaria informed the ERT that the energy balance does not split fuel consumption between civil aviation and aviation bunkers for the period 1991–1996. To compensate for this gap, interpolation of this split between 1990 and 1997 was used to estimate jet kerosene consumption in civil aviation. Bulgaria informed the ERT that planned improvements in this respect include cooperation with external consultants Denkstatt to improve fuel-use estimates for domestic and international aviation for the next annual submission. In addition, Bulgaria indicated its plan of applying a higher tier method to estimate emissions from civil aviation. This plan is based on the number of landing/take-off cycles and fuel-use data, which are already available from 1998 onwards but have not yet been verified. The ERT encourages Bulgaria to undertake these activities and report the results in its next annual submission.

61. In the NIR, Bulgaria indicates that the split of fuel consumption between navigation and marine bunkers for the complete time series is part of its improvement plan. During the review, Bulgaria informed the ERT that, although navigation is not a key category, further discussion with experts from NSI and the Ministry of Transport is envisaged in order to collect representative AD for the complete time series as well as cooperation with Denkstatt for improving the emission estimates. The ERT recommends that Bulgaria undertake these activities and report the results in its next annual submission.

Feedstocks and non-energy use of fuels

62. Bulgaria reports in the NIR and in CRF table 1.A(d) that seven types of fuels are used for non-energy purposes: bitumen, lubricants, naphtha, natural gas, other oil products, paraffin waxes and white spirit. In the reference approach, default values from the Revised 1996 IPCC Guidelines were used to estimate the fraction of carbon stored. To improve transparency, the ERT recommends that Bulgaria indicate in the NIR, of its next annual submission, under which categories the emissions associated with the non-energy use of fuels are allocated.

3. Key categoriesStationary combustion: solid, liquid and gaseous fuels – CO₂

63. Bulgaria used information reported annually under the EU ETS to estimate country-specific CO₂ EFs for anthracite, lignite, other bituminous coal, sub-bituminous coal and petroleum coke for 2007, 2008, and 2009 (para. 53). For each of these fuels, a country-specific EF was estimated as a weighted average in the period. During the review, Bulgaria informed the ERT that the selected data from the EU ETS represented 57 per cent (for the solid fuels) and 85 per cent (for the petroleum coke) of the corresponding total energy consumption reported under energy industries and manufacturing industries and construction. The ERT commends Bulgaria for estimating the country-specific EFs and having enhanced the accuracy of the inventory in line with the IPCC good practice guidance.

64. However, during the review, Bulgaria informed the ERT that the Party's decision to use a single average CO₂ EF for each fuel type for the full time series was mostly based on the relatively limited number of operators that reported their emissions using tier 2b or tier 3 (these tier levels refer to those levels specified in the European Commission guidelines for the monitoring and reporting of greenhouse gas emissions under the EU ETS). In addition, Bulgaria informed the ERT that, for the 2012 submission, the Party is considering the implementation of annual country-specific CO₂ EFs for 2007, 2008, 2009 and 2010 while keeping the weighted-average CO₂ EF for years in the period 1988–2006. The ERT commends Bulgaria for this planned improvement to data for recent years.

65. Regarding the years in the period 1998–2006, the ERT noted that the Bulgarian energy balance reports calorific values for all years and that the time series of these calorific values exhibits significant variability. It is well known that, on average, there is a relationship between the CO₂ EF and the calorific values for all fuels. The ERT recommends that Bulgaria explore the possibility of obtaining a correlation between the carbon content and the NCV of each fuel reported by the selected facilities that have used higher tier methods under the EU ETS, taking into account the recent scientific literature (e.g. Fott, 1999; Mazumdar, 2000; Mesroghli et al., 2009). If a satisfactory correlation is obtained, the ERT further recommends that Bulgaria use this correlation to generate the time series 1989–2006 of CO₂ EFs and recalculate the corresponding emissions.

66. Following recommendations in the previous review report, Bulgaria estimated a country-specific CO₂ EF for natural gas, based on data on physical properties and the chemical composition of the natural gas collected through questionnaires sent to the companies which supply and extract natural gas in the country. During the review, Bulgaria informed the ERT that consistency checks performed to this information included comparing calorific values reported by the companies with those reported in the national energy balance, and comparing calorific values and carbon content with those reported in the NIR of the Russian Federation (Bulgarian single natural gas exporter). The ERT commends Bulgaria for this undertaking and recommends that the Party include the information on the QA/QC checks in the NIR of its next annual submission.

67. Bulgaria reports in the NIR that the time series of GHG emissions from the category residential exhibit a sharp decrease, which amounts to 83.7 per cent between 1988 and 2009. Bulgaria does not discuss in the NIR the underlying causes of this sharp decrease in this specific category. To improve transparency, the ERT recommends that Bulgaria provide an explanation in the NIR of its next annual submission.

Road transportation: liquid fuels – CO₂, CH₄⁵ and N₂O

68. In its submission in 2010 Bulgaria implemented a vehicle kilometres travelled approach to estimate the emissions of CO₂, CH₄ and N₂O from road vehicles using the COPERT 4 model. Bulgaria provides information on the AD used as input to the model in annex 8 to the NIR and indicates in the NIR that the default EFs available in the COPERT IV model were used because of the lack of locally measured EFs. The ERT commends Bulgaria for this improvement.

69. The ERT noted that Bulgaria estimated and reported CO₂ emissions from road vehicles based on the mentioned vehicle-kilometres-travelled approach. The ERT recommends that Bulgaria report how the total fuel consumption collected from the national energy balance and the total fuel consumption calculated by the model has been dealt with.

⁵ Not all emissions related to all gases under this category are key categories, particularly CH₄ 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.

70. The ERT noted that the CH₄ implied emission factor (IEF) for gasoline decreased significantly between 2003 and 2004, from 20.32 kg/TJ to 16.42 kg/TJ, or 19.2 per cent. In its response to previous review stages of the review, Bulgaria provided a general explanation on the possible causes of this behaviour. However, the ERT encourages Bulgaria to fully exploit the capabilities of its recently implemented vehicle-kilometres-travelled approach within the framework of the COPERT IV model to improve its understanding of this variation, and also recommends that the Party provide explanations for these changes in the next annual submission.

Fugitive emissions from fuel: coal mining – CO₂ and CH₄

71. NSI reports AD for the period 1988–2009 for the different type of coals using different methodologies regarding the allocation between surface and underground mining of lignite and brown coals. To avoid underestimation, Bulgaria revised the AD for underground mining and made a conservative estimate for the share of underground production. This approach led to a significant increase in AD for underground mining, compared with the NIR for 2010 and consequently to an increase in emissions. Bulgaria plans to revise the AD for underground mining of coal for its next annual submissions. The ERT commends Bulgaria for its revision of AD to avoid underestimation and recommends that the Party undertake its improvement plan in its next annual submission in order to ensure the accuracy of the inventory.

4. Non-key categories

Navigation: liquid fuels – CO₂, CH₄ and N₂O

72. Emissions from the use of diesel and residual fuel oil in domestic navigation have been reported as included elsewhere (“IE”) for various years in the time series, but no explanation has been provided indicating the category where these emissions have been reported, either in the NIR or CRF table 9(a). Bulgaria reports in the NIR that this transportation mode is used mostly for freight transport and that the energy balance provides limited AD for this category for the period 1990–1999 and that there is no information in the energy balance for navigation after 1999. During the review, the inventory team consulted with NSI about the possibility of an underestimation of emissions from navigation. The energy experts of NSI confirmed that this category includes fuels delivered to vessels for which both port of departure and port of arrival are in Bulgaria, and indicated that although there are ships which transport goods at domestic ports (e.g. Ruse – Vidin), it is common practice for this to be part of the international cruise of the ship, for which the ship is refuelling at international ports. In addition, Bulgaria indicated that, although this is not a key category, further discussion with experts from NSI and Ministry of Transport is envisaged in order to collect representative AD for the complete time series as well as cooperation with Denkstatt for improving the inventory under contract for the energy sector. The ERT strongly recommends that Bulgaria undertake these plans and report the results in the next annual submission.

C. Industrial processes and solvent and other product use

1. Sector overview

73. In 2009, emissions from the industrial processes sector amounted to 3,437.84 Gg CO₂ eq, or 7.2 per cent of total GHG emissions, and emissions from the solvent and other product use sector amounted to 47.84 Gg CO₂ eq, or 0.1 per cent of total GHG emissions. Since the base year, which is 1988 for CO₂, CH₄ and N₂O and 1995 for F-gases, emissions have decreased by 72.3 per cent in the industrial processes sector and decreased by 94.7 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 activity across all categories (except for F-gases) resulting from the economic crises of 1989–1990, 1997–1998 and 2009. Within the industrial processes sector, 64.4 per cent of the emissions were from mineral products, followed by 25.2 per cent from chemical industries, and 2.3 per cent from metal production. The remaining 8.1 per cent were from consumption of halocarbons and SF₆.

74. The Party has made recalculations for the industrial processes sector between the 2010 and 2011 submissions in response to the 2010 annual review report and following changes in AD in order to update the latest statistical information. The impact of these recalculations on the industrial processes sector is an increase in emissions of 1.1 per cent for 2008. The main recalculations took place in the following categories:

- (a) Increase in emissions from mineral product of 62.49 Gg CO₂ eq (or 1.8 per cent);
- (b) Increase in emissions from consumption of halocarbons and SF₆ of 3.70 Gg CO₂ eq (or 1.2 per cent).

75. Bulgaria's estimation methods are in line with the Revised 1996 IPCC Guidelines and the IPCC good practice guidance. Bulgaria has implemented many of the recommendations of the previous review report, significantly improving the transparency, accuracy, completeness and consistency of its inventory. The inventory now includes a complete time series for F-gases (1988–2009), with the following improvements since last year's submission: many categories that were listed as "NE" in the previous year's submission are actually "NO" (e.g. PFC emissions from foam blowing and fire extinguishers); the inventory also incorporates the results of industry and government surveys of F-gas importers and users, leading to the significant revision of emissions from some end uses (e.g. domestic and transport refrigeration). For soda ash use, Bulgaria describes in the NIR how it has revised its emission estimates based on data on soda ash production, imports and exports, and the soda ash section also describes how double counting with glass production is avoided (although this clarification has not been fully implemented in the glass production section). In addition, Bulgaria now uses the default product life EF for fire protection equipment from the Revised 1996 IPCC Guidelines. The ERT commends Bulgaria for making these improvements to the completeness, accuracy and consistency of its inventory.

76. Bulgaria has made the CRF tables more complete and consistent with the NIR, but some issues remain unresolved. For example, CRF table 2(II).F includes emissions, EFs and AD for each lifecycle stage for most types of equipment and most chemicals. However, the table omits this information for SF₆ in electrical equipment, incorrectly indicates that the quantities of refrigerant remaining in decommissioned transport refrigeration are "NO", and provides an EF for use of domestic refrigeration that is ten times higher than the EF actually used. The ERT reiterates the recommendation in the previous review report that Bulgaria, in its next annual submission, strengthen its routine checking of CRF tables as part of QC activities to ensure that the CRF tables are correct and that they are consistent with the data in the inventory calculation sheets and in the NIR.

77. The ERT noted that various typographical errors and omissions occasionally make it challenging to follow the discussions in the NIR and impair general transparency. These include: the omission of page numbers for the industrial processes section as a whole; a heading for "soda ash production" in the carbide production and use discussion; and a reference to a non-existent "Table 9 in Annex 1" in the fire protection discussion. The ERT recommends that Bulgaria correct these mistakes in the NIR of its next annual submissions.

78. Bulgaria has increased the transparency of reporting for several categories (e.g. soda ash production and use, and categories relevant to F-gases), although this remains a

problem in other categories (lime production, other (mineral products (glass production)), and iron and steel production, which are discussed below). The discussion on cement production now includes information on the type of cement produced, as well as a helpful table in the NIR detailing the metal oxide contents of the clinker and the resulting IEF. Following the recommendations of the previous review report, a separate section has been included in the NIR to present the method and data used to estimate emissions from carbide production. In addition, the discussion of consumption of halocarbons and SF₆ includes illuminating graphs showing actual and potential emissions by end use. However, the information on potential emissions is not reflected to the CRF tables. The ERT commends Bulgaria's efforts to increase the transparency in several areas. However, the ERT reiterates the recommendation in the previous review report that Bulgaria consistently provide enough information in the NIR for a more transparent reporting of the basis and rationale behind AD, EFs, assumptions and methods, in its next annual submission.

2. Key categories

Lime production – CO₂

79. Bulgaria's method for estimating emissions from lime production is consistent with the Revised 1996 IPCC Guidelines and the IPCC good practice guidance. The ERT noted that Bulgaria has increased the transparency of the presentation of information for this category in the NIR, since the previous submission. In addition, Bulgaria followed the ERT's recommendations in the previous report and enhanced explanations of recalculation and its rationale. However, Bulgaria does not present the underlying reasons for the variability of the IEFs, which is probably driven by the variability in calcium and magnesium oxide contents, (e.g. a table similar to table 115 for clinker production would be helpful here). In its NIR, Bulgaria states that it intends to obtain plant-specific data regarding calcium and magnesium oxide contents and the types of lime produced. The ERT recommends that, in its next annual submission, Bulgaria improve the information on calcium and magnesium oxide contents and particularly for the split between high-calcium lime and dolomitic lime.

Other (mineral products) – CO₂

80. Although the discussion of soda ash use in the NIR indicates that no double counting exists between soda ash use and glass production, the NIR simply states that "plant-specific emissions and production data were used based on the data reported by operators under the EU ETS," and "plant-specific EFs were obtained" and the NIR does not clarify how double counting is avoided. The ERT notes that the comments in the NIR seem to imply that all carbonate emissions are included, i.e. including soda ash use. However, according to the previous review report, the plant-specific data include only emissions from limestone and dolomite use. The ERT recommends that Bulgaria verify that the plant-specific data for glass production include only emissions from limestone and dolomite use in order to ensure that double counting is avoided and, clearly indicate this in the NIR, in its next annual submission.

Iron and steel production – CO₂

81. The previous review report included several recommendations for improving Bulgaria's treatment of iron and steel emissions in its inventory. These included minimizing double counting of emissions from iron production in the industrial processes and energy sectors and increasing the transparency of the inventory.

82. The possibility of double counting arose from the use of default EFs from the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (hereinafter referred to as the

2006 IPCC Guidelines) for basic oxygen furnace (BOF) and open hearth furnace (OHF) steel production, which include the use of reducing agents that also serve as energy sources in iron production. In the NIR, Bulgaria indicates that it has recalculated its emission estimates from iron and steel production and has improved transparency in response to the recommendation in the previous review report. However, the information in the NIR is not sufficiently transparent to determine whether the recalculations that have occurred have addressed the double counting issue. In fact, the NIR does not include any discussion of the method used to estimate emissions from BOF and OHF steel making, although BOF accounted for the majority of steel production until 2008. In response to a question raised by the ERT during the review, Bulgaria provided the spreadsheets that it uses to estimate CO₂ emissions from iron and steel production. These spreadsheets indicate that Bulgaria continues to use default EFs for BOF and OHF production from the 2006 IPCC Guidelines. At the same time, the energy section of the NIR states that CO₂ emissions from BOF were attributable to consumption of coke. In its response to questions raised by the ERT during the review, Bulgaria informed that the industrial processes and energy experts had worked with NSI to minimize double counting, but it did not specify which results were achieved and what changes were made to the inventory.

83. Therefore, the ERT reiterates the recommendations in the previous review reports that Bulgaria revise its methodology for estimating emissions from BOF and OHF steel production using the difference between iron and steel carbon contents and that Bulgaria minimize double counting of iron-related emissions between the industrial processes and energy sectors. The ERT also recommends that Bulgaria clearly discuss in its NIR, of its next annual submission, the source of any remaining energy-related CO₂ emissions reported under iron and steel (fuel combustion) and why these do not double count emissions from iron and steel in the industrial processes sector. If Bulgaria chooses to discuss this in the energy section of the NIR, it should include a reference to the discussion in the industrial processes section. Further, the ERT recommends that Bulgaria include a detailed discussion of the method and EFs used to estimate emissions from BOF and OHF steel production and that the Party increase the transparency of the iron and steel discussion generally, in its next annual submission.

Consumption of halocarbons and SF₆ – HFCs, PFCs and SF₆

84. Bulgaria's methods for estimating emissions from air-conditioning and refrigeration equipment are generally in line with IPCC good practice guidance. Bulgaria has collected information on equipment imports and stocks from importers, operators (of large equipment) and service companies. However, it appears that some information is gathered annually (i.e. for equipment with relatively large charge sizes, such as commercial and industrial refrigeration), while other information is gathered less frequently (e.g. imports of domestic air conditioners and refrigerators). Because this information is integral to Bulgaria's inventory of F-gases, the ERT recommends that Bulgaria clearly describe its data-gathering exercises in the overview section of the NIR of its next annual submission, including: the end uses encompassed by each exercise; the information requested and reported under each exercise; and the frequency of each exercise. Where the frequency of data gathering is not annual, the ERT recommends that Bulgaria explain how it extrapolates potential and actual emissions from the most recent date of reporting. The ERT notes that it is not necessary for data to be collected every year for every end use; however, the ERT recommends that Bulgaria plan to collect data at regular intervals.

85. The NIR indicates that EFs have been selected from the 2006 IPCC guidelines so that they represent national circumstances to the extent possible. However, the ERT noted that, depending on the specific end use, Bulgaria's EFs fall within different parts of the range provided in the recent scientific literature: a few are from the high end of the range (commercial air conditioning); several others are from the low end (domestic air

conditioning, commercial refrigeration, motor vehicle air conditioning). In response to a question raised by the ERT during the review, Bulgaria stated that it used a relatively low EF for commercial refrigeration because information from equipment operators and service companies indicated that EFs were in the low end of the range. The ERT recommends that Bulgaria assess whether the usage of low EF is appropriate and report the result in its NIR in the next annual submission.

86. Bulgaria cites studies from Germany and the United Kingdom of Great Britain and Northern Ireland as sources for its EFs for domestic and motor vehicle air conditioning respectively, which are Bulgaria's highest emitting air conditioning and refrigeration end uses. Because emission rates are sensitive to service practices, the rates in Bulgaria may be different from those in other countries; for example, if refrigerant is not routinely recovered when equipment is serviced. The ERT recommends that Bulgaria present country-specific information on emission rates, where available, in the NIR of its next annual submission. In addition, the ERT also recommends that Bulgaria verify that service practices in Bulgaria are similar to those in Germany and the United Kingdom for domestic and motor vehicle air-conditioning equipment. For large and widely distributed equipment sets (e.g. domestic and motor vehicle air conditioning), the ERT recommends that Bulgaria consider checking its estimates of emissions by monitoring bulk imports of the refrigerants used to recharge equipment.

87. Bulgaria quantifies disposal-related emissions only from transport refrigeration because that is the only type of equipment in which HFCs have been used for longer than the equipment lifetime assumed by Bulgaria. The lifetimes used by Bulgaria for other types of air-conditioning and refrigeration equipment are at the upper end of the ranges suggested by the IPCC good practice guidance. Most notable is Bulgaria's use of a lifetime of 20 years for commercial and industrial refrigeration (which are combined in Bulgaria's inventory because the available data do not allow them to be separated). The lifetimes for commercial and industrial refrigeration in the IPCC good practice guidance are 7–10 and 10–20 years, respectively. The ERT recommends that, in its next annual submission, Bulgaria account for the disposal of at least a fraction of the commercial and industrial refrigeration equipment that is 15 or more years old. In addition, the ERT strongly recommends that, based on the equipment lifetimes currently used by Bulgaria, emissions from the decommissioning of domestic refrigeration and mobile and commercial air-conditioning equipment should be reported in the next annual submission.

88. Bulgaria quantifies emissions from both the manufacturing and use of foams. The emissions of HFC-134a from manufacturing are reported for one year only (2008), making up about one quarter of manufacturing emissions for that year. In addition, the previous review report noted that Bulgaria exported approximately 50 per cent of the foams it produced, but this is not reflected in Bulgaria's inventory. The ERT recommends that Bulgaria verify that HFC-134a was used in foam blowing for only one year and that Bulgaria explain, in the NIR of its next annual submission, why this was the case. The ERT also reiterates a recommendation in the previous review report that Bulgaria collect additional data to account for exports of foams in its next annual submission.

89. Bulgaria states that it contacted its sole semiconductor manufacturer and found that this manufacturer did not use F-gases in its production process. The ERT notes semiconductor manufacturing processes usually use F-gases, and recommends that Bulgaria check with this manufacturer the reasons for that situation, e.g. checking regarding the feature sizes of the devices that it makes. (Devices with a feature size above one micron, which are now relatively rare, may be made without using F-gases, but devices with smaller feature sizes are made using F-gases.) The ERT recommends that Bulgaria clarify this issue in its next annual submission.

Solvent and other product use – CO₂

90. Bulgaria's inventory indicates that emissions from solvent and other product use fell by almost a factor of 10 between 1993 and 1994, driven by precipitous decreases in emissions from degreasing and dry cleaning. The NIR explains that this resulted from the decrease in degreasing that accompanied the decrease in the production of iron and steel production during the same period. However, Bulgaria had reported that iron and steel production actually grew during this period. In response to a question raised by the ERT, Bulgaria stated that emissions from degreasing and dry cleaning were probably even higher between 1988 and 1992. However, this does not explain the large drop between 1993 and 1994. The ERT recommends that Bulgaria further explore the reason for the decrease and explain this in its NIR in the next annual submission.

3. Non-key categoriesLimestone and dolomite use – CO₂

91. The CO₂ emissions from limestone and dolomite use was reported as "IE". In response to recommendations in the previous review report, Bulgaria informed the ERT that it attempted to obtain top-down information on limestone and dolomite production, imports and exports, but it has not been able to do so. However, Bulgaria has addressed the double counting between lime production and limestone and dolomite use that was present in the 2010 submission, and it has included a chart in the NIR that describes where emissions from limestone and dolomite use are accounted for in the inventory. The ERT concluded, based on the information in its NIR, that emissions are accounted for under all categories (cement production, lime production, and other (mineral products, glass production, and desulphurization), with the exception of iron and steel production: the section of the NIR on iron and steel production does not include any mention of carbonate use. The ERT recommends that Bulgaria address this, either accounting for any limestone and dolomite use by iron and steel production or explaining that such use does not occur (and has not occurred) in its next annual submission. The ERT also recommends that Bulgaria continue to seek data on limestone and dolomite production, imports and exports so that it can confirm that its inventory for this category is complete.

D. Agriculture**1. Sector overview**

92. In 2009, emissions from the agriculture sector amounted to 6,180.59 Gg CO₂ eq, or 10.4 per cent of total GHG emissions. Since the base year, emissions have decreased by 67.5 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 structural changes transferring land back to private owners. Within the sector, 56.1 per cent of the emissions were from agricultural soils, followed by 21.8 per cent from enteric fermentation, 19.3 per cent from manure management and 1.7 per cent from burning of agricultural residues. The remaining 1.1 per cent were from rice cultivation.

93. The Party has made recalculations for the agriculture sector between the 2010 and 2011 submissions following changes in AD in order to update statistical information. The impact of these recalculations on the agriculture sector is an increase in emissions of 4.7 per cent for 2008. The main recalculations took place in the following categories:

- (a) Increase in emissions from manure management of 371.26 Gg CO₂ eq (or 42.1 per cent);

(b) Decrease in emissions from rice cultivation of 23.07 Gg CO₂ eq (or 35.3 per cent).

94. The ERT noted that Bulgaria had improved the inventory for the 2011 submission and used more detailed methodologies and a greater number of country-specific parameters. However, the NIR and the CRF tables provide only limited and sometimes inconsistent information on the EFs, parameters and estimation processes used. The ERT recommends that Bulgaria solve those issues in its next annual submission. The ERT identified:

(a) Numerous inconsistencies between the CRF tables and the NIR, as already noted in the previous review report (e.g. NIR tables 141 and 165);

(b) Incorrect values in the CRF tables due to transcription errors (e.g. average CH₄ conversion rate (Y_m) in CRF table 4.A, volatile solids (VS) and methane conversion factors (MCFs) for swine in CRF table 4.B(a));

(c) Limited information on the cultivation of histosols and the application of sewage sludge, as already found during the previous review;

(d) Lack of transparency in the documentation on recalculations in the NIR;

(e) Limited information on QA/QC procedures;

(f) Limited documentation of uncertainties.

95. In the follow-up to recommendations from previous review reports Bulgaria had made efforts to recalculate emissions using more detailed methodologies and a larger amount of country-specific data in the 2011 annual submission. For 2008, total emissions from the agriculture sector were 4.7 per cent higher than in the previous submission. The ERT noted that some uncertainty of emission estimates for subcategories were reduced comparing with the previous submission and that the consistency of the time series has improved in comparison with previous submissions. The ERT commends Bulgaria for its progress in enhancing the accuracy of the inventory.

96. The ERT found that the documentation for recalculations is not transparently presented in the NIR. During the review week, Bulgaria provided additional information that supports the rationale for the recalculations it had conducted. The ERT recommends that Bulgaria improve its documentation of recalculations and provide more information on this issue in the category specific chapters of the NIR and CRF table 8(b) in its next annual submission.

97. The ERT noted that Bulgaria has implemented various QA/QC measures, including checklists for general and specific procedures for QA and QC. However, the NIR does not include information on specific QC checks for the agriculture sector. The ERT encourages Bulgaria to include more information on sector-specific QA/QC measures in the NIR.

2. Key categories

Enteric fermentation – CH₄

98. Bulgaria uses a tier 2 approach to estimate CH₄ emissions from cattle and sheep and a tier 1 approach 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 implemented most of the recommendations in the previous review reports, including:

(a) Improving time-series consistency by using disaggregated livestock population data;

(b) Using country-specific estimates of animal weight for cattle, sheep and swine;

(c) Using country-specific estimates for milk yield for cattle and sheep.

99. The IEFs are comparable with the IPCC default values. During the review, Bulgaria provided additional detailed information on methodologies and underlying data. The ERT welcomes the efforts made by the Party and encourages Bulgaria to further improve estimation methods using country-specific information and improve the documentation of information on methodologies and underlying data in the NIR, in its next annual submission.

Manure management – CH₄ and N₂O

100. The values for VS for cattle and sheep were estimated using equation 4.16 from the IPCC good practice guidance. For all other animals VS values are the IPCC default values. Given that swine and poultry are significant sub-categories, the ERT recommends that Bulgaria generate appropriate and country-specific values of VS and MCF for these animal types.

101. Bulgaria used IPCC default values for distribution of AWMS and MCFs. All AWMS are reported under temperate climate conditions except for pasture, range and paddock, which is reported under cool climate. The ERT agreed to this reporting. Bulgaria indicates in the NIR that it will collect more country-specific data to implement higher tier methods. Furthermore, during the review, Bulgaria stated that during the last agrostatistic survey it became clear that the survey alone would not be enough to generate sufficient data on AWMS distribution. Accordingly, another project with the Agrarian University of Plovdiv has been initiated which will be concluded by the end of November 2011. The ERT welcomes these efforts and reiterates the recommendation in the previous review report that Bulgaria improve emission estimates by obtaining more precise data on animal populations by climate zone and the respective distributions of AWMS. The ERT also recommends that Bulgaria report on these recalculations in its next annual submission and provide adequate information in the NIR.

102. Bulgaria used the default values of the IPCC good practice guidance to estimate nitrogen excreted by animal livestock. However, a project between ExEA and the Agrarian University of Plovdiv will provide equations to estimate the nitrogen excretion based on animal weight. Bulgaria indicated that these equations and the respective data will be available by the end of 2011 and will be used for the preparation of the 2012 annual submission. The ERT commends Bulgaria for its initiative to improve the accuracy of the inventory and encourages Bulgaria to implement country-specific data for nitrogen excretion in the next annual submission.

Direct soil emissions – N₂O

103. Bulgaria used the tier 1a and tier 1b approaches from the IPCC good practice guidance to estimate direct emission of N₂O from soils. Most parameters used in the estimation process are the IPCC default values. Bulgaria states in its NIR that a project between ExEA and the Agrarian University of Plovdiv has been initiated and, when finished, will provide more country-specific information regarding emissions from agricultural soils. The ERT recommends that Bulgaria further proceed collecting country-specific data on crop production and implement the respective results in future submissions.

104. The ERT noted that N₂O emissions originating from nitrogen fixation are very low compared with other direct soil emissions (total of direct soil emissions, 6.43 Gg; nitrogen fixation, 0.01 Gg) in the original submission in 2011. During the review week, Bulgaria provided the ERT with further information including a spreadsheet that allowed a thorough assessment of the estimation process. The ERT found an error in the application of equation 4.26 of the IPCC good practice guidance and calculated emissions using the correct

formula. The new emission estimates were 3.45 Gg CO₂ eq higher for the year 2009 and 33.01 Gg CO₂ eq higher for the base year (1988). Bulgaria confirmed the error and expressed its agreement with the new values. This issue was raised in the list of potential problems and further question raised by the ERT, and, on 17 October, Bulgaria submitted a complete set of revised CRF tables for 1988–2009 and KP-LULUCF CRF tables for 2008 and 2009. The ERT concluded that the issue has been solved by the Party by providing new estimates of N₂O emissions from nitrogen-fixing crops using equation 4.26 from the IPCC good practice guidance.

Indirect soil emissions – N₂O

105. Bulgaria estimated indirect N₂O emissions from atmospheric deposition and nitrogen leaching and runoff using the IPCC tier 1a method and default IPCC EFs and parameters. However, the ERT found that more detailed data on ammonia volatilization are available from the Party's submission under the Convention on Long-range Transboundary Air Pollution (CLRTAP) of the United Nations Economic Commission for Europe (UNECE). The ERT reiterates recommendations in the previous review report that Bulgaria consider using country-specific parameters to estimate N₂O emissions from indirect soil emissions.

3. Non-key categories

Field burning of agricultural residues – CH₄ and N₂O

106. Bulgaria estimated CH₄ and N₂O emissions for this category assuming that 10 per cent of the residues were burned on site. Previous review reports recommended that Bulgaria improve the transparency of the AD on crop areas across crop types and reconsider the aforementioned assumption. Furthermore, Bulgaria states in its NIR that projects have already started and will provide country-specific information for field burning of agricultural residues. The ERT commends Bulgaria for its improvement plans and recommends that the Party promote the collection of country-specific data. The ERT also recommends that Bulgaria report on the progress in its next annual submission and provide additional explanation on its methodological choice.

E. Land use, land-use change and forestry

1. Sector overview

107. In 2009, net removals from the LULUCF sector amounted to 11,781.88 Gg CO₂ eq. Since the base year, net removals have decreased by 16.7 per cent. The key driver for the fall in removals is the decrease of removals due to carbon stock changes in forest land remaining forest land. Within the sector, removals of 13,807.79 Gg CO₂ eq were from forest land, followed by emissions of 2,226.99 Gg CO₂ eq from cropland, removals of 786.64 Gg CO₂ eq from grassland and emissions of 390.67 Gg CO₂ eq from settlements. The remaining emissions of 194.89 Gg CO₂ eq were from wetlands.

108. The Party has made recalculations for the LULUCF sector between the 2010 and 2011 submissions following changes in AD in order to update the latest statistical information. The impact of these recalculations on the LULUCF sector is a decrease in net emissions of 5.0 per cent for 2008. The main recalculations took place in a decrease in emissions from wetland of 603.29 Gg CO₂ eq (or 76.9 per cent).

109. Bulgaria reported all mandatory reporting categories in the LULUCF sector and the estimations are generally in line with the IPCC good practice guidance for LULUCF. The recommendations made by the previous review report were generally reflected in the 2011

annual submission through modification of the inventory or preparing future improvement plans. The ERT commends Bulgaria on its significant improvement in the quality and the amount of reporting of LULUCF under the Convention compared with the 2010 annual submission. However, the ERT notes a lack of transparency regarding the underlying information for the selection and estimation of some country-specific AD and parameters. In response to the questions raised by the ERT during the review, the Party provided additional explanations about the way country-specific AD had been constructed. The ERT recommends that Bulgaria improve the quality of information in the NIR in order to improve transparency in its next annual submission.

110. Bulgaria used a combination of several data sources of land for representing land use and land-use changes, with some assumptions to manage the lack of land use data. The ERT notes that the net change of areas converted from a given land use plus the areas converted to the same given land use (the so called in-out balance) should be equal to the change of total area for this certain land use category. However, in cropland and grassland, the Party estimated the area of land-use change to each land use category first, and then the area of each remaining land category was calculated by the total area of each land use minus the area of land-use change to each land category. The total areas and the land-use change areas were independently assessed for these two land use categories, thus the in-out balance and the total area change did not match in each category. The fluctuation of the areas in each category mentioned above resulted in the fluctuation of the area for other land remaining other land, and this fluctuation was not always due to the result of the estimation of land-use change. The ERT notes that the same issue happened in settlements, although the fluctuation of the area for settlements is very small. The ERT recommends that Bulgaria further improve land use representation especially for cropland and grassland ensuring in-out balances.

111. Bulgaria reported the analysis of uncertainty for some elements in forest land for the first time. However, uncertainties for land-use categories other than forest land have not been quantified. Bulgaria stated in the NIR that, in response to the recommendation in the previous review report, it has launched a project, which will be carried out in 2011, to undertake a complete uncertainty analysis for the LULUCF sector. The ERT reiterates the recommendation in the previous review report that Bulgaria include the complete LULUCF sector in its uncertainty analysis for its next annual submission, assessing uncertainties for each LULUCF category.

2. Key categories

Land converted to forest land – CO₂

112. Bulgaria separated the carbon stock in the litter pool from the mineral soil pool, in accordance with the recommendations in the previous review report. However, the ERT notes that part of the explanation in the NIR about the figures of mineral soil pool was inconsistent with that improvement. During the review, the Party confirmed that the properly separated values have been used for the calculations but the description in the NIR had not been updated. The ERT recommends that Bulgaria report the relevant information correctly in the NIR of its next annual submission.

Forest land converted to wetlands, settlements and other land – CO₂

113. Bulgaria estimated the average carbon stock of living biomass in forest land as 45.1 t C/ha and this value was used in the calculation of carbon loss due to the land-use change from forest land to non-forest land for the whole time series. Bulgaria explained during the review that the national forest inventories provides the basis of the average carbons stock of living biomass, which are tree volume stock for the year 1990, 1995, 2000

and 2005. The value 45.1 t C/ha was the average value for these four years. According to data provided by the Party, the ERT notes that the biomass stock per hectare exhibits a continuously increasing trend since 1990 and the ERT considers that the use of the averaged value may cause an overestimation of emissions in the early 1990s and an underestimation of emissions for recent years. The ERT recommends that Bulgaria analyse the adequacy of using the averaged value for the whole time series since the base year and report the results of the justification of this issue in its next annual submission.

114. Bulgaria calculated carbon stock changes in the litter pool due to land-use change from forest to non-forest land use by applying a 20-year transition period, while the default methodology in the IPCC good practice guidance for LULUCF indicates that the relevant carbon is oxidized following the conversion. During the review, Bulgaria informed the ERT that the Party will correct the estimation method in its next annual submission. The ERT recommends that Bulgaria reflect this improvement in its next annual submission.

F. Waste

1. Sector overview

115. In 2009, emissions from the waste sector amounted to 4,755.00 Gg CO₂ eq, or 8.0 per cent of total GHG emissions. Since the base year, emissions have decreased by 30.5 per cent. The key driver for the fall in emissions is a decline in the quantity of municipal solid waste (MSW) sent to landfills. Within the sector, 81.4 per cent of the emissions were from solid waste disposal on land, followed by 17.9 per cent from wastewater handling and 0.7 per cent from waste incineration.

116. The Party has made recalculations for the waste sector between the 2010 and 2011 submissions following changes in AD in order to update the latest statistical information and methodological change. The impact of these recalculations on the waste sector is a decrease in emissions of 52.6 per cent for 2008. The main recalculations took place in the following categories:

(a) Decrease in emissions from solid waste disposal on land of 5,372.44 Gg CO₂ eq (or 57.2 per cent), following the recommendation from the previous review report change in degradable organic carbon (DOC) from 24.9 to 11.6 per cent;

(b) Increase in emissions from waste-water handling of 111.99 Gg CO₂ eq (or 11.1 per cent).

117. Bulgaria has reported all the categories for which there are methodologies in the Revised 1996 IPCC Guidelines and the IPCC good practice guidance including emissions from solid waste disposal on land, wastewater handling and waste incineration for the whole time series.

118. During the review, in response to questions raised by the ERT, Bulgaria has provided information on MSW composition, wastewater management systems, how historical data were generated, how data gaps were filled throughout the time series and how uncertainties of AD and EF_s were derived, that was not included in the NIR. The ERT welcomes this improvement in transparency and recommends that Bulgaria include this information in the NIR of its next annual submission.

2. Key categories

Solid waste disposal on land – CH₄

119. Bulgaria applied the first order decay (FOD) model from the IPCC good practice guidance (tier 2) to estimate CH₄ emissions from solid waste disposal on land. The

generation of historical and missing data on the amount of MSW generated is not transparently documented in the NIR. Bulgaria reported that a single regression method based on population was used to derive historical data for the period 1950–1978. In response to question raised by the ERT during the review, Bulgaria provided more information on the method and showed its adequacy for the national circumstances. The ERT encourages Bulgaria to analyse the possibility of using, in addition to population, the gross domestic product (GDP) to derive historical data. The trend of waste generation rate is not explained. The ERT therefore reiterates the recommendation from the previous review report that the Party explain the trend of waste generation rate.

120. To fill the data gap on the amount of MSW generated between the period 1993–1999, Bulgaria applied simple linear interpolation using data for 1993 and 1999. In response to a recommendation formulated during the review, Bulgaria indicated that the Party will analyse the applicability of interpolation based on drivers such as population and GDP to derive missing data for its next annual submission. The ERT encourages Bulgaria to do so.

121. Bulgaria used default DOC data from the Revised 1996 IPCC Guidelines for Eastern Europe for the period 1950–2001, following a recommendation from the previous review report. For 2002 onwards, Bulgaria used country-specific data for 2002 together with a model based on human settlements and distribution of population therein and revised its DOC values from 24.9 per cent to 11.6 per cent (a decrease of 53.3 per cent), which is a similar order of magnitude to the default data contained in the Revised 1996 IPCC Guidelines. In addition, Bulgaria improved the AD and performed recalculations which resulted in a decrease in CH₄ emissions from landfills by 57.3 per cent in 2008.

122. In response to a question raised by the ERT during the review, Bulgaria provided information that MSW includes some industrial waste with similar composition and sewage sludge. The ERT recommends that Bulgaria include this information in the NIR of its next annual submission.

123. Bulgaria used expert judgement based on the Council directive 1999/31/EC to conclude that all landfills before the year 2000 were unmanaged and distribute landfills from 2000 onwards between managed and unmanaged. In the application of the first order decay model, Bulgaria used default parameters including DOC dissimilated, oxidation factor, fraction of CH₄ in landfill gas, and half life time. The NIR did not provide data on the amount of CH₄ recovered from landfill gas. In response to a question raised by the ERT during the review, Bulgaria indicated that all new managed landfills are equipped with a gas storage system operating as pilot plants. The ERT strongly reiterates the recommendation from the previous review report that Bulgaria include detailed information on estimates of CH₄ recovery from landfill in its next annual submission.

Wastewater handling – CH₄ and N₂O

124. The trend in CH₄ emissions from wastewater handling is decreasing throughout the time series. During the review and in response to a question raised by the ERT, Bulgaria explained that this trend is the consequence of the decline in population and the industrial wastewater production. The method and the parameters used (e.g. biological oxygen demand) are the IPCC default values. During the review, Bulgaria provided information about the wastewater management systems and the distribution of wastewater among those systems, that were not included in the NIR. The ERT recommends that the Party include this information in the NIR of its next annual submission in order to enhance transparency of reporting.

125. In response to recommendations in the previous review report, Bulgaria used for its 2011 submission data on per capita protein consumption from the Food and Agriculture

Organization of the United Nations. The Party has also updated its population data (which decreases between 2008 and 2009) and performed recalculations accordingly. The recalculation resulted in a decrease in N₂O emissions by 40.2 per cent. The method used is the default method from the Revised 1996 IPCC Guidelines.

3. Non-key categories

Waste incineration – CO₂ and N₂O

126. Bulgaria reported CO₂ and N₂O emissions from incineration of clinical and hazardous waste. MSW is not incinerated. The Party has implemented its improvement plan as reported in the previous annual submission by moving from the use of data from NSI to plant-specific data on the amount of incinerated waste for the whole time series. This resulted in a decrease in emissions by only 0.3 per cent in 2008. EFs were from the IPCC good practice guidance.

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

127. Bulgaria submitted estimates for afforestation and reforestation and deforestation activities under Article 3, paragraph 3, of the Kyoto Protocol. The Party did not elect to report on any activities under Article 3, paragraph 4, for the first commitment period. Bulgaria chose commitment period accounting for activities under Article 3, paragraph 3.

128. The information included in the NIR has been improved since the 2010 annual submission. The Party's report generally covered most of the information required in paragraphs 5–9 of the annex to decision 15/CMP.1 in the annual submission except for several elements that are discussed in the following paragraphs.

129. Bulgaria has made recalculations for the KP-LULUCF activities between the 2010 and 2011 submissions following changes in AD because barren area was excluded from the forest land. The impact of these recalculations on each KP-LULUCF activity for 2008 is as follows:

- (a) Increase in removals by afforestation and reforestation of 125.06 Gg CO₂ eq (or 9.2 per cent);
- (b) Decrease in emissions from deforestation of 1.41 Gg CO₂ eq (or 0.5 per cent).

130. The previous review report concluded that Bulgaria could not provide proper information demonstrating that activities under Article 3, paragraph 3, began on or after 1 January 1990 and are directly human induced, in line with the requirement set out in paragraph 8 (a) of the annex to decision 15/CMP.1.

131. In the NIR, Bulgaria stated that it had launched a project for the reassessment of afforestation and reforestation land in response to the recommendation in the previous review report, and the project had found that some of this reported land included a simple expansion of the target research area of forest which did not meet the requirement of "began on or after 1 January 1990". However, Bulgaria could not accurately provide revised estimates for afforestation and reforestation land to fully meet the requirement above in time for the annual submission in 2011, and, therefore, reported the values derived

from the same existing procedure in the 2010 annual submission. The ERT concluded that the reported afforestation and reforestation land in the current version of the annual submission for 2011 includes the area afforested/reforested before 1 January 1990.

132. In the list of the potential problems and further questions, the ERT recommended that, in order to fulfill the reporting requirement set out in paragraph 8(a) of the annex to decision 15/CMP.1, Bulgaria provide the figure of those afforestation and reforestation activities which it can confirm occurred on or after 1 January 1990. The ERT also recommended that Bulgaria provide the data and methodology explaining how the Party concluded that all afforestation and reforestation activities occurred on or after 1 January 1990 and provide a resubmission of the 2011 KP-LULUCF tables if necessary.

133. In response to the list of potential problems and further question raised by the ERT during the review week, Bulgaria stated that the reassessment work had not been completed, but that Bulgaria will give priority to this work in order to report an improved value in its 2012 annual submission and to complete the work by the 2014 annual submission at the latest.

134. The ERT concludes that the figures reported in the Party's 2011 submission for afforestation and reforestation land are not appropriate and that the Party could not demonstrate that the reported afforestation and reforestation began on or after 1 January 1990. However, the ERT notes that Bulgaria provided information on a concrete plan and steps to resolve the problem for reporting in its 2012 submission and for accounting in its 2014 submission. Therefore, the ERT strongly recommends that the Party increase efforts and provide revised estimates in time for its 2014 submission in accordance with the requirements in decision 15/CMP.1.

135. The ERT strongly recommends that, in its next annual submission, the Party report on the progress of this project. For the further steps, the ERT strongly recommends that Bulgaria conduct the following reassessment works for afforestation and reforestation land:

(a) For the 2012 annual submission, Bulgaria should report the number of state forest enterprises (SFE) already reviewed and those reported activities were conducted prior to 1 January 1990. Bulgaria should also report the number of state forest enterprises to be reviewed in the years 2012 and 2013 in order to ensure that this work will be completed by the 2014 annual submission;

(b) For the intermediate years before the work is completed, the ERT further recommends that the Party research whether a correction factor could be developed based on the available information in each year and, if so, to use that factor to report the areas for its submissions in 2012 and 2013;

(c) For the 2014 submission, Bulgaria is strongly recommended to complete the relevant work and ensure that the method and results for the proper assessment of the afforestation and reforestation activities began on or after 1 January 1990 are well documented. This documentation will be highly important for the assessment of the accounting of the afforestation and reforestation activities at the end of the commitment period.

136. In addition, the ERT recommends that Bulgaria ensure the consistency of the area of forest land prior to 1990 in the LULUCF tables for the reporting under the Convention and in the KP-LULUCF reporting tables.

137. The ERT noted that the information relating to paragraph 8(c) of the annex to decision 15/CMP.1 (lands harvested during the first commitment period following afforestation and reforestation on these units of land since 1990) was not provided in the annual submission. The ERT also considered that the information related to paragraph 6(d) (activities under Article 3, paragraphs 3 and 4, for all geographical locations) provided by

the Party in its annual submission did not properly address the relevant reporting requirement. Bulgaria submitted additional explanation and information about the reporting requirements as part of its answer to questions raised by the ERT during the review. The ERT considered that the information provided by Bulgaria was able to meet the reporting requirements and recommends that Bulgaria provide the information on paragraphs 6(d) and 8(c) of the annex to decision 15/CMP.1 in its next annual submission.

138. The NIR reports that a model-based approach will be used to assess the uncertainties of emissions/removals of afforestation/reforestation and deforestation units. The ERT reiterates the recommendation of the previous review report that Bulgaria assess the uncertainty of afforestation/reforestation and deforestation units for its next annual submission, in line with the requirement mentioned in paragraph 5 of the annex to decision 15/CMP.1.

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

Afforestation and reforestation – CO₂

139. Bulgaria stated in its NIR that the natural regeneration of forest on all the abandoned agricultural land in Bulgaria is: subject to human-induced promotion through direct human-induced seeding; subject to the land owner's decision to convert the land to forest land and official administrable procedure; and subject to forest management regulated by the Forest Act, and that this demonstrates that all activities under Article 3, paragraph 3 are directly human-induced. The ERT notes that there are some time lags between the point at which the forest inventory survey take place, the point when administrative information is updated after the land owner's decision and the point of reporting forest area information for the forest fund. The ERT could not clearly identify if the current reporting system captures the increase of forest area after the land owner's decision and that the land which returned to agricultural land is excluded from afforestation and reforestation. Therefore it is not evident to the ERT that the current reporting system captures the increase in forest area after the land owner's decision. The ERT strongly recommends that, in its next annual submission, Bulgaria include transparent information on the identification of areas subjected to afforestation/reforestation land ensuring that only human induced conversions are included (i.e. after the land owner's decision).

140. The ERT noted that the following incorrect information was reported in the NIR for afforestation and reforestation activities: the value of averaged annual increment of living biomass for age class; and the starting year for the application of the second age class value for afforestation and reforestation activities. The ERT reiterates the recommendation made in the previous review report that the Party ensure consistency and accuracy in the estimation process and report correct information in its next annual submission.

141. Bulgaria reported carbon stock change in dead wood as "NO" with information that this pool is not a net source of emissions. The rationale of "not a net source" was that the dead wood in non-forest land prior to the conversion were assumed to be zero and the dead wood in afforestation and reforestation land must only increase. As afforestation and reforestation is a key category, the ERT recommends that Bulgaria, for its next annual submission, provide additional tier 2 estimates as set out in the IPCC good practice guidance for LULUCF, to support checking the validity of the zero assumption for non-forest land, especially for perennial cropland and the existence of significant changes in forest types, disturbance or management regimes in the afforestation and reforestation area, which have the potential to decrease carbon stock during the first commitment period.

Deforestation – CO₂

142. Carbon stock change in litter due to deforestation was estimated using a 20-year transition period. However, the methodology for calculating carbon stock change in litter provided in the IPCC good practice guidance for LULUCF is that, in the case of deforestation, all the litter pool is oxidized following the land conversion; thus all loss of litter pools should be estimated as emissions in the year the deforestation occurred. The ERT recommends that the Party modify the calculation of carbon stock change in litter in line with the IPCC good practice guidance for LULUCF in its next annual submission.

2. Information on Kyoto Protocol unitsStandard electronic format and reports from the national registry

143. Bulgaria has reported information on its accounting of Kyoto Protocol units in the required SEF tables, as required by decisions 15/CMP.1 and 14/CMP.1. The ERT took note of the findings and recommendations included in the SIAR on the SEF tables and the SEF comparison report.⁶ 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.

144. Information on the accounting of Kyoto Protocol units has been prepared and reported in accordance with chapter I.E of the annex to decision 15/CMP.1, and reported in accordance with decision 14/CMP.1 using the SEF tables. This information is consistent with that contained in the national registry and with the records of the international transaction log (ITL) and the clean development mechanism registry and meets the requirements set out in paragraph 88(a-j) of the annex to decision 22/CMP.1. The transactions of Kyoto Protocol units initiated by the national registry are in accordance with the requirements of the annex to decision 5/CMP.1 and the annex to decision 13/CMP.1.

National registry

145. 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 the following problem: the national registry has not fulfilled the requirements regarding the public availability of information in accordance with section II.E of the annex to decisions 13/CMP.1. The ERT recommends that Bulgaria include:

- (a) In the account information section:
 - (i) An index with numerical identifiers for account types;
 - (ii) An index with numerical identifiers for commitment period information in the account information section;
 - (iii) A statement regarding the confidentiality of holding and transaction information;

⁶ 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.

- (iv) An identification of legal entities authorized by the Party.
- (b) On the MoEW's new website:
 - (i) The years in which emission reduction units have been issued as a result of the Article 6 projects;
 - (ii) Downloadable electronic versions of all publicly available documentation relating to Article 6 projects.

Calculation of the commitment period reserve

146. Bulgaria has reported its commitment period reserve in its 2011 annual submission. The Party reported its commitment period reserve to be 29,595,155 t CO₂ eq based on the national emissions in its most recently reviewed inventory (59,493.04 Gg CO₂ eq). The ERT disagrees with this figure. Responding to the list of potential problems and further questions formulated by the ERT, Bulgaria reported that its revised commitment period reserve is 24,748,247 t CO₂ eq, based on the national emissions in its revised 2009 inventory. The ERT disagrees with this figure; its calculation of the Party's commitment period reserve is 297,482,467 t CO₂ eq, based on the national emissions in the 2009 inventory (59,496.49 Gg CO₂ eq). The ERT recommends that Bulgaria correctly calculate and report its commitment period reserve in its next annual submission.

3. Changes to the national system

147. Bulgaria reported that there are no changes in its national system since the previous annual submission. The ERT concluded that the Party's national system continues to be in accordance with the requirements of national systems outlined in decision 19/CMP.1.

4. Changes to the national registry

148. Bulgaria reported that there are changes in its national registry since the previous annual submission. The ERT concluded that security measures to prevent unauthorized manipulations and to prevent operator error in order to undo the eligibility suspension executed on 29 June 2010. In addition, the Party indicated that the Enforcement Branch of the Compliance Committee concluded that the question of implementation put before the branch was resolved on 4 February 2011. The SIAR did not identify any problem associated with these changes. Acknowledging the above and based on the finding of the SIAR, the ERT concluded that the Party's national system continues to be in accordance with the requirements of national systems outlined in decision 19/CMP.1.

149. No discrepancy has been identified by the ITL and no non-replacement has occurred. However, the ERT reiterates a recommendation of the SIAR that Bulgaria make available on the registry's public website, the information required in accordance with paragraphs 44–48 of the annex to decision 13/CMP.1.

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

150. 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 reported information in the 2011 submission is identical to that reported in the 2010 submission and is considered complete and transparent. The ERT recommends that the Party, in its next annual submission, report 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.

III. Conclusions and recommendations

151. Bulgaria made its annual submission on 14 April 2011 and resubmitted the CRF tables under the Kyoto Protocol and the KP-LULUCF CRF tables on 17 October 2011. 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, paragraph 3 of the Kyoto Protocol, Kyoto Protocol units, changes to 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.

152. The ERT concludes that the inventory submission of Bulgaria has been prepared and generally reported in accordance with “Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual inventories”. The inventory submission is complete and the Party has submitted a complete set of CRF tables for the years 1988–2009 and an NIR; these are complete in terms of geographical coverage, years and sectors, as well as generally complete in terms of categories and gases.

153. 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, Bulgaria could not provide sufficient information to fulfil the requirement set out in paragraph 8(a) of the annex to decision 15/CMP.1.

154. The Party’s inventory is generally in line with the Revised 1996 IPCC Guidelines, the IPCC good practice guidance and the IPCC good practice guidance for LULUCF. The ERT noted that there is room for improvement regarding transparency in relation to improved documentation of category-level methodologies, AD, EFs and other parameters used to estimate emissions, references to sources of AD and the rationale for selecting a methodology; and the use of EU ETS data in the inventory demonstrating how its use is in line with the IPCC good practice guidance.

155. The Party has made recalculations for the inventory between the 2010 and 2011 submissions in response to the 2010 annual review report, and following changes in AD. The impact of these recalculations on the national totals is an decrease in emissions of 8.2 per cent for 2008. The main recalculations took place in the following sectors/categories:

- (a) Decrease in emissions from the energy sector of 1,026.28 Gg CO₂ eq (or 1.9 per cent);
- (b) Decrease in emissions from the waste sector of 5,484.57 Gg CO₂ eq (or 52.6 per cent).

156. The 2011 submission on KP-LULUCF was generally prepared and reported in line with the requirements of paragraphs 5–9 of the annex to decision 15/CMP.1. However, the ERT noted that Bulgaria still faces difficulties in providing enough information which demonstrates that activities under Article 3, paragraph 3, began on or after 1 January 1990 and are directly human induced, in line with the requirement set out in paragraph 8(a) of the annex to decision 15/CMP.1. Nevertheless, Bulgaria provided information on a concrete plan and steps to resolve the problem for reporting in its 2012 annual submission and for accounting in the 2014 submission. The ERT strongly recommends that the Party ensure that the reporting KP-LULUCF activities meets the reporting requirement in decision 15/CMP.1 and the accounting requirement in decision 16/CMP.1 in its next annual submission.

157. The Party has made recalculations for the KP-LULUCF activities between the 2010 and 2011 submissions following changes in AD because barren area was excluded from the forest land. The impact of these recalculations on each KP-LULUCF activity for 2008 is as follows:

- (a) Increase in removals by afforestation and reforestation of 125.06 Gg CO₂ eq (or 9.2 per cent);
- (b) Decrease in emissions from deforestation of 1.41 Gg CO₂ eq (or 0.5 per cent).

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

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

160. 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.

161. Bulgaria has reported the information requested in chapter I.H of the annex to decision 15/CMP.1, "Minimization of adverse impacts in accordance with Article 3, paragraph 14" as part of its 2011 annual submission. The information is considered complete and transparent; however the Party did not provide any information if there were any changes compared with the previous annual submission.

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

- (a) Continue to further strengthen the national system by improving the technical competence of the inventory team and undertaking the signing of contracts with external consultants in due course (see paras. 13–19, 27, and 34);
- (b) Improve the transparency of the inventory regarding documentation of methods, data, recalculations and uncertainty estimates (see paras. 54, and 78).
- (c) Transparency of the underlying information for the selection and estimation of country-specific data (see paras. 69, 79, 80, and 83);
- (d) Transparency of the procedures used for expert judgment (see para. 123);
- (e) Include the information on data obtained through EU-ETS (see para. 53);
- (f) Improve consistency in relation to addressing discrepancies between the NIR and the CRF tables (see para. 76);
- (g) Make available on the registry's public website the information required in accordance with paragraphs 44–48 of the annex to decisions 13/CMP.1 (see para. 145).

163. In the course of the review, the ERT formulated a number of recommendations relating to the transparency and sector-specific recommendations in regards to methods, AD and EFs of the information presented in Bulgaria's annual submission. The key recommendations are that Bulgaria:

- (a) Transparency of the underlying reasons for certain emission trends (e.g. fuel combustion from residential (see para. 67), CO₂ from solvent and other product use (see para. 90));
- (b) Describe its data-gathering exercised for F-gases in the NIR (see para. 84);

- (c) Report the revised estimation of emission from nitrogen fixation crops (see para. 104);
- (d) Implement its plans to assess the uncertainties for the LULUCF sector and include them in the overall inventory uncertainty analysis (see para. 111);
- (e) Prepare and report information on afforestation and reforestation and deforestation in line with the requirements in paragraph 8(a) of the annex to decision 15/CMP.1 in relation to demonstrating that afforestation/reforestation and deforestation activities began on or after 1 January 1990 and human induced? (see para. 134);
- (f) Make efforts to further complete and improve the reporting of information on activities under Article 3, paragraph 3, of the Kyoto Protocol (see paras. 135–142).

IV. Questions of implementation

164. 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 2011. Available at <http://unfccc.int/resource/docs/2011/asr/bgr.pdf>.

Synthesis and assessment report on the greenhouse gas inventories submitted in 2011. Available at <http://unfccc.int/resource/webdocs/sai/2011.pdf>.

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

UNFCCC. *Standard Independent Assessment Report*, Parts I and II. Available at http://unfccc.int/kyoto_protocol/registry_systems/independent_assessment_reports/items/4061.php.

B. Additional information provided by the Party

Responses to questions during the review were received from Ms. Detelina Petrova (Ministry of Environment and Water), including additional material on the methodology and assumptions used.

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.

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.

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.

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

Annex II

Acronyms and abbreviations

AD	activity data
AWMS	animal waste management systems
BOF	basic oxygen furnace
CH ₄	methane
CO ₂	carbon dioxide
CO ₂ eq	carbon dioxide equivalent
CRF	common reporting format
DOC	degradable organic carbon
EF	emission factor
ERT	expert review team
EU	European Union
EU ETS	European Union Emission Trading Scheme
F-gas	fluorinated gas
FOD	first order decay
GDP	gross domestic product
GHG	greenhouse gas; unless indicated otherwise, GHG emissions are the sum of CO ₂ , CH ₄ , N ₂ O, HFCs, PFCs and SF ₆ without GHG emissions and removals from LULUCF
GJ	gigajoule (1 GJ = 10 ⁹ joule)
HFCs	hydrofluorocarbons
ITL	international transaction log
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
kg	kilogram (1 kg = 1,000 grams)
IE	included elsewhere
IEF	implied emission factors
LULUCF	land use, land-use change and forestry
MCF	methane conversion factor
MSW	municipal solid waste
NA	not applicable
NE	not estimated
NCV	net calorific values
NO	not occurring
N ₂ O	nitrous oxide
NIR	national inventory report
PFCs	perfluorocarbons
QA/QC	quality assurance/quality control
SEF	standard electronic format
SF ₆	sulphur hexafluoride
SIAR	standard independent assessment report
TJ	terajoule (1 TJ = 10 ¹² joule)
VS	volatile solids
UNFCCC	United Nations Framework Convention on Climate Change
Ym	average CH ₄ conversion rate