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## **Report on the individual review of the annual submission of Bulgaria submitted in 2022\***

**Note by the expert review team**

### *Summary*

Each Party included in Annex I to the Convention must submit an annual inventory of emissions and removals of greenhouse gases for all years from the base year (or period) to two years before the inventory due date (decision 24/CP.19). Parties included in Annex I to the Convention that are Parties to the Kyoto Protocol are also required to report supplementary information under Article 7, paragraph 1, of the Kyoto Protocol with the inventory submission due under the Convention. This report presents the results of the individual review of the 2022 annual submission of Bulgaria, conducted by an expert review team in accordance with the “Guidelines for review under Article 8 of the Kyoto Protocol”. The review took place from 17 to 22 October 2022 in Bonn.

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\* In the symbol for this document, 2022 refers to the year in which the inventory was submitted, not to the year of publication.



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## Abbreviations and acronyms

2006 IPCC Guidelines	<i>2006 IPCC Guidelines for National Greenhouse Gas Inventories</i>
2019 Refinement to the 2006 IPCC Guidelines	<i>2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories</i>
AAU	assigned amount unit
AD	activity data
Annex A source	source category included in Annex A to the Kyoto Protocol
AR	afforestation and reforestation
Article 8 review guidelines	“Guidelines for review under Article 8 of the Kyoto Protocol”
C	carbon
CaO	calcium oxide
CER	certified emission reduction
CH <sub>4</sub>	methane
CM	cropland management
CO <sub>2</sub>	carbon dioxide
CO <sub>2</sub> eq	carbon dioxide equivalent
Convention reporting adherence	adherence to the “Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual greenhouse gas inventories”
COPERT	software tool for calculating road transport emissions
CPR	commitment period reserve
CRF	common reporting format
CSC	carbon stock change
DE	digestible energy
EEA	European Environment Agency
EF	emission factor
EMEP	Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe
EMEP/EEA guidebook	<i>EMEP/EEA air pollutant emission inventory guidebook</i>
ERT	expert review team
ERU	emission reduction unit
EU	European Union
FM	forest management
FMRL	forest management reference level
FMRL <sub>corr</sub>	forest management reference level technical correction
Frac <sub>GASF</sub>	fraction of synthetic nitrogen fertilizer applied to soils that volatilizes as nitrogen oxides and ammonia
GE	gross energy intake
GHG	greenhouse gas
GM	grazing land management
HFC	hydrofluorocarbon
IE	included elsewhere
IEF	implied emission factor
IPCC	Intergovernmental Panel on Climate Change
IPPU	industrial processes and product use
KP reporting adherence	adherence to the reporting guidelines under Article 7, paragraph 1, of the Kyoto Protocol
KP-LULUCF	activities under Article 3, paragraphs 3–4, of the Kyoto Protocol

Kyoto Protocol Supplement	2013 Revised Supplementary Methods and Good Practice Guidance Arising from the Kyoto Protocol
LULUCF	land use, land-use change and forestry
MgO	magnesium oxide
MMS	manure management system(s)
N	nitrogen
N <sub>2</sub> O	nitrous oxide
NA	not applicable
NE	not estimated
Nex	nitrogen excretion
NF <sub>3</sub>	nitrogen trifluoride
NIR	national inventory report
NO	not occurring
PFC	perfluorocarbon
QA/QC	quality assurance/quality control
RMU	removal unit
RV	revegetation
SEF	standard electronic format
SF <sub>6</sub>	sulfur hexafluoride
SIAR	standard independent assessment report
SOC	soil organic carbon
SOC <sub>REF</sub>	reference soil organic carbon stocks
UNFCCC Annex I inventory reporting guidelines	“Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual greenhouse gas inventories”
UNFCCC review guidelines	“Guidelines for the technical review of information reported under the Convention related to greenhouse gas inventories, biennial reports and national communications by Parties included in Annex I to the Convention”
VS	volatile solid(s)
WDR	wetland drainage and rewetting
Wetlands Supplement	<i>2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands</i>

## I. Introduction

1. This report covers the review of the 2022 annual submission of Bulgaria, organized by the secretariat in accordance with the Article 8 review guidelines (adopted by decision 22/CMP.1 and revised by decision 4/CMP.11). In accordance with the Article 8 review guidelines, this review process also encompasses the review under the Convention as described in the UNFCCC review guidelines, particularly in part III thereof, namely the “UNFCCC guidelines for the technical review of greenhouse gas inventories from Parties included in Annex I to the Convention” (annex to decision 13/CP.20). The review took place from 17 to 22 October 2022 in Bonn, and was coordinated by Simon Wear, Javier Hanna Figueroa and Gopal Joshi (secretariat). Table 1 provides information on the composition of the ERT that conducted the review for Bulgaria.

Table 1

### Composition of the expert review team that conducted the review for Bulgaria

<i>Area of expertise</i>	<i>Name</i>	<i>Party</i>
Generalist	Mauro Santos	Brazil
	Sina Wartmann	Germany
Energy	Nicholas Giles	Australia
	Lungile Manzini	South Africa
	Gherghita Nicodim	Romania
	Luis de la Torre	Peru
IPPU	Niculina Mihaela Balanescu	Romania
	David Kuntze	Germany
Agriculture	Abdulkadir Bektas	Türkiye
	Christopher Dore	United Kingdom
LULUCF and KP-LULUCF	Rosie Brook	United Kingdom
	Esther Mertens	Belgium
	Eray Özdemir	Türkiye
	Miguel Angel Taboada	Argentina
Waste	Juliana Bempah	Ghana
	Gustavo Mozzer	Brazil
Lead reviewers	David Kuntze	
	Mauro Santos	

2. The basis of the findings in this report is the assessment by the ERT of the Party’s 2022 annual submission in accordance with the UNFCCC review guidelines and the Article 8 review guidelines.

3. The ERT has made recommendations that Bulgaria resolve identified findings, including issues<sup>1</sup> designated as problems.<sup>2</sup> Other findings, and, if applicable, the encouragements of the ERT to Bulgaria to resolve related issues, are also included in this report.

4. 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.

5. Annex I presents the annual GHG emissions of Bulgaria, including totals excluding and including LULUCF, indirect CO<sub>2</sub> emissions, and emissions by gas and by sector, and

<sup>1</sup> Issues are defined in decision 13/CP.20, annex, para. 81.

<sup>2</sup> Problems are defined in decision 22/CMP.1, annex, paras. 68–69, as revised by decision 4/CMP.11.

contains background data on emissions and removals from KP-LULUCF, if elected by the Party, by gas, sector and activity.

6. Information to be included in the compilation and accounting database can be found in annex II.

## II. Summary and general assessment of the Party’s 2022 annual submission

7. Table 2 provides the assessment by the ERT of the Party’s 2022 annual submission with respect to the tasks undertaken during the review. Further information on the issues identified, as well as additional findings, may be found in tables 3 and 5.

Table 2

### Summary of review results and general assessment of the 2022 annual submission of Bulgaria

<i>Assessment</i>	<i>Issue/problem ID#(s) in table 3 or 5<sup>a</sup></i>
Dates of submission	Original submission: NIR, 15 April 2022; CRF tables (version 1), 15 April 2022; SEF tables, 15 April 2022 Revised submission: SEF tables, 18 May 2022 Unless otherwise specified, values from the most recent submission are included in this report
Review format	Centralized
Application of the requirements of the UNFCCC	Have any issues been identified in the following areas:
Annex I inventory reporting guidelines and the Wetlands Supplement (if applicable)	(a) Identification of key categories? No (b) Selection and use of methodologies and assumptions? Yes I.17, L.5, L.7, L.11, L.16 (c) Development and selection of EFs? Yes E.5 (d) Collection and selection of AD? Yes I.3, A.16, L.9, L.15, L.18 (e) Reporting of recalculations? No (f) Reporting of a consistent time series? Yes I.17 (g) Reporting of uncertainties, including methodologies? Yes G.11, G.12 (h) QA/QC? QA/QC procedures were assessed in the context of the national system (see supplementary information under the Kyoto Protocol below) (i) Missing categories, or completeness? <sup>b</sup> Yes I.14, A.15, A.17, W.8, L.18 (j) Application of corrections to the inventory? No
Significance threshold	For categories reported as insignificant, has the Party provided sufficient information showing that the likely level of emissions meets the criteria in paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines? NA
Description of trends	Did the ERT conclude that the description in the NIR of the trends for the different gases and sectors is reasonable? Yes
Supplementary information under the Kyoto Protocol	Have any issues been identified related to the following aspects of the national system: (a) Overall organization of the national system, including the effectiveness and reliability of the institutional, procedural and legal arrangements? No (b) Performance of the national system functions? No Have any issues been identified related to the national registry: (a) Overall functioning of the national registry? No

Assessment	Issue/problem ID#(s) in table 3 or 5 <sup>a</sup>
(b) Performance of the functions of the national registry and the adherence to technical standards for data exchange?	No
Have any issues been identified related to the reporting of information on AAUs, CERs, ERUs and RMUs and on discrepancies in accordance with decision 15/CMP.1, annex, chapter I.E, in conjunction with decision 3/CMP.11, taking into consideration any findings or recommendations contained in the SIAR?	No
Have any issues been identified in matters related to Article 3, paragraph 14, of the Kyoto Protocol, specifically problems related to the transparency, completeness or timeliness of the reporting on the Party's activities related to the priority actions listed in decision 15/CMP.1, annex, paragraph 24, in conjunction with decision 3/CMP.11, including any changes since the previous annual submission?	Yes G.1
Have any issues been identified related to the following reporting requirements for KP-LULUCF:	
(a) Reporting requirements of decision 2/CMP.8, annex II, paragraphs 1–5?	No
(b) Demonstration of methodological consistency between the reference level and reporting on FM in accordance with decision 2/CMP.7, annex, paragraph 14?	Yes KL.9
(c) Reporting requirements of decision 6/CMP.9?	No
(d) Country-specific information to support provisions for natural disturbances in accordance with decision 2/CMP.7, annex, paragraphs 33–34?	No
CPR	Was the CPR reported in accordance with decision 18/CP.7, annex; decision 11/CMP.1, annex; and decision 1/CMP.8, paragraph 18? Yes
Adjustments	Has the ERT applied any adjustments under Article 5, paragraph 2, of the Kyoto Protocol? No
	Has the Party submitted a revised estimate to replace a previously applied adjustment? NA
Response from the Party during the review	Has the Party provided the ERT with responses to the questions raised, including the data and information necessary for assessing conformity with the UNFCCC Annex I inventory reporting guidelines and any further guidance adopted by the Conference of the Parties? Yes
Recommendation for an exceptional in-country review	On the basis of the issues identified, does the ERT recommend that the next review be conducted as an in-country review? No
Questions of implementation	Did the ERT list any questions of implementation? No

<sup>a</sup> Further information on the issues identified, as well as additional findings, may be found in tables 3 and 5.

<sup>b</sup> Missing categories for which methods are provided in the 2006 IPCC Guidelines may affect completeness and are listed in annex III.

### III. Status of implementation of recommendations included in the previous review report

8. Table 3 compiles the recommendations from previous review reports that were included in the most recent previous review report, published on 26 August 2021,<sup>3</sup> and had not been resolved by the time of publication of the report on the review of the Party's 2020 annual submission. The ERT has specified whether it believes the Party had resolved, was addressing or had not resolved each issue or problem by the time of publication of this review report and has provided the rationale for its determination, which takes into consideration the publication date of the most recent previous review report and national circumstances.

Table 3  
Status of implementation of recommendations included in the previous review report for Bulgaria

<i>ID#</i>	<i>Issue/problem classification<sup>a, b</sup></i>	<i>Recommendation from previous review report</i>	<i>ERT assessment and rationale</i>
General			
G.1	Article 3.14 (G.1, 2020) (G.4, 2018) KP reporting adherence	Provide information on any changes in the reporting of the minimization of adverse impacts in accordance with Article 3, paragraph 14, of the Kyoto Protocol.	Not resolved. The Party reported in its NIR (section 15, pp.462–463) the same information it has reported since the 2018 submission, with no explicit information on the changes. During the review, the Party acknowledged that this remained an issue. The ERT considers that the recommendation has not yet been addressed because the Party has not yet explicitly demonstrated in the NIR that no changes were made in its reporting of the minimization of adverse impacts. The ERT concludes that this potential problem of a mandatory nature does not influence the Party's ability to fulfil its commitments for the second commitment period of the Kyoto Protocol, and therefore this issue was not included in the list of potential problems and further questions raised.
G.2	CPR (G.12, 2020) Convention reporting adherence	Update the information in the NIR to reflect correctly which submission and inventory year was used to calculate the CPR.	Resolved. The Party reported in its NIR (section 12.5, pp.455–456) that it compared 90 per cent of its assigned amount (0.9 x 222,945,983 t CO <sub>2</sub> eq = 200,651,385 t CO <sub>2</sub> eq) with the total emissions in its most recently reviewed inventory (emission level in 2020 without LULUCF including indirect CO <sub>2</sub> emissions) times eight (8 x 49,185,623 t CO <sub>2</sub> eq = 393,484,985 t CO <sub>2</sub> eq); the lower of the two values is 200,651,385 t CO <sub>2</sub> eq, which, in accordance with paragraph 6 of the annex to decision 11/CMP.1, in conjunction with decision 1/CMP.8, should be used as the Party's CPR.
G.3	CRF tables (G.2, 2020) (G.5, 2018) Comparability	Complete CRF table 9 (information on notation keys) using CRF Reporter.	Not resolved. The Party reported an empty CRF table 9. During the review, the Party explained that this was due to technical issues with CRF Reporter. The ERT considers that the recommendation has not yet been addressed because the Party has not yet correctly filled CRF table 9 using CRF Reporter, as other Parties have done.

<sup>3</sup> FCCC/ARR/2020/BGR. The ERT notes that the report on the individual inventory review of Bulgaria's 2021 annual submission has not been published yet owing to insufficient funding for the review process. As a result, the latest previously published annual review report reflects the findings of the review of the Party's 2020 annual submission.



<i>ID#</i>	<i>Issue/problem classification<sup>a, b</sup></i>	<i>Recommendation from previous review report</i>	<i>ERT assessment and rationale</i>
G.4	CRF tables (G.13, 2020) Comparability	Report “NE” for indirect CO <sub>2</sub> emissions for relevant categories if no emissions are estimated.	Addressing. The Party reported “NO” in CRF table 6 for indirect CO <sub>2</sub> emissions. However, it reported CO <sub>2</sub> emissions from solvent use under category 2.D.3.b. According to the NIR (section 4.5.4.1, p.221), these emissions come from the oxidation in the atmosphere of the non-methane volatile organic compound emissions, meaning that Bulgaria is calculating indirect CO <sub>2</sub> emissions.  In response to questions from the ERT, the Party agreed that these emissions were incorrectly reported as direct emissions and will correct this in the next annual submission.
G.5	Key category analysis (G.4, 2020) (G.7, 2018) Convention reporting adherence	Include in the NIR the summary table for key categories identified for the latest reported year (by level and trend) (e.g. in section 1.5 of the NIR).	Addressing. The Party reported in its NIR (annex 1, pp.466–488) tables listing identified key categories. However, a summary table was not included in the NIR. During the review, the Party provided the ERT with the summary table, which will be included in the next annual submission.
G.6	NIR (G.5, 2020) (G.2, 2018) (G.5, 2016) (G.5, 2015) Transparency	Include all references and sources of information used in the NIR, in line with decision 24/CP.19, annex I, paragraph 50.	Resolved. The Party reported references throughout its NIR (e.g. section 4.7.7, p.245; section 3.3.8.8, p.81; section 3.3.12.3.4, p.124; section 5.5.2.2.1, p.281; and section 6.1.5, p.299). During the review, the Party clarified that where references were available, they were given in the sections where the information is mentioned. The ERT understands that decision 24/CP.19, annex I, paragraph 50, does not mention a separate section for references, and therefore the issue is considered resolved.
G.7	QA/QC and verification (G.6, 2020) (G.3, 2018) (G.4, 2016) (G.4, 2015) Transparency	Clearly indicate in chapter 1 of the NIR that category-specific QA/QC checks are applied for all categories of the inventory and discuss in the corresponding sectoral chapters only the additional QA/QC checks that are done for certain categories.	Resolved. The Party reported in its NIR (section 1.3.1, p.42) that the QA/QC manager prepares a plan for the implementation of QA/QC activities, which includes a checklist for all specific QA/QC procedures. Furthermore, additional QA/QC checks are included in several sectoral chapters. The ERT concludes that the Party’s reporting of QA/QC activities is sufficient.
G.8	QA/QC and verification (G.7, 2020) (G.8, 2018) Convention reporting adherence	Revise the checklist for QC activities and strengthen QA/QC procedures to avoid inconsistencies between the NIR and CRF tables.	Resolved. No information was reported in the NIR on strengthening QA/QC procedures. During the review, the Party clarified that the recommendation was addressed. The ERT considers this broad recommendation resolved.
G.9	QA/QC and verification (G.8, 2020) (G.8, 2018) Convention reporting adherence	Allocate sufficient time and human resources to the final stages of the inventory compilation process in which cross-sectoral work occurs to enhance the QC procedures (so that inconsistencies are avoided).	Resolved. The Party allocated an external consultant to the LULUCF sector (NIR table 6, section 1.3.1, p.44). During the review, the Party explained that the extra human resources allowed more time to be spent in avoiding inconsistencies in the 2022 submission, noting that it will continue to improve the quality of the national inventory.
G.10	QA/QC and verification (G.9, 2020) (G8, 2018) Convention reporting adherence	Document in the NIR any updated QA/QC procedures implemented to avoid inconsistencies between the NIR and CRF tables.	Resolved. The Party allocated an external consultant to the LULUCF sector, as described in ID# G.9 above. During the review, the Party explained that the recommended QA/QC procedures have been implemented and are described in the respective sections of the NIR.

<i>ID#</i>	<i>Issue/problem classification<sup>a, b</sup></i>	<i>Recommendation from previous review report</i>	<i>ERT assessment and rationale</i>
G.11	Uncertainty analysis (G.10, 2020) (G.9, 2018) Transparency	Explain the reasons for the difference in the calculated uncertainty estimates between submissions.	Not resolved. The Party did not provide in its NIR an explanation for the difference in the calculated uncertainty estimates between submissions. During the review, the Party provided spreadsheets showing uncertainty assessments, with and without the LULUCF sector, for the 2021 and 2022 submissions. The ERT noted that the overall uncertainty including LULUCF increased from 25.5 per cent to 53.5 per cent between the 2021 submission and the 2022 submission.
Energy			
E.1	1.A.1.c Manufacture of solid fuels and other energy industries – CO <sub>2</sub> , CH <sub>4</sub> and N <sub>2</sub> O (E.4, 2020) (E.15, 2018) Comparability	Report emissions from fuel combusted during coal mining operations under category 1.A.1.c in line with the 2006 IPCC Guidelines (chap. 2, table 2.1).	Resolved. The Party reported in NIR table 42 (section 3.3.10.3, p.93) and CRF table 1.A(a)s1 emissions from fuel combusted during coal mining operations under category 1.A.1.c for the complete time series, 1988–2020.
E.2	1.A.3.b Road transportation – liquid fuels – CO <sub>2</sub> (E.5, 2020) (E.5, 2018) (E.3, 2016) (E.3, 2015) (E.28, 2014) Accuracy	Conduct a tier 2 estimation of CO <sub>2</sub> emissions from gasoline using country-specific EFs (CO <sub>2</sub> emission estimates resulting from the COPERT model may serve to cross-check the tier 2 estimates).	Resolved. The Party reported in its NIR (section 3.3.12.3.4, pp.123–124) that emissions from road transport including CO <sub>2</sub> were calculated using the COPERT model version 5.5.1 corresponding to a tier 2 methodology. The country-specific technology-based EFs were derived for road transport using parameters such as the fuel standards used in the country, characteristics of the fleet, subsectors, temperatures, average daily trip distance and other default parameters. The specifications for liquid fuels were supplied by Lukoil Neftohim Burgas (Bulgaria's dominant supplier of oil products in the country) and the State Agency for Meteorological and Technical Surveillance. The fuels supplied to the market were sampled and measured in an accredited laboratory and the resulting information analysed using the COPERT model. The fuels comply with EU quality standards and include imports from neighbouring countries. Values are representative of comparable countries. The COPERT model considers all these circumstances to compute the best estimates and has the facility to calibrate values. For previous years, these data were estimated using surrogate data from various sources to complete the gaps, supplemented by expert judgment. The average daily trip distance and speeds were based on a study by Samaras and Zachariadis (2001) and geographic information system analysis using BGmaps ( <a href="http://www.bgmaps.com">www.bgmaps.com</a> ). The Reid vapour pressure of fuels was estimated using legal market references and market averages of specific years. After benchmarking with European neighbours, Bulgaria adopted the driving share split for Slovakia.
E.3	1.A.3.b Road transportation – liquid fuels – CO <sub>2</sub> (E.6, 2020) (E.6, 2018) (E.10, 2016) (E.10, 2015) Accuracy	Provide CO <sub>2</sub> emission estimates in accordance with the 2006 IPCC Guidelines by using country-specific EFs for the used liquid fuels, as category 1.A.3.b (road transportation) is a key category for CO <sub>2</sub> emissions.	Resolved. The Party provided in its NIR (p.124) an explanation of the market circumstances of the country and that it had used data from the national fuel supplier Lukoil Neftohim Burgas to elaborate values for 2006–2020 along with previous values based on estimates. Since 2004 only unleaded gasoline has been sold in the country. NIR table 84 (section 3.3.12.3.5, p.127) shows the CO <sub>2</sub> emission estimates for gasoline, diesel and liquefied petroleum gas. Information is provided in the related text on how the data

ID#	Issue/problem classification <sup>a, b</sup>	Recommendation from previous review report	ERT assessment and rationale
E.4	1.B.1.a Coal mining and handling – CH <sub>4</sub> (E.7, 2020) (E.8, 2018) (E.12, 2016) (E.12, 2015) Accuracy	Clarify which type of coal was used as AD for the estimates across the time series and, if the Party used the amount of saleable coal as AD, estimate the fugitive emissions from mining activities by using the entire quantity of raw coal material, in accordance with the 2006 IPCC Guidelines.	were treated by type and by supplier, and the standards of local versus imported liquid fuels in Bulgaria. A net calorific value methodology was used for the estimates.  Resolved. The Party reported in its NIR (section 3.4.1, pp.148–149) on the status of the coal mines with historical information on emissions. Detailed information on the past and current state of all abandoned mines is presented in NIR table 107. The information includes the type and historical quantities of coal mined, mine depth, an estimate of the average emissions prior to closure, year of closure, method of closure and current state (flooded or non-flooded). From the 21 mines closed in 1942–2017, 19 were found to be non-flooded and thus a source of fugitive emissions. On the basis of the type of coal mined and year of closure, an annual EF was calculated for individual mines using equation 4.1.12 and parameters from table 4.1.9 of the 2019 Refinement to the 2006 IPCC Guidelines. The ERT notes that there is no underestimation for the years of the second commitment period of the Kyoto Protocol and thus this issue was not included in the list of potential problems and no further questions were raised.
E.5	1.B.1.a Coal mining and handling – CH <sub>4</sub> (E.8, 2020) (E.9, 2018) (E.4, 2016) (E.4, 2015) (E.30, 2014) Accuracy	Develop a country-specific EF for fugitive CH <sub>4</sub> emissions from underground coal mining and handling to enable a higher-tier method to be applied for this category.	Addressing. The last underground mine in Bulgaria closed in 2019, and the Party has reported “NO” for the years since then. The Party indicated in the NIR (p.156) that implementing a tier 2 or tier 3 approach from the 2006 IPCC Guidelines would require expensive laboratory testing and there is no coal production from active underground mines.  During the review, the Party provided a progress report on the development of a country-specific EF for fugitive CH <sub>4</sub> emissions from underground coal mining.  The ERT considers that the recommendation has not been fully addressed. A recent study (based on the number of mines closed) considered abandoned underground mines by region and annual factor in accordance with the 2019 Refinement to the 2006 IPCC Guidelines, but did not include a specific country or basin value.  The use of coal will continue to decline, as confirmed in the NIR (section 3.3.9, p.83) owing to changes in demographics, the introduction of new technologies during the present energy transition and other economic factors. The lack of further activity could constrain the development of this country-specific EF. The ERT suggested that this issue could be solved through a comparative study of the factor used in neighbouring countries with similar geophysical conditions according to type of coal, or if necessary, use global references broadly to support this position. The study should formalize the best available knowledge around this issue and use statistical procedures to reach a conclusion on whether the EF is reasonable.
E.6	1.B.2.a Oil – liquid fuels – CO <sub>2</sub> and CH <sub>4</sub> (E.10, 2020) (E.11, 2018) (E.14, 2016) (E.14, 2015)	Ensure consistency between the AD on exploration and production of oil reported in the NIR and the CRF tables.	Resolved. The Party reported in NIR table 111 (section 3.4.2, pp.151–152) the AD of exploration and production as “C” (confidential) owing to the legal mandate for the confidentiality of information if the number of operators in a sector is below three. “C” was also reported in CRF table 1.B.2 under oil exploration, production and transport.

ID#	Issue/problem classification <sup>a, b</sup>	Recommendation from previous review report	ERT assessment and rationale
Convention reporting adherence			
E.7	International aviation – liquid fuels – CO <sub>2</sub> (E.11, 2020) Transparency	Revise the values for the consumption of jet kerosene for international aviation in order to avoid inconsistencies between CRF tables 1.A(b) and 1.D, and provide in the NIR information on the methodology applied for disaggregating jet kerosene consumption into domestic and international aviation for 1988–1996, excluding 1990.	Resolved. The Party reported in its NIR (section 3.3.12.2.4, p.118) on the methodology it applied for disaggregating the domestic and international fuel consumption for 1988–1996, excluding 1990. The data reported for jet kerosene consumption under international bunkers in CRF table 1.A(b) are included with the disaggregated estimates.  The ERT agrees that there is no inconsistency between CRF tables 1.A(b) and 1.D for 1988–1996.
E.8	1.B.1.a Coal mining and handling – CH <sub>2</sub> (E.12, 2020) Transparency	Provide in the methodological section of the NIR (section 3.4.3) information to clarify which type of coal was used as AD (mined raw coal or upgraded saleable coal) and for which years of the time series.	Resolved. The Party reported in its NIR (section 3.4.3, p.153, and section 3.4.6, p.155) that it uses the quantities of raw coal production as AD. Currently the mined coal is not upgraded, so the amount of raw coal is equal to that of the saleable coal. Bulgaria’s coal upgrade facilities were closed at the beginning of the 2000s and there are no data available on the raw and upgraded coal quantities, so the ERT finds the Party’s approach reasonable.  The Party confirmed the type of coal used as AD and researched the differences between raw coal and saleable coal, in line with recommendation ID# E.12 from the 2016 annual review report (FCCC/ARR/2016/BGR). This information is reported in the NIR (section 3.4.4, pp.153 and 155).
E.9	1.B.1.a Coal mining and handling – CH <sub>4</sub> (E.13, 2020) Transparency	Include in the NIR the main parameters used for estimating CH <sub>4</sub> emissions from abandoned underground mines using a tier 3 method (e.g. closure year, average emission rate and EFs applied).	Resolved. The Party reported in NIR tables 107–109 (section 3.4.1, pp.148–150) all parameters used for estimating CH <sub>4</sub> emissions from abandoned underground mines (year of closure, coal rank, gassy/non-gassy status, flooded/non-flooded status, mine depth and average emissions prior to closure).  The ERT considers that the recommendation has been fully addressed because the Party has reported the specifications of the abandoned underground mines and computed the emissions using the 2019 Refinement to the 2006 IPCC Guidelines, as shown in NIR tables 107–109.
E.10	1.B.2.a Oil – CO <sub>2</sub> , CH <sub>4</sub> and N <sub>2</sub> O (E.14, 2020) Transparency	Include in the NIR relevant information on the scope and coverage of the AD used under category 1.B.2.a.iv (oil – refining/storage) and an explanation of the reasons for the significant increase in emissions between 2008 and 2009. If recalculations are performed for this category for the next submission, include information in the NIR on those recalculations in accordance with	Resolved. The Party reported in its NIR (section 3.4.6, pp.155–156) on the scope and coverage of the AD used under category 1.B.2.a.iv (oil refining/storage). The Party explained that the unstable trend in emissions after 2009 is due to the introduction of the use of petroleum coke. Additionally, for the 2021 submission fugitive emissions were recalculated following updates to methodologies and the default EFs from the 2019 Refinement to the 2006 IPCC Guidelines that were applied. The updated EFs are provided in the NIR (section 3.4.3, pp.153–154).  The ERT considers that the recommendation has been fully addressed because the Party included an explanation of the use of petroleum coke in its refineries. The use of coke depends on the level of conversion of the facilities in the country; production schemes,

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		paragraphs 43–45 of the UNFCCC Annex I inventory reporting guidelines.	economics and the use of energy vary between refineries. The Party included in the NIR (pp.155–156) an explanation of the use of petroleum coke and its reporting of emissions in CRF table 1.B.2.a.4. It also included in the NIR (pp.153–154) information on the recalculated emissions and the AD sources and EFs used.
<b>IPPU</b>			
I.1	2.A.1 Cement production – CO <sub>2</sub> (I.14, 2020) Transparency	Make efforts to report more qualitative data on CaO and MgO content without violating confidentiality, such as range of CaO and MgO content, AD in 100 base indexed on 1990 or presenting trends as graphics without any numbers.	Not resolved. The Party did not report more qualitative data on CaO and MgO content in its NIR.  During the review, the Party explained to the ERT that the reasons for the confidentiality of the data lie in the Law of Statistics, adding that it aims to include a graph displaying percentages in the next annual submission.
I.2	2.A.2 Lime production – CO <sub>2</sub> (I.15, 2020) Transparency	Provide in the NIR an explanation of the reasons for the changes in the trend in the CO <sub>2</sub> IEF between 2008 and 2009.	Not resolved. Bulgaria did not provide in its NIR (section 4.2.2.2) an explanation of the changes in the trend in the CO <sub>2</sub> IEF between 2008 and 2009 (from 0.796 t CO <sub>2</sub> /t in 2008 to 0.780 t CO <sub>2</sub> /t in 2009).  During the review, the Party explained that this information will be provided in the next annual submission.
I.3	2.A.3 Glass production – CO <sub>2</sub> (I.16, 2020) Comparability	Obtain data on soda ash used in glass production and reallocate its emissions from category 2.A.4.b to category 2.A.3 in accordance with the 2006 IPCC Guidelines, noting that, to avoid double counting, the amount of soda ash used in glass production should be subtracted from the total amount of soda ash use reported under category 2.A.4.b.	Not resolved. The Party did not report in its NIR data on soda ash used in glass production and did not reallocate its emissions from category 2.A.4.b to category 2.A.3.  During the review, Bulgaria explained it has been seeking to obtain the necessary information and the results will be presented in the next annual submission.
I.4	2.A.4 Other process uses of carbonates – CO <sub>2</sub> (I.17, 2020) Convention reporting adherence	Update the information in the NIR to reflect the correct method applied for calculating emissions from soda ash use and the correct value of the country-specific EF applied.	Not resolved. The Party has not updated the information in its NIR to reflect the method applied for the calculation of the emissions from soda ash use and the correct value for the country-specific EF. The ERT noted that for 2020, the NIR presents the same value from 1998 to 2020 for the EF (415.229 kg CO <sub>2</sub> /t soda ash).  During the review, the Party provided the ERT with the calculation datasheets. The ERT agrees with the method applied, on the basis of the data from the European Union Emissions Trading System and country-specific EFs (410.069 kg CO <sub>2</sub> /t soda ash). The Party indicated that it would include detailed information in the next annual submission.
I.5	2.B.1 Ammonia production – CO <sub>2</sub> (I.3, 2020) (I.10, 2018)	Further investigate the use of produced urea to ensure that emissions from all sources of urea use are estimated and reported under the respective sectors of the	Addressing. The Party did not include in its NIR (section 4.3.1.1) information on analysing the use of produced urea or on current practices. Moreover, no details were provided on the use of urea in the other sectors (particularly agriculture).

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	(I.18, 2016) (I.18, 2015) Accuracy	inventory and provide this information in the NIR.	<p>As explained by the Party during the previous review, the production of urea stopped in 2003. The only use of urea was as a fertilizer in agriculture and this was reported accordingly. Regarding current practices, urea has not been used in denitrification plants since 2012. Urea was not used in transport before the introduction of EU emission standards for heavy-duty vehicles in 2009, and there was no evidence that urea was used in the pharmaceutical and cosmetic industries in the country. Bulgaria explained that all known sources of urea use were reported in the inventory, adding that it would continue to search for other sources in the sector.</p> <p>The ERT notes that, as urea production ceased in 2003, this issue does not lead to an underestimate of emissions for the second commitment period of the Kyoto Protocol and therefore this issue was not included in the list of potential problems and further questions raised.</p> <p>The ERT considers that the explanation provided by the Party is a good overview of the sources of urea use estimated in the inventory; however, none of these explanations were reported in the 2022 NIR (see also ID#s I.6, I.7 and I.8 below).</p>
I.6	2.B.1 Ammonia production – CO <sub>2</sub> (I.5, 2020) (I.12, 2018) (I.6, 2016) (I.6, 2015) (39, 2014) (44, 2013) Transparency	Clearly report how emissions of CO <sub>2</sub> recovered for use in urea production are accounted for in the inventory.	<p>Not resolved. The Party did not report in its NIR (section 4.3.1, p.181) how the emissions from CO<sub>2</sub> recovered for use in urea production were accounted for in its inventory.</p> <p>During the review, the Party explained to the ERT that this issue will be resolved in the next annual submission.</p>
I.7	2.B.1 Ammonia production – CO <sub>2</sub> (I.6, 2020) (I.26, 2018) Transparency	Include the years of urea production (1988–2003) in NIR table 119 for clarity.	<p>Addressing. The Party did not update NIR table 124 (p.183) to include all years of urea production (1988–2003).</p> <p>During the review, in a response to questions from the ERT, Bulgaria explained that the AD of urea production are available for 1988–2003 and will be included in the next annual submission.</p>
I.8	2.B.1 Ammonia production – CO <sub>2</sub> (I.7, 2020) (I.26, 2018) Transparency	Include more detailed information regarding the CO <sub>2</sub> emissions from ammonia production used to produce urea, to facilitate a better understanding of the emissions.	<p>Not resolved. Bulgaria did not include detailed information regarding CO<sub>2</sub> emissions from ammonia production used to produce urea (see ID#s I.5, I.6 and I.7 above).</p> <p>The ERT agrees with the assessment of the previous ERT that additional information would significantly improve the transparency of the reporting. The Party did not provide in its NIR (section 4.3.1) details of the ammonia production industry in Bulgaria, such as whether all plants produced urea until 2003. The limited information provided in the NIR (section 4.3.1.2) on emission trends does not assist with the understanding of the industry's development or justify the confidentiality rules applied by the Party. NIR section 4.3.1.1 provides only a general explanation of the industry and the production process.</p>
I.9	2.B.1 Ammonia production – CO <sub>2</sub>	Ensure that the title of the relevant chart in the NIR (figure 60, p.186) is correct.	Not resolved. Bulgaria did not correct the title of the chart in the NIR (figure 61, p.179) to reflect the data (CO <sub>2</sub> emissions, and recovery CO <sub>2</sub> emissions) that are reported in the chart.

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	(I.8, 2020) (I.26, 2018) Transparency		During the review, Bulgaria explained that this information will be provided in the next annual submission.
I.10	2.B.2 Nitric acid production – CO <sub>2</sub> (I.18, 2020) Transparency	Explain in the NIR how the N <sub>2</sub> O EF for 1988–2000 was calculated (i.e. that it was based on data from 2000–2004 for which limited abatement technology was assumed).	Not resolved. The Party did not include in its NIR (section 4.3.2.2) information regarding the estimation of the N <sub>2</sub> O EF for 1988–2000.  During the review, Bulgaria explained that the N <sub>2</sub> O EF for the whole period is calculated on the basis of the AD available for the reported period and the chemical compound formulae according to the mass weight of the compound produced.
I.11	2.B.5 Carbide production – CO <sub>2</sub> (I.19, 2020) Convention reporting adherence	Correct the emission values in NIR table 122 for carbide production and carbide use.	Resolved. Bulgaria presented in NIR table 127 (section 4.3.5.3.3) the correct values of the CO <sub>2</sub> emissions for carbide production and carbide use. The total CO <sub>2</sub> emission values presented in table 127 are comparable with the total CO <sub>2</sub> emission values presented in CRF table 2(I).A-Hs1.
I.12	2.B.8 Petrochemical and carbon black production – CO <sub>2</sub> and CH <sub>4</sub> (I.9,2020) (I.27, 2018) Transparency	State in the NIR (section 4.3.8) that vinyl chloride production is not occurring.	Not resolved. Bulgaria did not report in the NIR that the production of vinyl chloride is not occurring. During the review, the Party confirmed that vinyl chloride production was not occurring and continued to report in the NIR (section 4.3.8) that vinyl chloride production is not occurring.
I.13	2.C.1 Iron and steel production – CO <sub>2</sub> (I.20, 2020) Transparency	Include, in the description of the trends, the reasons for the lower CO <sub>2</sub> EF for 1988.	Not resolved. The Party presented in its NIR (section 4.4.1.2, p.201) a description of the trends, but there is no information provided on the reasons for the lower CO <sub>2</sub> EF in 1988.  During the review, the Party provided the ERT with information concerning the source of the AD (National Statistical Institute and plant data) and the calculation datasheets. The ERT noted lower values of some parameters (e.g. coke consumption per tonne of steel) for 1990 compared with the values for 1989 and 1991.
I.14	2.D.3 Other (non-energy products from fuels and solvent use) – CO <sub>2</sub> (I.12, 2020) (I.29, 2018) Completeness	Include emissions from urea-based selective catalytic reduction systems in off-road machinery for the entire time series.	Not resolved. The Party did not include emissions from urea-based selective catalytic reduction systems in off-road machinery under category 2.D.3.d other chemical products.  During the review, the Party explained that no relevant AD are gathered in the country and that legislative changes are needed.  The ERT considers that information on AD and the legislative information should be provided, and efforts made to report emissions from urea-based selective catalytic reduction systems in off-road machinery. The ERT considers that, given the nature of the category, any underestimates resulting from failure to report these emissions would be below the level of significance for Bulgaria (24.59 kt CO <sub>2</sub> eq in 2020) for application of an adjustment in accordance with decision 22/CMP.1, annex, paragraph 80(b), in conjunction with decision 4/CMP.11 and therefore this issue was not included in the list of potential problems and further questions raised by the ERT.

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I.15	2.D.3 Other (non-energy products from fuels and solvent use) – CO <sub>2</sub> (I.13, 2020) (I.30, 2018) Transparency	Clearly document in the NIR the methods used to calculate emissions from paint application, degreasing and dry cleaning and chemical products and show all numeric calculations for all years (e.g. in tabular format).	<p>Addressing. Bulgaria has not yet included in the NIR any information on how the EF of 0.013286 kt CO<sub>2</sub>/1,000 people is applied (i.e. applied to all categories in which solvents were used) nor clarified that emissions from other product use – printing and domestic solvent use were subtracted from the resulting emissions.</p> <p>During the review, in response to questions from the ERT, it was determined that CO<sub>2</sub> emissions for this category were calculated using an average CO<sub>2</sub> emission rate from a cluster of countries with similar national circumstances (Austria, Croatia, Czechia, Hungary, Italy, Poland, Romania and Slovakia) based on population.</p> <p>Furthermore, the Party reports in CRF tables 10s1 and 10s6 total national emission estimates with and without LULUCF with indirect CO<sub>2</sub> as “NA”, although indirect CO<sub>2</sub> emissions were estimated and reported in the GHG inventory (i.e. CO<sub>2</sub> indirect emissions for category 2.D.3.b), which is not in accordance with the mandatory requirement of decision 24/CP.19, annex I, paragraph 29. During the review, the Party provided, for the entire time series, national totals (with and without LULUCF) including and not including those CO<sub>2</sub> indirect emissions that had been reported as direct CO<sub>2</sub>, as requested by the ERT. Bulgaria further stated that this will be revised in future annual submissions.</p>
I.16	2.F.1 Refrigeration and air conditioning – HFCs (I.21, 2020) Transparency	Explain in the NIR the approach used for estimating emissions from disposal of commercial refrigeration equipment.	<p>Not resolved. The previous ERT considered that the approach used could lead to underestimates of emissions from disposal of commercial and industrial refrigerators and, during the previous review the Party had provided information concerning the national reporting procedure and reasons for considering that the HFCs emissions from disposal of commercial refrigeration equipment are included in the inventory.</p> <p>The current ERT considers that the recommendation has not yet been addressed because the Party has not included in its NIR the information about the approach used to estimate emissions from disposal of equipment under the commercial and industrial refrigeration categories (2.F.1.a and 2.F.1.c).</p> <p>During the review, Bulgaria explained that this information will be provided in the next annual submission.</p> <p>The ERT considers that this information is necessary to understand the approach used by the Party to estimate emissions from disposal of commercial refrigeration equipment.</p>
Agriculture			
A.1	3. General (agriculture) – CH <sub>4</sub> (A.20, 2020) Convention reporting adherence	Correct the value reported in NIR table 153 for total CH <sub>4</sub> emissions from the agriculture sector to reflect the value reported in CRF table 10s3.	Resolved. The Party reported in NIR table 161 (p.260) CH <sub>4</sub> emissions that are consistent with those reported in CRF table 10s3.
A.2	3. General (agriculture) – CO <sub>2</sub> , CH <sub>4</sub> and N <sub>2</sub> O (A.4, 2020) (A.24, 2018)	Improve the QA/QC procedures to be applied to resolve inconsistencies within the NIR and between the NIR and the CRF	Resolved. The Party reported total N <sub>2</sub> O emissions and total CO <sub>2</sub> eq emissions for the agriculture sector that are consistent between NIR table 161 (p.260) and CRF table 10s4.



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	Convention reporting adherence	tables regarding total N <sub>2</sub> O emissions and total CO <sub>2</sub> eq emissions from the agriculture sector.	
A.3	3. General (agriculture) – CO <sub>2</sub> , CH <sub>4</sub> and N <sub>2</sub> O (A.5, 2020) (A.26, 2018) Convention reporting adherence	Address inconsistencies between NIR tables 169 and 183 on the swine population and between the NIR and the CRF tables.	Resolved. The Party reported consistent data in NIR tables 172 (p.268) and 186 (p.280) and CRF table 3.B(b).
A.4	3.B Manure management – CH <sub>4</sub> (A.8, 2020) (A.27, 2018) Transparency	Provide in the NIR justification of the specific temperature value chosen (12 °C), especially if the source of the information is available only in Bulgarian, to improve transparency.	Not resolved. The Party did not include a justification of the specific temperature value chosen (12 °C) in the NIR (section 5.5.2.1, pp.275–278). During the review, the Party clarified that it would include in its next annual submission information on the average annual temperature for the country for the whole time series (1988–2020) provided by the National Institute of Meteorology and Hydrology. The ERT considers this will resolve the issue.
A.5	3.B Manure management – N <sub>2</sub> O (A.9, 2020) (A.28, 2018) Transparency	Explain in the NIR how the N <sub>2</sub> O IEF for poultry is calculated, the sources of parameters chosen for maximum theoretical methane-producing capacity and volatile solids and the MMS distribution chosen.	Resolved. The Party reported in its NIR (section 5.5.2.1, p.276) information on the sources of parameters chosen for maximum theoretical methane-producing capacity and volatile solids and the MMS distribution chosen, as well as information on how the N <sub>2</sub> O IEF for poultry is calculated.
A.6	3.B.1 Cattle – CH <sub>4</sub> (A.10, 2020) (A.18, 2018) (A.18, 2016) (A.18, 2015) Transparency	Document the explanation provided by the Agricultural University of Plovdiv to justify the choice of dry lot management system.	Resolved. The Party reported in NIR table 181 (p.277) the animal waste management system categories used for cattle, noting that “dry lot” is no longer included. During the review, the Party clarified that, in response to discussions held with the ERT during previous reviews, the animal waste management system category “liquid systems” is now used in place of “dry lot” for relevant livestock categories, which is consistent with the definitions provided in the 2006 IPCC Guidelines (vol. 4, chap. 10, table 10.18).
A.7	3.B.1 Cattle – N <sub>2</sub> O (A.11, 2020) (A.29, 2018) Transparency	Provide a detailed explanation in the NIR of the methods and values applied to estimate Nex for cattle to improve transparency.	Not resolved. The Party did not report in its NIR a detailed explanation of the methods and values applied to estimate Nex for cattle. The ERT noted the discussion between the Party and the ERT during the review of the 2020 submission, where the Party clarified that the method and values for calculating Nex were based on a study on DE, average feed rations per day, amount of crude protein in daily rations and percentage of N. The previous ERT considered, and the current ERT agrees, that the Party should provide in the NIR the reference to this study as a source of data, explaining (for the different types of cattle) how the N fraction in food is calculated and providing all data used in the calculations for N the fraction in food, undigested N, daily N excretion and annual Nex.

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A.8	3.B.3 Swine – CH <sub>4</sub> (A.21, 2020) Convention reporting adherence	Ensure consistency among NIR tables 165 and 179 and CRF table 3.B(b) regarding the total swine population.	Resolved. The Party reported in NIR tables 165 (p.263) and 179 (p.274) swine population data that are consistent with CRF table 3.B(b).
A.9	3.B.3 Swine – CH <sub>4</sub> (A.12, 2020) (A.30, 2018) Transparency	Include a detailed explanation of the methods and values used to estimate CH <sub>4</sub> emissions from manure management of swine.	Not resolved. The Party did not include in its NIR a detailed explanation of the methods and values used to estimate CH <sub>4</sub> emissions from manure management of swine.  To resolve this issue, as noted by the previous ERT, the current ERT considers that the Party should reference the data source for the method used for calculating country-specific DE and GE values and include both a description of the methodology applied to calculate average VS and GE and a table setting out the parameters for each animal type and the average values used in the emission estimates.  During the review, the Party clarified that a detailed explanation will be included in the NIR of the next annual submission.
A.10	3.D.a.1 Inorganic N fertilizers – N <sub>2</sub> O (A.14, 2020) (A.31, 2018) Accuracy	Include ammonium phosphate in the emission calculations.	Resolved. The Party included ammonium phosphate in the emission calculations and reported the information in NIR table 194 (p.287).
A.11	3.D.a.1 Inorganic N fertilizers – N <sub>2</sub> O (A.15, 2020) (A.31, 2018) Transparency	Include detailed information in the NIR on the rationale for choosing a Frac <sub>GASF</sub> value from the EMEP/EEA guidebook 2016.	Resolved. The Party included in its NIR (section 5.7.2.1, p.287) detailed information on the derivation of Frac <sub>GASF</sub> and a reference to the most recent version of the EMEP/EEA guidebook (2019).
A.12	3.D.a.2.b Sewage sludge applied to soils – N <sub>2</sub> O (A.16, 2020) (A.20, 2018) (A.21, 2016) (A.21, 2015) Transparency	Document and clearly report that the application of sewage sludge to soils did not occur before 2007 and provide details of the corresponding legislation.	Resolved. The Party reported in its NIR (section 5.7.2.1, p.286) that the application of sewage sludge to soils did not occur before 2007 and provided details of the corresponding legislation.
A.13	3.D.a.2.b Sewage sludge applied to soils – N <sub>2</sub> O (A.17, 2020) (A.33, 2018) Transparency	Include detailed information about the source of sewage sludge applied to agricultural soils and explain how AD are coordinated between the agriculture and waste sectors to prevent N <sub>2</sub> O emissions from being double counted in the inventory.	Resolved. The Party reported in its NIR (section 5.7.2.3, p.288) information about the source of sewage sludge applied to agricultural soils, and noted that it reported “IE” for “sludge removed” in CRF table 5.D to avoid double counting.
A.14	3.D.a.4 Crop residues – N <sub>2</sub> O	Include detailed information in the NIR on the process and parameters used to	Addressing. The Party reported in NIR table 197 (p.289) areas of cropland by crop type, and references for the parameters used to estimate N <sub>2</sub> O emissions from the crop residues

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	(A.18, 2020) (A.34, 2018) Transparency	estimate N <sub>2</sub> O emissions from the crop residues returned to soils (e.g. a table presenting information on the plant waste composition of a list of crops) in order to improve transparency.	returned to soils (NIR table 198, p.289). However, the ERT considers that the recommendation has not yet been fully addressed because the Party has not yet reported the values that are used to estimate N <sub>2</sub> O emissions from the crop residues returned to soils (other than crop areas).  During the review, the Party explained that it will include this information in the NIR of its next annual submission. The ERT considers that including this information will resolve the issue.
A.15	3.G Liming – CO <sub>2</sub> (A.22, 2020) (A.35, 2018) Completeness	Obtain the balance of lime production, imports, and exports to check whether any lime remains in the country and research agricultural practices in nearby countries and, if liming occurs, determine the average volume of lime applied per area of agricultural land and calculate the values for Bulgaria, and report in the NIR on the progress and results of the investigations.	Not resolved. See ID# A.17 in table 5.
<b>LULUCF</b>			
L.1	Land representation – all gases (L.1, 2020) (L.15, 2018) Accuracy	Review the assumptions used to assign land areas to other land and avoid unjustifiable increases in the land area that is assigned to the other land category, ensuring that the IPCC definition is consistently applied and avoiding any possible omission or double counting in the reporting of the LULUCF sector.	Resolved. The Party reported in its NIR (pp.305 and 309) all definitions and assumptions with respect to land categories and land representation. The total area assigned to the category other land is decreasing in relation to the total land area of the country. The total category other land covers only bare lands, rock, sands, sparsely vegetated areas, and all areas that do not fall into any of the other five land-use categories, in accordance with the IPCC definition of other land.  During the review, the Party clarified that there is no unjustifiable increase in the land area assigned to the category other land. The area of other land decreased over the time series.
L.2	4. General (LULUCF) – all gases (L.12, 2020) Convention reporting adherence	Correct the values in NIR table 199 to ensure consistency with CRF table summary 2.	Resolved. The Party reported in NIR table 208 (p.296) (table 199 in the 2020 NIR), which is consistent with CRF table summary 2.
L.3	4.A Forest land – CO <sub>2</sub> (L.2, 2020) (L.16, 2018) Accuracy	Review the data on land areas and removals, the assumptions used for land representation and other factors possibly affecting the removals trend in the forest land category (e.g. presence and condition of a large share of coniferous plantations at lower altitudes and the share of old coppice and low-stem forest which are now intensively harvested) and provide	Resolved. The Party reviewed the data on land areas and removals, resulting in a recalculation of net emissions and removals across the time series, as reported in CRF table 4.A. and described in the NIR (pp.318–321). The Party reported in its NIR (section 6.3.1, pp.316–318) that increased harvesting has an impact on the removal capacities of the forests under management (forest land remaining forest land) and how this leads to a relative decrease in removal rate per area. Therefore, despite a growing forest area, the total removals from forests will decline. The Party also conducted a gain–loss estimate to

ID#	Issue/problem classification <sup>a, b</sup>	Recommendation from previous review report	ERT assessment and rationale
L.4	4.A Forest land – CO <sub>2</sub> (L.13, 2020) Transparency	Provide in the NIR a definition for out-of-yield forest clarifying why “NO” is reported for this forest type.	<p>clear justification for the resulting removals trend in the submission.</p> <p>compare the results with the stock difference in forest land. The trend in removals is comparable using the two methodologies (see ID# L.7 below).</p> <p>Resolved. The Party reported in its NIR (section 6.3.1, p.314) the definition of out-of-yield forest. This stratum includes areas covered by <i>Pinus mugo</i>, which is common for the high elevation habitats in Bulgaria. The Party clarified that most of this forest is protected, with no harvesting occurring. No data on growing stocks for these forests are available and thus the Party did not estimate the stock changes for the category. In the absence of information, the Party assumes that at tier 1, gains equal losses. The Party used “NE” in CRF table 3.A for all forests in the category out-of-yield.</p>
L.5	4.A.1 Forest land remaining forest land – CO <sub>2</sub> (L.14, 2020) Accuracy	Elaborate in the NIR on the method and calculate emissions and removals from the deadwood pool by estimating the initial stock of the deadwood in forests for the base year and improve the documentation in the NIR of its modelling approach.	<p>Not resolved. The Party reported in its NIR (section 6.3.3.1.2.1, pp.327–331) a methodology to calculate deadwood in forest land remaining forest land per age class and species type. The ERT noted that the Party used the stock-difference method through an empiric model that uses biomass data from the forest inventory and mortality rates to determine the level of deadwood associated with forest age. The ERT further noted that it is not clear whether the model explicitly includes the losses from decay and disturbances to deadwood and that this could lead to an underestimate of emissions.</p> <p>During the review, the Party clarified that it used data on deadwood stocks measured in mature forests during a scientific study as an input to the model, and that this implicitly includes decay rates for this type of forest. The Party confirmed that decay in mature forests leads to an overestimate of losses if applied for young forests and therefore considers that the model is conservative.</p> <p>The ERT found that the methodology reported does not yet reflect how the time series has been constructed based on the deadwood estimates taken from studies (Zlatanov et al., 2013) referred to in the NIR (p.329). The ERT suggests updating NIR table 223 to reflect the time series of deadwood stocks used per forest age class and clarifying how the applied model is dealing with decay and disturbances so that emissions are not underestimated.</p>
L.6	4.A.1 Forest land remaining forest land – CO <sub>2</sub> (L.15, 2020) Consistency	Investigate the causes of the decrease in the values of CSC in living biomass between 2000 and 2005 and provide in the NIR a relevant explanation for the trends observed in the time series for 2000–2005.	Resolved. During 2021 the Party recalculated the CSC for the years prior to 2000. The change mostly affected the deciduous forests, and the recalculation was reported in the 2021 NIR (pp.332–333). For the 2022 submission the Party improved on the land representation regarding land converted to forest land for the period before the base year and provided an explanation of the trend in the 2022 NIR (pp.316–317).
L.7	4.A.1 Forest land remaining forest land – CO <sub>2</sub> (L.3, 2020) (L.5, 2018) (L.2, 2016) (L.2, 2015) (67, 2014) (74, 2013) Accuracy	Apply a higher-tier method to estimate emissions and removals from the dead organic matter (deadwood and litter) and soil carbon pools.	Addressing. The Party reported in its NIR (p.326) on CSCs in the deadwood pool using a tier 2 level approach (see ID# L.5 above). As there were no proper data to accurately estimate the emissions and removals in the litter and soil pools, there was no alternative but to again apply a tier 1 approach for these pools until proper data and/or model become available. The Party reported in its NIR (section 6.3.3.1.2.2, pp.331–334) a Wilcoxon signed-rank test for litter based on 116 litter samples from 1998 and 2019, demonstrating that the litter pool is not a source. The Party also reported in the NIR (section 6.3.3.1.3) a t-test analysis showing that the soil pool is not a source. Therefore, the Party decided to use a

<i>ID#</i>	<i>Issue/problem classification<sup>a, b</sup></i>	<i>Recommendation from previous review report</i>	<i>ERT assessment and rationale</i>
			<p>tier 1 method. The ERT considers that the recommendation has not been fully addressed because the Party has not developed country-specific values for the soil and litter pools.</p>
L.8	4.A.1 Forest land remaining forest land – CO <sub>2</sub> (L.4, 2020) (L.6, 2018) (L.8, 2016) (L.8, 2015) Accuracy	Provide estimates of changes in carbon stock in living biomass by applying the gain–loss method in future annual submissions for verification purposes.	Resolved. The Party reported in its NIR (section 6.3.5, p.344) under category-specific QA/QC and verification that it applied the gain–loss method on CSC in biomass in forest land. The results projected from 2000 onward are comparable with those produced using the stock–difference method.
L.9	4.A.2 Land converted to forest land – CO <sub>2</sub> (L.5, 2020) (L.8, 2018) (L.9, 2016) (L.9, 2015) Accuracy	Develop country-specific values for both deadwood and litter.	<p>Addressing. The Party reported in its NIR (p.340) that the deadwood pool on young forest stands (land converted to forest land) can be assumed to be insignificant, and therefore did not provide a stock change factor for this pool for the land converted to forest land category, reporting “NO” in CRF table 4.A.2 (i.e. there is no change in the information reported for deadwood compared with the 2020 submission). For the litter pool, a country-specific value of 10.23 t C/ha was reported in CRF table 4.A.2. The value is calculated from 116 plots under the International Cooperative Programme on Forests, with samples taken between 2011 and 2016.</p> <p>The ERT considers that the recommendation has not yet been fully addressed because the Party has not yet developed country-specific values for deadwood to be applied in land converted to forest land or provided further justification that deadwood accumulation in young forests can be expected to be minimal, as noted by the previous ERT.</p>
L.10	4.A.2 Land converted to forest land – CO <sub>2</sub> (L.7, 2020) (L.18, 2018) Accuracy	Apply higher-tier methods to stratify and disaggregate data by forest type and species in the estimation of CSCs in land converted to forest land and provide improved estimates.	<p>Not resolved. The Party reported in its NIR (p.339) the methodology used for calculating biomass under land converted to forest land, which is identical to that used in the previous annual submission. In CRF table 4.B, the Party also reported all emissions and removals associated with a land conversion to forest land at an aggregated level.</p> <p>During the review, the Party clarified that it is working on the stratification between coniferous and deciduous forests and will include it in the next annual submission. The ERT considers that the recommendation has not yet been addressed because the Party has not yet disaggregated the reporting of emissions and removals by forest type.</p>
L.11	4.B.1 Cropland remaining cropland – CO <sub>2</sub> (L.8, 2020) (L.11, 2018) (L.12, 2016) (L.12, 2015) Accuracy	Develop country-specific estimates for all pools that are significant.	<p>Not resolved. The Party reported in its NIR (pp.353 and 357) that it used a tier 1 methodology for perennial biomass and mineral soils using equation 2.25, formulation A, from the 2006 IPCC Guidelines (vol. 4, chap. 2).</p> <p>During the review, the Party clarified that the share of cropland remaining cropland and land-use change from annual to perennial from the total LULUCF emissions and removals is relatively small and it has therefore prioritized other updates. The ERT considers that the recommendation has not yet been addressed because the Party has not yet included country-specific estimates for living biomass and mineral soils on perennial cropland.</p>

<i>ID#</i>	<i>Issue/problem classification<sup>a, b</sup></i>	<i>Recommendation from previous review report</i>	<i>ERT assessment and rationale</i>
L.12	4.C.1 Grassland remaining grassland – CO <sub>2</sub> (L.10, 2020) (L.12, 2018) (L.13, 2016) (L.13, 2015) Transparency	Include in the NIR information on changes in carbon stock in the dead organic matter pool.	<p>Not resolved. The Party did not report in its NIR (section 6.3) any information about the dead organic matter pool for grassland. In CRF table 4.C, the Party reported “NE” and “NO”, but without any justifications in the NIR.</p> <p>During the review, the Party indicated that it would seek data or literature sources to provide more information for the next annual submission. The ERT considers that the recommendation has not yet been addressed because the Party has not yet justified in the NIR the use of “NE” and “NO” in the CRF tables for grassland remaining grassland, by including in the NIR, for example, references to studies or literature demonstrating that there is no woody vegetation under grassland remaining grassland.</p>
L.13	4.C.2 Land converted to grassland – CO <sub>2</sub> (L.11, 2020) (L.13, 2018) (L.14, 2016) (L.14, 2015) Transparency	Include consideration of the dead organic matter pool in the NIR to ensure the completeness of the reporting.	<p>Not resolved. Bulgaria did not include estimates of dead organic matter under this key category and reported “NO” and “NA” in CRF table 4.C for category 4.C.2. The Party did not report in its NIR (section 6.3) any information related to the dead organic matter pool in land converted to grassland.</p> <p>During the review, the Party clarified that only cropland and other land are converted to grassland and that it assumes that dead organic matter is in equilibrium in line with a tier 1 methodology. The ERT considers that the recommendation has not yet been addressed because the Party has not yet reported this information in its NIR.</p>
L.14	4.E Settlements – CO <sub>2</sub> (L.16, 2020) Convention reporting adherence	Correct the values in NIR tables 225 and 226 to ensure consistency with CRF table 4.E.	Resolved. The Party reported in NIR tables 237 and 238 the updated values, which are consistent with those in CRF tables 4.E and 4(III).
Waste			
W.1	5.A Solid waste disposal on land – CH <sub>4</sub> (W.2, 2020) (W.1, 2018) (W.2, 2016) (W.2, 2015) (74, 2014) Transparency	Make further efforts to increase transparency by reporting on the industrial waste amounts and the types considered.	<p>Addressing. The ERT noted the explanation provided in the NIR (section 7.2.3.2) that good-quality country-specific AD on historical solid waste disposal are not available domestically. According to national expert judgment, the share of industrial waste disposed in landfill is small and it is mostly composed of inert substances.</p> <p>During the review, the Party explained to the ERT that it had tried to further explain the source of the AD under NIR section 7.2.3.2 (p.395). The ERT acknowledged the explanation provided by the Party that historical country-specific AD on industrial solid waste disposal are not available, and that historical data had been estimated using a regression analysis.</p> <p>The ERT commends Bulgaria for its efforts to enhance the transparency of the NIR; however, further transparency is needed on details of the composition, including amounts and the types of industrial waste assimilated to municipal solid waste, for example, in a specific tabular format.</p>
W.2	5.B.1 Composting – CH <sub>4</sub> and N <sub>2</sub> O	Include information in the NIR to explain that the AD are reported on a wet weight basis or modify 2020 NIR table 243	Resolved. During the review, the Party confirmed that NIR table 255 (table 243 in the 2020 NIR) included annual data from 2011 to 2020 on total amount of dry matter treated by biological treatment facilities. The ERT confirmed that this improvement is in line with the

<i>ID#</i>	<i>Issue/problem classification<sup>a, b</sup></i>	<i>Recommendation from previous review report</i>	<i>ERT assessment and rationale</i>
	(W.9, 2020) Transparency	(p.382) to provide the AD on a dry weight basis, as reported in CRF table 5.B, to ensure consistency between the NIR and the CRF tables.	recommendation and increased the transparency of the NIR. During the review, the Party confirmed that composting was not developed in the country until 2011 and no AD from previous years were available.
W.3	5.B.1 Composting – CH <sub>4</sub> and N <sub>2</sub> O (W.10, 2020) Transparency	Clarify in the NIR (section 7.3.1.2) the trends in AD for waste composted, explaining that, between 2017 and 2018, the amount of composted waste decreased in line with more stringent requirements for the fraction of separated waste to be composted, and including a reference to the law providing for the introduction of those requirements.	Addressing. The ERT acknowledged the Party's reporting in NIR section 7.3.1.2 (p.403). The ERT noted that there was still variation in AD but recognized the effort made by the Party to include information on the reduction of the amount of waste composted between 2017 and 2018 in NIR table 255 (p.403).  During the review, the Party confirmed its goal to include the entire time series (2011–2021) and explain the trends in AD for waste composted and reduced between 2017 and 2018. The Party informed the ERT that an additional effort to explain this variation will be made and that a reference to national legislation would also be included in the next annual submission. The ERT commends Bulgaria for its efforts to explain variations in AD for category 5.B.1. The ERT considers that this recommendation will not be fully addressed until the planned improvements can be verified in future submissions.
W.4	5.C.1 Waste incineration – CH <sub>4</sub> (W.11, 2020) Transparency	Explain in the NIR (e.g. in section 7.2.1) that all clinical waste is considered hazardous waste by law and is therefore incinerated.	Resolved. The Party reported in its NIR (section 7.2.1, p.393) that in accordance with local legislation all waste materials collected on the premises of medical and health institutions are to be considered clinical waste, classified as hazardous material and incinerated.
W.5	5.C.1 Waste incineration – CO <sub>2</sub> (W.12, 2020) Transparency	Correct NIR tables 233 and 244 to reflect the total CO <sub>2</sub> emissions reported in CRF table 5.C for category 5.C.1.	Addressing. The ERT noted that the Party reported in its NIR revised versions of NIR tables 244 (p.390) and 256 (p.404) (tables 233 and 244, respectively, in the 2020 NIR).  During the review, the Party provided a new version of NIR table 256 that includes CO <sub>2</sub> emissions from incineration of clinical and hazardous waste. The ERT confirmed that the CO <sub>2</sub> emissions presented in NIR table 256 reflect the CO <sub>2</sub> emissions for incineration of clinical and hazardous waste as reported in CRF table 5.C.1. The ERT commends Bulgaria for providing revised data; however, it considers that this issue will not be resolved until the total CO <sub>2</sub> emissions reported in CRF table 5.C for category 5.C.1 can be revised and included in the next annual submission.
W.6	5.D Wastewater treatment and discharge – CH <sub>4</sub> (W.7, 2020) (W.14, 2018) Transparency	Include in the NIR a description of the national circumstances justifying the use of a methane correction factor of 0.1 for latrines (e.g. regarding climate conditions in Bulgaria and the average number of persons per family).	Resolved. The Party reported in its NIR (section 7.5.3.3, p.414) that the methane correction factor of 0.1 for water treated in latrines was chosen according to climate conditions in Bulgaria and the average number of persons per family, that is, on the basis of dry climate conditions, the small size of families (3–5 persons) and a biochemical oxygen demand value of 60 g/person/day in line with the 2006 IPCC Guidelines (vol. 5, chap. 6, table 6.3).
W.7	5.D Wastewater treatment and discharge – CH <sub>4</sub> (W.8, 2020) (W.15, 2018) Accuracy	Extend the extrapolation of the sludge AD to before 2004.	Resolved. During the review, the Party confirmed that it had included in the NIR a revised table 247 (section 7.2.3.2, p.396) containing a time series of sewage sludge production and disposed in landfill. The ERT confirmed that the provided information is in line with the data provided in CRF table 5.A. The ERT considers that the information provided in the NIR is in line with the recommendation made by the previous ERT, which indicated that

ID#	Issue/problem classification <sup>a, b</sup>	Recommendation from previous review report	ERT assessment and rationale
			extrapolation of sludge AD for years before 2004 should take into account data on landfill sludge across the time series.
<b>KP-LULUCF</b>			
KL.1	General (KP-LULUCF) – CO <sub>2</sub> , CH <sub>4</sub> and N <sub>2</sub> O (KL.1, 2020) (KL.2, 2018) (KL.9, 2016) (KL.9, 2015) Transparency	Strengthen QC procedures to ensure that information in the NIR on the intention to use the natural disturbance provision to exclude emissions from natural disturbances applies to both AR and FM areas, to ensure the transparency of the reporting.	Resolved. The Party reported in its NIR (p.449) that it decided not to apply the natural disturbance provision. Therefore, no information on this has been included in the 2022 submission.
KL.2	General (KP-LULUCF) – CO <sub>2</sub> , CH <sub>4</sub> and N <sub>2</sub> O (KL.2, 2020) (KL.14, 2018) Transparency	Report in the NIR the single spatial assessment unit used for determining the areas for the accounting of AR, deforestation and FM, as required by decision 2/CMP.8, annex II, paragraph 2(c).	Resolved. The Party reported in its NIR (p.431) that the minimum spatial assessment unit determining the areas of AR, deforestation and FM is the area of subcompartments (1–25 ha). In addition, the area data for deforestation are a total aggregate and cannot be provided at the spatial assessment unit level. During the review, the Party explained that the forest definition is used as a basic input for the creation of the deforestation and AR maps and that the minimum assessment unit is 0.1 ha.
KL.3	AR – CO <sub>2</sub> (KL.4, 2020) (KL.5, 2018) (KL.4, 2016) (KL.4, 2015) KP reporting adherence	Include an explanation in the documentation box of the CRF tables where the notation key “IE” is used.	Not resolved. The Party did not report a justification in the documentation box of the CRF tables where “IE” was used.  During the review, the Party explained that the documentation box was completed for the 2021 submission but not for the 2022 submission. Moreover, in CRF table 4(KP-1)A.1, the Party reported gains and losses and net change of below-ground biomass as “IE” because the figures on below-ground biomass carbon stock and stock changes are included in the above-ground biomass.  The ERT concludes that this potential problem of a mandatory nature does not influence the Party’s ability to fulfil its commitments for the second commitment period of the Kyoto Protocol and therefore this issue was not included in the list of potential problems and further questions raised.
KL.4	FM – CO <sub>2</sub> (KL.6 and KL.8, 2020) (KL.16 and KL.18, 2018) Accuracy	Include the result of the technical correction to the background level and margin.	Resolved. The Party reported in its NIR (p.449) that it decided not to apply the natural disturbance provision. Therefore, no information on this has been included in the 2022 submission.
KL.5	Deforestation – CO <sub>2</sub> (KL.12, 2020) KP reporting adherence	Correct the value of carbon stock in litter for KP-LULUCF to be consistent with the value applied in the LULUCF sector for forest land converted to other land uses.	Addressing. The Party reported in its NIR 10.22 t C/ha for the carbon stocks in the litter pool under the Kyoto Protocol (p.442), and 10.23 t C/ha under the Convention (p.340), based on the same data source, namely the International Cooperative Programme on Forests.  During the review, the Party clarified that the analysis in NIR section 6.3.3.1.2 is different in that it aims to justify that the pool is not a source and thus it focuses only on a



ID#	Issue/problem classification <sup>a, b</sup>	Recommendation from previous review report	ERT assessment and rationale
			<p>subsample. The Party also clarified that 10.22 t C/ha was mistakenly reported instead of 10.23 t C/ha in the NIR (p.442).</p> <p>The ERT concludes that this potential problem of a mandatory nature does not influence the Party's ability to fulfil its commitments for the second commitment period of the Kyoto Protocol and therefore this issue was not included in the list of potential problems and further questions raised.</p>
KL.6	Deforestation and FM – CO <sub>2</sub> (KL.13, 2020) KP reporting adherence	Update the information in the NIR to reflect the correct methodology applied for deadwood stock changes under deforestation and FM activities.	<p>Addressing. The Party reported in its NIR (p.327) the methodology used to calculate carbon stocks in deadwood for forest land remaining forest land and reported the values used for deadwood on deforested lands in NIR table 270 (p.441). For FM, the information on the deadwood pool was included in the FMRL<sub>corr</sub> as reflected in the NIR (p.451), but the data or description of the methodology have not been included in the NIR.</p> <p>During the review, the Party confirmed that NIR table 241 (p.383) contains an incorrect value and should reflect the same value for deadwood as in NIR table 270, which has been used in all CRF tables.</p> <p>The ERT concludes that this potential problem of a mandatory nature does not influence the Party's ability to fulfil its commitments for the second commitment period of the Kyoto Protocol and therefore this issue was not included in the list of potential problems and no further questions were raised.</p>
KL.7	FM – CO <sub>2</sub> (KL.16, 2020) KP reporting adherence	Follow good practice and include in the NIR a list of all elements identified as leading to a technical correction to the FMRL in accordance with the Kyoto Protocol Supplement (chap. 2.7.6.3).	<p>Resolved. The Party reported in its NIR (p.451) the list of all elements that have led to a technical correction.</p> <p>During the review, the Party clarified that it used the same stratification as for forest land remaining forest land but has included only the aggregation of emissions and removals in CRF table 4(KP-I)B.1.</p>
KL.8	FM – CO <sub>2</sub> (KL.14, 2020) Completeness	Provide estimates for CSC in litter, mineral soils and organic soils or present verifiable information demonstrating that these pools are not a net source of anthropogenic GHG emissions, in accordance with decision 2/CMP.7, annex, paragraph 26, and decision 2/CMP.8, annex II, paragraph 2(e).	<p>Resolved. The Party reported a Wilcoxon signed-rank test for litter based on 116 litter samples from 1998 and 2019 in its NIR (section 6.3.3.1.2.2) demonstrating that the litter pool is not a source. The Party reported a t-test analysis in the NIR (section 6.3.3.1.3) showing that the soil pool is not a source.</p>
KL.9	FM – CO <sub>2</sub> (KL.9, 2020) (KL.19, 2018) Transparency	Provide detailed documentation on the updated technical correction, in line with decision 2/CMP.7.	<p>Addressing. The Party provided in its NIR (p.452) a table with an estimate of the technical correction. The technical correction is reported in the NIR and CRF table 4(KP-I)B.1.1 and amounts to 2,941.67 kt CO<sub>2</sub> eq.</p> <p>During the review, the Party clarified that it reported an incorrect estimate for the total FMRL<sub>corr</sub> in NIR table 272 owing to the reporting in the NIR of an incorrect projection of the original FMRL for 2013–2020.</p>

<i>ID#</i>	<i>Issue/problem classification<sup>a, b</sup></i>	<i>Recommendation from previous review report</i>	<i>ERT assessment and rationale</i>
			The ERT concludes that this potential problem of a mandatory nature does not lead to an overestimation of removals from FM and does not influence the Party's ability to fulfil its commitments for the second commitment period of the Kyoto Protocol and therefore this issue was not included in the list of potential problems and further questions raised.

<sup>a</sup> References in parentheses are to the paragraph(s) and the year(s) of the previous review report(s) in which the issue or problem was raised. Issues are identified in accordance with paras. 80–83 of the UNFCCC review guidelines and classified as per para. 81 of the same guidelines. Problems are identified and classified as problems of transparency, accuracy, consistency, completeness or comparability in accordance with para. 69 of the Article 8 review guidelines in conjunction with decision 4/CMP.11.

<sup>b</sup> The report on the review of the 2021 annual submission of Bulgaria was not available at the time of this review. Therefore, the recommendations reflected in this table are taken from the 2020 annual review report. For the same reason, 2021, 2019 and 2017 are excluded from the list of review years in which issues could have been identified.

#### IV. Issues and problems identified in three or more successive reviews and not addressed by the Party

9. In accordance with paragraph 83 of the UNFCCC review guidelines, the ERT noted that the issues and/or problems included in table 4 have been identified in three or more successive reviews, including the review of the 2022 annual submission of Bulgaria, and had not been addressed by the Party at the time of publication of this review report.

Table 4

##### Issues and/or problems identified in three or more successive reviews and not addressed by Bulgaria

<i>ID#</i>	<i>Previous recommendation for issue</i>	<i>Number of successive reviews issue not addressed<sup>a</sup></i>
General		
G.1	Provide information on any changes in the reporting of the minimization of adverse impacts in accordance with Article 3, paragraph 14, of the Kyoto Protocol.	3 (2018–2022)
G.3	Complete CRF table 9 (information on notation keys) using CRF Reporter.	3 (2018–2022)
G.5	Include in the NIR the summary table for key categories identified for the latest reported year (by level and trend) (e.g. in section 1.5 of the NIR).	3 (2018–2022)
G.11	Explain the reasons for the difference in the calculated uncertainty estimates between submissions.	3 (2018–2022)
Energy		
E.5	Develop a country-specific EF for fugitive CH <sub>4</sub> emissions from underground coal mining and handling to enable a higher-tier method to be applied for this category.	5 (2014–2022)
IPPU		
I.5	Further investigate the use of produced urea to ensure that emissions from all sources of urea use are estimated and reported under the respective sectors of the inventory and provide this information in the NIR.	4 (2015/2016–2022)

<i>ID#</i>	<i>Previous recommendation for issue</i>	<i>Number of successive reviews issue not addressed<sup>a</sup></i>
I.6	Clearly report how emissions of CO <sub>2</sub> recovered for use in urea production are accounted for in the inventory.	6 (2013–2022)
I.7	Include the years of urea production (1988–2003) in NIR table 119 for clarity.	3 (2018–2022)
I.8	Include more detailed information regarding the CO <sub>2</sub> emissions from ammonia production used to produce urea, to facilitate a better understanding of the emissions.	3 (2018–2022)
I.9	Ensure that the title of the relevant chart in the NIR (figure 60, p.186) is correct.	3 (2018–2022)
I.12	State in the NIR (section 4.3.8) that vinyl chloride production is not occurring	3 (2018–2022)
I.14	Include emissions from urea-based selective catalytic reduction systems in off-road machinery for the entire time series.	3 (2018–2022)
I.15	Clearly document in the NIR the methods used to calculate emissions from paint application, degreasing and dry cleaning and chemical products and show all numeric calculations for all years (e.g. in tabular format).	3 (2018–2022)
<b>Agriculture</b>		
A.4	Provide in the NIR justification of the specific temperature value chosen (12 °C), especially if the source of the information is available only in Bulgarian, to improve transparency.	3 (2018–2022)
A.7	Provide a detailed explanation in the NIR of the methods and values applied to estimate Nex for cattle to improve transparency.	3 (2018–2022)
A.9	Include a detailed explanation of the methods and values used to estimate CH <sub>4</sub> emissions from manure management of swine.	3 (2018–2022)
A.14	Include detailed information in the NIR on the process and parameters used to estimate N <sub>2</sub> O emissions from the crop residues returned to soils (e.g. a table presenting information on the plant waste composition of a list of crops) in order to improve transparency.	3 (2018–2022)
A.15	Obtain the balance of lime production, imports, and exports to check whether any lime remains in the country and research agricultural practices in nearby countries and, if liming occurs, determine the average volume of lime applied per area of agricultural land and calculate the values for Bulgaria, and report in the NIR on the progress and results of the investigations.	3 (2018–2022)
<b>LULUCF</b>		
L.7	Apply a higher-tier method to estimate emissions and removals from the dead organic matter (deadwood and litter) and soil carbon pools.	6 (2013–2022)
L.9	Develop country-specific values for both deadwood and litter.	4 (2015/2016–2022)
L.10	Apply higher-tier methods to stratify and disaggregate data by forest type and species in the estimation of CSCs in land converted to forest land and provide improved estimates.	3 (2018–2022)
L.11	Develop country-specific estimates for all pools that are significant.	4 (2015/2016–2022)
L.12	Include in the NIR information on changes in carbon stock in the dead organic matter pool.	4 (2015/2016–2022)
L.13	Include consideration of the dead organic matter pool in the NIR to ensure the completeness of the reporting.	4 (2015/2016–2022)

<i>ID#</i>	<i>Previous recommendation for issue</i>	<i>Number of successive reviews issue not addressed<sup>a</sup></i>
Waste		
W.1	Make further efforts to increase transparency by reporting on the industrial waste amounts and the types considered.	5 (2014–2022)
KP-LULUCF	No issues identified.	

<sup>a</sup> Reports on the reviews of the 2017, 2019 and 2021 annual submissions of Bulgaria have not yet been published. Therefore, 2017, 2019 and 2021 were not included when counting the number of successive years for this table. In addition, as the reviews of the Party's 2015 and 2016 annual submissions were conducted together, they are not considered successive reviews and 2015/2016 is counted as one year.

## V. Additional findings made during the individual review of the Party's 2022 annual submission

10. Table 5 presents findings made by the ERT during the individual review of the 2022 annual submission of Bulgaria that are additional to those identified in table 3.

Table 5

### Additional findings made during the individual review of the 2022 annual submission of Bulgaria

<i>ID#</i>	<i>Finding classification</i>	<i>Description of finding with recommendation or encouragement</i>	<i>Is finding an issue/problem?<sup>a</sup></i>
General			
G.12	Uncertainty analysis	<p>The ERT noted that in NIR table 11 (section 1.6, p.52) the uncertainty information excludes LULUCF, which is not in accordance with decision 24/CP.19, annex I, paragraph 15, explaining that all sources and sink categories are to be included in an uncertainty assessment.</p> <p>During the review, the Party provided the ERT with an updated NIR table 11 with total uncertainties including and excluding LULUCF, for the present and previous submission.</p> <p>The ERT recommends that the Party update NIR table 11 with uncertainties including LULUCF and include in the NIR both the explanation of this table and the methodology used for the uncertainty estimate in the next annual submission.</p>	Yes. Convention reporting adherence
Energy			
E.11	1.B.2.a Oil – liquid fuels – CO <sub>2</sub> and CH <sub>4</sub>	<p>The ERT noted that the hydrogen production for oil refineries in CRF table 1.B.2 is reported in the venting and flaring section. This hydrogen is typically used for the reduction of sulfur in diesel and gasoline and is produced with a steam reforming process that can have natural gas or other fossil fuels as feedstock.</p> <p>During the review, the Party confirmed its intention to follow the 2019 Refinement to the 2006 IPCC Guidelines (section 3.11), which its supports reallocation.</p>	Yes. Comparability

ID#	Finding classification	Description of finding with recommendation or encouragement	Is finding an issue/problem? <sup>a</sup>
		<p>Hydrogen production can be outsourced or be an ancillary offline process, not necessarily integrated with the refining units. No information on the type of feedstock used in this process was provided in the NIR or the CRF tables.</p> <p>To improve comparability, the ERT recommends that the Party reallocate associated AD and EFs to IPPU category 2.B.10 as a separate chemical process and confirm the feedstock of the steam reforming process.</p>	
IPPU			
I.17	2.F.1 Refrigeration and air conditioning – HFCs	<p>The Party reported in its NIR significant changes in HFC emissions from commercial refrigeration for 2013–2019 (e.g. an increase of 835 per cent from 333.23 kt CO<sub>2</sub> eq to 3,117.26 kt CO<sub>2</sub> eq for 2019) compared with the values reported in the 2021 submission. The ERT noted a sharp decrease in the HFC emissions from stationary air conditioning in 2020 compared with the 2019 values (from 3,117.26 kt CO<sub>2</sub> eq in 2019 to 157.96 kt CO<sub>2</sub> eq in 2020). Furthermore, the ERT noted that for category 2.F.1.f stationary air conditioning for 2013–2019 there are significant changes in HFC emissions. During the review, in response to questions from the ERT, the Party provided estimates showing an increase of 197 per cent from 946.98 kt CO<sub>2</sub> eq to 2,813.09 kt CO<sub>2</sub> eq for 2019 in the current (2022) submission compared with the previous submission of 2021.</p> <p>In its NIR (section 4.7.1.5, p.237) the Party reported that a technical correction was made for category 2.F.1.a commercial refrigeration by the technical expert review team of the EU effort-sharing decision in 2020 and that for category 2.F.1.f stationary air conditioning a recalculation was made after the 2020 inventory review.</p> <p>During the review, Bulgaria clarified that the technical correction from the technical expert review team of the EU was for inventory year 2020 and was for the current submission. In addition, the Party informed the ERT that during the 2022 effort-sharing decision review of the EU it was agreed that there was a mistake in the application of this technical correction.</p> <p>Bulgaria provided the ERT with the values agreed with the technical expert review team for category 2.F.1. The ERT noted that for 2013–2020 the new values are lower and that the values presented in the current submission (e.g. for 2020 for category 2.F.1.a the HFC value decreases from 157.96 kt CO<sub>2</sub> eq to 4.61 kt CO<sub>2</sub> eq and for category 2.F.1.f the HFC value decreases from 1,015.65 kt CO<sub>2</sub> eq to 977.69 kt CO<sub>2</sub> eq) do not represent an underestimate of the HFC emissions.</p> <p>The ERT recommends that the Party revise its reporting of the HFC emissions for this category and apply the technical correction agreed with the technical expert review team of the EU during the 2022 effort-sharing decision review and provide explanations on this in the NIR.</p>	Yes. Consistency
Agriculture			
A.16	3.B Manure management 3.D.a.2.a Animal manure applied to soils 3.D.b Indirect N <sub>2</sub> O	<p>The Party made no reference in its NIR to the import or export of animal manure. The ERT noted that such import or export can have an impact on the estimates of N<sub>2</sub>O emissions for categories 3.B manure management and 3.D.a.2 organic N fertilizers.</p> <p>During the review, the Party explained that the import and export of N in animal manure is not considered in its emission calculations and that it will make an inquiry to the National Statistical Institute and/or the Ministry of Agriculture, Food and Forestry and include the result of the investigation in the next annual</p>	Yes. Accuracy

ID#	Finding classification	Description of finding with recommendation or encouragement	Is finding an issue/problem? <sup>a</sup>
	emissions from managed soils – N <sub>2</sub> O	<p>submission. Although the ERT considers that the net trade of animal manure, if it exists, could result in higher or lower N<sub>2</sub>O emissions, at this stage the ERT considers that any possible under- or overestimate would be below the significance threshold for application of an adjustment (24.59 kt CO<sub>2</sub> eq in 2020) in accordance with decision 22/CMP.1, annex, paragraph 80(b), in conjunction with decision 4/CMP.11 and therefore this issue was not included in the list of potential problems and further questions raised.</p> <p>The ERT recommends that the Party investigate the extent to which animal manure import or export exists, and whether this has a significant impact on the estimates of N<sub>2</sub>O emissions. The ERT also recommends that the import and export of animal manure N be considered in the emission calculation methodology.</p>	
A.17	3.G Liming – CO <sub>2</sub>	<p>The Party reported in its NIR (section 5.9, p.292) that there has been no liming in Bulgaria since 1987. During the review, in response to the request of the ERT for evidence of this, the Party clarified that the National Statistical Institute does not have data for lime production, imports and exports, and consequently it is investigating other sources of AD. The ERT considered that this may lead to a potential underestimate and asked the Party to provide emission estimates or demonstrate that emissions are under the threshold of significance. Bulgaria provided a spreadsheet of calculations which showed that estimates of CO<sub>2</sub> emissions from liming for 2020, which used expert judgment, are below the threshold of significance for application of an adjustment (24.59 kt CO<sub>2</sub> eq in 2020) in accordance with decision 22/CMP.1, annex, paragraph 80(b), in conjunction with decision 4/CMP.11 and therefore this issue was not included in the list of potential problems and further questions raised.</p> <p>The ERT recommends that Bulgaria obtain reliable estimates of AD and use these to calculate CO<sub>2</sub> emissions from liming and include these in future submissions.</p>	Yes. Completeness
LULUCF			
L.15	Land representation – CO <sub>2</sub> , N <sub>2</sub> O and CH <sub>4</sub>	<p>The Party has updated the land-use change matrices to include historical forest land assessment data (1968–1988), affecting forest land and conversion to other land. The Party reported in its NIR (p.307) that limited data exist on land-use changes between categories, explaining that expert judgment was used to allocate land conversions to categories if data were not available.</p> <p>The ERT noted that in CRF table 4.1, the land-use change matrices reported contain inconsistencies between the initial and final land use for the categories forest land, cropland and grassland. The inconsistencies in CRF table 4.1 between different reporting years lead to a maximum difference of 642 ha per year allocated between forest land, grassland and cropland. This is not in accordance with the 2006 IPCC Guidelines (vol. 2, chap. 3, p.3.16), which requires countries to present consistent information in CRF table 4.1, while using an approach 2 method.</p> <p>The ERT recommends that the Party update the land-use change matrices so that inconsistencies in CRF table 4.1 are resolved and ensure consistency with the values reported in the NIR.</p>	Yes. Consistency
L.16	4.A.2 Land converted to forest land – CO <sub>2</sub>	<p>The Party reported the following country-specific SOC<sub>REF</sub> values in its NIR (p.341): 67.74 t C/ha for annual crops, 67.49 t C/ha for perennial crops, 72.77 t C/ha and 86.96 t C/ha for grassland and 51.8 t C/ha for other lands. The Party reported that the estimates include the SOC<sub>REF</sub> for carbon stock and the land-use management impact based on each land-use category. The ERT noted that the values reported for</p>	Yes. Transparency

ID#	Finding classification	Description of finding with recommendation or encouragement	Is finding an issue/problem? <sup>a</sup>
L.17	4.C Grassland – CO <sub>2</sub>	<p>grassland and cropland are significantly different from the default temperate SOC<sub>REF</sub> values for high activity clay in the 2006 IPCC Guidelines (vol. 4, chap. 2, p.231, table 2.3) but could not find an explanation in the NIR for the differences.</p> <p>During the review, the Party clarified that the differences are mostly due to a relatively large representation of high-carbon stocks in these soils, with a considerable share of soil types classified as Chernozems, Vertisols, Phaeozems and Fluvisols. The Party also explained that it plans to use more recent and full data on soil carbon stock from the national surveys and make a comparison with independent national and/or international data sets. The Party is also planning to derive the country-specific land management factor and thus implement more precisely the equation for estimating the SOC for mineral soil.</p> <p>The ERT recommends that the Party include in the NIR a justification for the large differences between the country-specific SOC values reported and the default values for SOC<sub>REF</sub>.</p> <p>The Party reported in its NIR (p.368) the estimated biomass increases on grassland. The Party reported that the annual average increment on grassland is calculated using country-specific data and defaults using the yield biomass, biomass growth and root-to-shoot ratio. The ERT noted that the Party did not specify which tier level has been used and did not refer to the relevant methodological guidance for gain–loss estimations from the 2006 IPCC Guidelines (vol. 4, chap. 2, equation 2.8) and how the equation has been adapted to use the country-specific data available for Bulgaria.</p> <p>During the review, the Party clarified that the data for yield biomass are from annual statistics on hay production yields, which are used to estimate gains for conversion to pasture and meadows and form the basis for developing the annual increment rate. However, it is unclear to the ERT how the gains of the hay production and peak above-ground biomass are used to calculate the annual increment rate and how this results in net annual removals, and how annual losses from biomass cuts/harvests have been included in grassland reported in CRF tables 3.E and 3.F.</p> <p>The ERT recommends that the Party improve the information reported on how different increment rates per subcategory are calculated and provide in the NIR a clear overview table for biomass carbon stock factors and annual average increment rates per subcategory in grassland with associated references to the literature.</p>	Yes. Transparency
L.18	4(V) Biomass burning – N <sub>2</sub> O and CH <sub>4</sub>	<p>The Party reported in CRF table 4(V) “NO” for wildfires on grassland.</p> <p>During the review, the Party clarified that wildfires are expected on grassland (e.g. shrublands). It is investigating whether there are sufficient available data to include emissions from wildfires on grassland for future annual submissions. The ERT noted that this is not in accordance with the UNFCCC Annex I inventory reporting guidelines because “NE” should be used for categories that are occurring but are not estimated.</p> <p>The ERT recommends that the Party estimate and report the N<sub>2</sub>O and CH<sub>4</sub> emissions from wildfires in managed grassland in CRF table 4(V) or, if this is not possible, report “NE” instead of “NO”.</p>	Yes. Completeness

<i>ID#</i>	<i>Finding classification</i>	<i>Description of finding with recommendation or encouragement</i>	<i>Is finding an issue/problem?<sup>a</sup></i>
Waste			
W.8	5.B.2 Anaerobic digestion at biogas facilities – CH <sub>4</sub>	<p>The Party reported in CRF table 5.B CH<sub>4</sub> emissions for category 5.B.2 anaerobic digestion at biogas facilities as “NE” for 2014–2020 and did not provide justification for not estimating or quantifiable information to demonstrate that emissions are negligible.</p> <p>During the review, the Party provided the ERT with a spreadsheet containing AD for anaerobic digestion at biogas facilities for 2014–2020 and CH<sub>4</sub> emission calculations for this category using the tier 1 method from the 2006 IPCC Guidelines (vol. 5, chap. 4.1.3.1, table 4.1, p.4.6). The ERT revised the calculation provided and concluded that CH<sub>4</sub> emissions for this category are deemed to be negligible (0.22 kt CO<sub>2</sub> eq for 2020) and below the significance threshold for application of an adjustment (24.59 kt CO<sub>2</sub> eq) in accordance with decision 22/CMP.1, annex, paragraph 80(b), in conjunction with decision 4/CMP.11 and therefore this issue was not included in the list of potential problems and further questions raised.</p> <p>The ERT recommends that the Party collect and include in the NIR relevant AD and report CH<sub>4</sub> emissions for category 5.B.2 anaerobic digestion at biogas facilities.</p>	Yes. Completeness
KP-LULUCF		No findings for the KP-LULUCF sector additional to those included in table 3 were made by the ERT during the review.	

<sup>a</sup> Recommendations made by the ERT during the review are related to issues as defined in para. 81 of the UNFCCC review guidelines or problems as defined in para. 69 of the Article 8 review guidelines.



## **VI. Application of adjustments**

11. The ERT did not identify the need to apply any adjustments for the 2022 annual submission of Bulgaria.

## **VII. Accounting quantities for activities under Article 3, paragraph 3, and, if any, activities under Article 3, paragraph 4, of the Kyoto Protocol**

12. Table I.5 presents the accounting quantities for KP-LULUCF reported by Bulgaria and the final values agreed by the ERT. The final quantities of units to be issued and cancelled are presented in table I.6.

## **VIII. Questions of implementation**

13. No questions of implementation were identified by the ERT during the individual review of the Party's 2022 annual submission.

## Annex I

## Overview of greenhouse gas emissions and removals and data and information on activities under Article 3, paragraphs 3–4, of the Kyoto Protocol, as submitted by Bulgaria in its 2022 annual submission

1. Tables I.1–I.4 provide an overview of the total GHG emissions and removals as submitted by Bulgaria.

Table I.1  
**Total greenhouse gas emissions and removals for Bulgaria, base year–2020**  
 (kt CO<sub>2</sub> eq)

	<i>Total GHG emissions excluding indirect CO<sub>2</sub> emissions</i>		<i>Total GHG emissions and removals including indirect CO<sub>2</sub> emissions<sup>a</sup></i>		<i>Land-use change (Article 3.7 bis as contained in the Doha Amendment)<sup>b</sup></i>	<i>KP-LULUCF (Article 3.3 of the Kyoto Protocol)<sup>c</sup></i>	<i>KP-LULUCF (Article 3.4 of the Kyoto Protocol)</i>	
	<i>Total including LULUCF</i>	<i>Total excluding LULUCF</i>	<i>Total including LULUCF</i>	<i>Total excluding LULUCF</i>			<i>CM, GM, RV, WDR</i>	<i>FM</i>
FMRL								–7 950.00
Base year <sup>d</sup>	95 372.17	113 151.94	NA	NA	NA		NA	
1990	80 468.09	98 356.81	NA	NA				
1995	54 038.12	71 677.02	NA	NA				
2000	39 208.65	56 965.77	NA	NA				
2010	47 022.53	59 321.21	NA	NA				
2011	55 695.63	64 625.48	NA	NA				
2012	51 234.67	59 659.34	NA	NA				
2013	48 278.55	55 591.15	NA	NA		–723.74	NA	–7 670.97
2014	50 308.75	58 876.26	NA	NA		–877.42	NA	–7 712.60
2015	54 188.37	62 269.03	NA	NA		–795.79	NA	–7 848.80
2016	50 267.41	60 140.86	NA	NA		–893.95	NA	–9 342.52
2017	53 521.67	63 332.78	NA	NA		–944.93	NA	–9 533.80
2018	50 262.74	60 309.81	NA	NA		–1 115.58	NA	–9 494.12
2019	49 484.30	59 472.62	NA	NA		–1 013.30	NA	–9 469.17
2020	39 580.40	49 185.62	NA	NA		–1 207.75	NA	–9 173.88

*Note:* Emissions and removals reported for the sector other (sector 6) are not included in the total GHG emissions.

<sup>a</sup> The Party did not report indirect CO<sub>2</sub> emissions in CRF table 6.

<sup>b</sup> The value reported in this column relates to GHG emissions from conversion of forests (deforestation) in 1990 as contained in the report on the review of the Party's report to facilitate the calculation of the assigned amount for the second commitment period of the Kyoto Protocol.

<sup>c</sup> Activities under Article 3, para. 3, of the Kyoto Protocol, namely AR and deforestation.

<sup>d</sup> “Base year” refers to the base year under the Kyoto Protocol, which is 1988 for CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O and 1995 for HFCs, PFCs, SF<sub>6</sub> and NF<sub>3</sub>. Bulgaria has not elected any activities under Article 3, para. 4, of the Kyoto Protocol. For activities under Article 3, para. 3, of the Kyoto Protocol and FM under Article 3, para. 4, only the inventory years of the commitment period must be reported.

Table I.2

**Greenhouse gas emissions and removals by gas for Bulgaria, excluding land use, land-use change and forestry, 1988–2020**

(kt CO<sub>2</sub> eq)

	CO <sub>2</sub> <sup>a</sup>	CH <sub>4</sub>	N <sub>2</sub> O	HFCs	PFCs	Unspecified mix of HFCs and PFCs	SF <sub>6</sub>	NF <sub>3</sub>
1988	89 610.79	13 560.91	9 972.01	NO, NA	NO, NA	NO, NA	3.30	NO, NA
1990	76 699.20	13 063.80	8 590.12	NO, NA	NO, NA	NO, NA	3.69	NO, NA
1995	57 951.03	8 899.86	4 817.90	3.33	NO, NA	NO, NA	4.90	NO, NA
2000	45 464.33	7 585.49	3 876.41	33.04	NO, NA	NO, NA	6.49	NO, NA
2010	47 858.93	6 772.68	4 007.66	663.13	0.06	NO, NA	18.76	NO, NA
2011	53 174.76	7 031.80	3 649.14	752.75	0.06	NO, NA	16.97	NO, NA
2012	48 338.91	6 750.71	3 730.36	823.22	0.05	NO, NA	16.10	NO, NA
2013	42 678.60	6 665.79	4 124.72	2 101.58	0.04	NO, NA	20.42	NO, NA
2014	45 266.30	6 610.74	4 574.56	2 407.74	0.03	NO, NA	16.88	NO, NA
2015	48 260.53	6 642.25	4 676.44	2 671.71	0.03	NO, NA	18.07	NO, NA
2016	45 484.31	6 481.04	5 007.49	3 149.26	0.02	NO, NA	18.75	NO, NA
2017	47 569.76	6 360.79	4 988.97	4 395.72	0.03	NO, NA	17.51	NO, NA
2018	43 616.07	6 072.10	4 892.07	5 711.56	0.01	NO, NA	17.99	NO, NA
2019	42 255.77	5 825.25	4 904.61	6 468.72	0.01	NO, NA	18.26	NO, NA
2020	36 967.11	5 733.60	4 760.57	1 704.49	0.01	NO, NA	19.84	NO, NA
<b>Percentage change 1988– 2020</b>	<b>–58.7</b>	<b>–57.7</b>	<b>–52.3</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>501.2</b>	<b>NA</b>

Note: Emissions and removals reported for the sector other (sector 6) are not included in this table.

<sup>a</sup> Bulgaria did not report indirect CO<sub>2</sub> emissions in CRF table 6.

Table I.3

**Greenhouse gas emissions and removals by sector for Bulgaria, 1988–2020**

(kt CO<sub>2</sub> eq)

	Energy	IPPU	Agriculture	LULUCF	Waste	Other
1988	81 282.66	13 480.60	13 614.07	–17 779.78	4 769.69	NO
1990	71 271.25	10 084.04	12 263.32	–17 888.73	4 738.20	NO
1995	51 432.16	10 485.91	5 753.30	–17 638.90	4 005.64	NO

	<i>Energy</i>	<i>IPPU</i>	<i>Agriculture</i>	<i>LULUCF</i>	<i>Waste</i>	<i>Other</i>
2000	40 933.40	7 230.49	5 014.82	-17 757.11	3 787.05	NO
2010	46 226.88	4 441.53	5 288.98	-12 298.68	3 363.82	NO
2011	51 301.40	5 017.10	4 940.64	-8 929.84	3 366.34	NO
2012	46 500.15	4 780.32	5 072.35	-8 424.68	3 306.53	NO
2013	40 766.70	5 888.01	5 560.01	-7 312.61	3 376.44	NO
2014	43 167.45	6 415.14	6 025.12	-8 567.51	3 268.54	NO
2015	45 773.88	7 214.20	6 074.86	-8 080.66	3 206.09	NO
2016	42 703.03	7 864.16	6 423.68	-9 873.46	3 150.00	NO
2017	45 013.78	8 986.99	6 393.53	-9 811.11	2 938.48	NO
2018	41 271.24	9 985.07	6 244.50	-10 047.06	2 809.00	NO
2019	40 215.32	10 316.36	6 233.77	-9 988.32	2 707.17	-
2020	35 063.74	5 300.15	6 188.05	-9 605.23	2 633.68	-
<b>Percentage change 1988–2020</b>	<b>-56.9</b>	<b>-60.7</b>	<b>-54.5</b>	<b>-46.0</b>	<b>-44.8</b>	<b>NA</b>

*Notes:* (1) Bulgaria did not report emissions or removals for the sector other (sector 6); the corresponding cells in the CRF tables were left blank; (2) Bulgaria did not report indirect CO<sub>2</sub> emissions in CRF table 6.

Table I.4

**Greenhouse gas emissions and removals from activities under Article 3, paragraphs 3–4, of the Kyoto Protocol by activity, base year–2020, for Bulgaria**  
(kt CO<sub>2</sub> eq)

	<i>Article 3.7 bis as contained in the Doha Amendment<sup>a</sup></i>	<i>Activities under Article 3.3 of the Kyoto Protocol</i>		<i>FM and elected activities under Article 3.4 of the Kyoto Protocol</i>				
	<i>Land-use change</i>	<i>AR</i>	<i>Deforestation</i>	<i>FM</i>	<i>CM</i>	<i>GM</i>	<i>RV</i>	<i>WDR</i>
FMRL				-7 950.00				
Technical correction				-2 941.67				
Base year <sup>b</sup>	NA				NA	NA	NA	NA
2013		-885.06	161.32	-7 670.97	NA	NA	NA	NA
2014		-952.18	74.76	-7 712.60	NA	NA	NA	NA
2015		-1 006.60	210.81	-7 848.80	NA	NA	NA	NA
2016		-1 071.80	177.85	-9 342.52	NA	NA	NA	NA
2017		-1 134.47	189.54	-9 533.80	NA	NA	NA	NA
2018		-1 202.23	86.65	-9 494.12	NA	NA	NA	NA
2019		-1 256.85	243.55	-9 469.17	NA	NA	NA	NA
2020		-1 327.66	119.91	-9 173.88	NA	NA	NA	NA

	Article 3.7 bis as contained in the Doha Amendment <sup>a</sup>	Activities under Article 3.3 of the Kyoto Protocol		FM and elected activities under Article 3.4 of the Kyoto Protocol				
	Land-use change	AR	Deforestation	FM	CM	GM	RV	WDR
<b>Percentage change base year–2019</b>					<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>

Note: Values in this table exclude emissions from land subject to natural disturbances, if applicable.

<sup>a</sup> The value reported in this column relates to 1990.

<sup>b</sup> Bulgaria has not elected to report on any activities under Article 3, para. 4, of the Kyoto Protocol. For activities under Article 3, para. 3, of the Kyoto Protocol and FM under Article 3, para. 4, only the inventory years of the commitment period must be reported.

2. Table I.5 provides information on the Party's accounting quantities for reporting under Article 3, paragraphs 3–4, of the Kyoto Protocol.

Table I.5  
**Accounting quantities for activities under Article 3, paragraph 3, and forest management and any elected activities under Article 3, paragraph 4, of the Kyoto Protocol for Bulgaria**

(kt CO<sub>2</sub> eq)

GHG source/sink activity	Base year <sup>b</sup>	Net emissions/removals									Accounting parameters	Accounting quantity <sup>d</sup>
		2013	2014	2015	2016	2017	2018	2019	2020	Total <sup>c</sup>		
A.1. AR		-885.061	-952.178	-1 006.597	-1 071.803	-1 134.473	-1 202.231	-1 256.851	-1 327.663	-8 836.858		-8 836.858
Excluded emissions from natural disturbances <sup>d</sup>		NO	NO	NO	NO	NO	NO	NO	NO	NO		NO
Excluded subsequent removals from land subject to natural disturbances		NO	NO	NO	NO	NO	NO	NO	NO	NO		NO
A.2. Deforestation		161.324	74.762	210.809	177.853	189.543	86.647	243.547	119.910	1 264.396		1 264.396
B.1. FM										-70 245.852		16 887.473
Net emissions/ removals		-7 670.968	-7 712.605	-7 848.796	-9 342.520	-9 533.797	-9 494.120	-9 469.170	-9 173.876	-70 245.852		
Excluded emissions from natural disturbances <sup>d</sup>		NA	NA	NA	NA	NA	NA	NA	NA	NA		NA
Excluded subsequent removals from		NO	NO	NO	NO	NO	NO	NO	NO	NO		NO

GHG source/sink activity	Net emissions/removals										Accounting parameters	Accounting quantity <sup>a</sup>	
	Base year <sup>b</sup>	2013	2014	2015	2016	2017	2018	2019	2020	Total <sup>c</sup>			
land subject to natural disturbances													
Any debits from newly established forest		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA
FMRL <sup>e</sup>												-7 950.000	
Technical corrections to FMRL												-2 941.666	
FM cap												31 949.490	16 887.473

<sup>a</sup> The accounting quantity is the total quantity of units to be issued or cancelled for a particular activity.

<sup>b</sup> Net emissions and removals from CM, GM, RV and/or WDR, if elected, in the Party's base year as established in decision 9/CP.2.

<sup>c</sup> Cumulative net emissions and removals for all years of the commitment period reported in the annual submission under review.

<sup>d</sup> The Party decided not to exclude emissions and subsequent removals from natural disturbances in its accounting for the 2022 annual submission.

<sup>e</sup> As inscribed in the appendix to the annex to decision 2/CMP.7 in kt CO<sub>2</sub> eq per year.

3. Table I.6 provides an overview of key data from Bulgaria's reporting under Article 3, paragraphs 3–4, of the Kyoto Protocol.

Table I.6

**Key data for Bulgaria under Article 3, paragraphs 3–4, of the Kyoto Protocol from its 2022 annual submission**

<i>Parameter</i>	<i>Data</i>
Periodicity of accounting	(a) AR: commitment period accounting (b) Deforestation: commitment period accounting (c) FM: commitment period accounting (d) CM: not elected (e) GM: not elected (f) RV: not elected (g) WDR: not elected
Elected activities under Article 3, paragraph 4, of the Kyoto Protocol	None
Election of application of provisions for natural disturbances	Yes, for AR and FM
3.5% of total base-year GHG emissions, excluding LULUCF	3 993.686 kt CO <sub>2</sub> eq (31 949.490 kt CO <sub>2</sub> eq for the duration of the commitment period)
Cancellation of AAUs, CERs and ERUs and/or issuance of RMUs in the national registry for:	
1. AR	Issue 8 836 858 RMUs
2. Deforestation	Cancel 1 264 396 units
3. FM	Cancel 16 887 473 units

*Note:* Values in this table reflect the accounting quantities for activities under Article 3, para. 3, and FM and any elected activities under Article 3, para. 4, of the Kyoto Protocol as reported in table I.5.

## Annex II

### Information to be included in the compilation and accounting database

Tables II.1–II.8 include the information to be included in the compilation and accounting database for Bulgaria. Data shown are from the Party's annual submission, including the latest revised estimates submitted, adjustments (if applicable) and the final data to be included in the compilation and accounting database.

Table II.1

#### Information to be included in the compilation and accounting database for 2020, including on the commitment period reserve, for Bulgaria

(t CO<sub>2</sub> eq)

	<i>Original submission</i>	<i>Revised submission</i>	<i>Adjustment</i>	<i>Final value</i>
<b>CPR</b>	<b>200 651 385</b>			<b>200 651 385</b>
<b>Annex A emissions</b>				
CO <sub>2</sub>	36 967 113			36 967 113
CH <sub>4</sub>	5 733 602			5 733 602
N <sub>2</sub> O	4 760 571			4 760 571
HFCs	1 704 486			1 704 486
PFCs	10			10
Unspecified mix of HFCs and PFCs	NO, NA			NO, NA
SF <sub>6</sub>	19 840			19 840
NF <sub>3</sub>	NO, NA			NO, NA
<b>Total Annex A sources<sup>a</sup></b>	<b>49 185 624</b>			<b>49 185 624</b>
<b>Activities under Article 3, paragraph 3, of the Kyoto Protocol</b>				
AR	–1 327 663			–1 327 663
Deforestation	119 910			119 910
<b>FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol</b>				
FM	–9 173 876			–9 173 876

<sup>a</sup> The sum of the values for the individual gases and groups of gases may not match the total owing to rounding.

Table II.2

#### Information to be included in the compilation and accounting database for 2019 for Bulgaria

(t CO<sub>2</sub> eq)

	<i>Original submission</i>	<i>Revised submission</i>	<i>Adjustment</i>	<i>Final value</i>
<b>Annex A emissions</b>				
CO <sub>2</sub>	42 255 765			42 255 765
CH <sub>4</sub>	5 825 253			5 825 253
N <sub>2</sub> O	4 904 612			4 904 612
HFCs	6 468 719			6 468 719
PFCs	12			12
Unspecified mix of HFCs and PFCs	NO, NA			NO, NA
SF <sub>6</sub>	18 261			18 261
NF <sub>3</sub>	NO, NA			NO, NA
<b>Total Annex A sources<sup>a</sup></b>	<b>59 472 624</b>			<b>59 472 624</b>
<b>Activities under Article 3, paragraph 3, of the Kyoto Protocol</b>				
AR	–1 256 851			–1 256 851
Deforestation	243 547			243 547
<b>FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol</b>				



	<i>Original submission</i>	<i>Revised submission</i>	<i>Adjustment</i>	<i>Final value</i>
FM		-9 469 170		-9 469 170

<sup>a</sup> The sum of the values for the individual gases and groups of gases may not match the total owing to rounding.

Table II.3

**Information to be included in the compilation and accounting database for 2018 for Bulgaria**(t CO<sub>2</sub> eq)

	<i>Original submission</i>	<i>Revised submission</i>	<i>Adjustment</i>	<i>Final value</i>
<b>Annex A emissions</b>				
CO <sub>2</sub>	43 616 065			43 616 065
CH <sub>4</sub>	6 072 101			6 072 101
N <sub>2</sub> O	4 892 072			4 892 072
HFCs	5 711 561			5 711 561
PFCs	14			14
Unspecified mix of HFCs and PFCs	NO, NA			NO, NA
SF <sub>6</sub>	17 993			17 993
NF <sub>3</sub>	NO, NA			NO, NA
<b>Total Annex A sources<sup>a</sup></b>	<b>60 309 807</b>			<b>60 309 807</b>
<b>Activities under Article 3, paragraph 3, of the Kyoto Protocol</b>				
AR	-1 202 231			-1 202 231
Deforestation	86 647			86 647
<b>FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol</b>				
FM		-9 494 120		-9 494 120

<sup>a</sup> The sum of the values for the individual gases and groups of gases may not match the total owing to rounding.

Table II.4

**Information to be included in the compilation and accounting database for 2017 for Bulgaria**(t CO<sub>2</sub> eq)

	<i>Original submission</i>	<i>Revised submission</i>	<i>Adjustment</i>	<i>Final value</i>
<b>Annex A emissions</b>				
CO <sub>2</sub>	47 569 757			47 569 757
CH <sub>4</sub>	6 360 788			6 360 788
N <sub>2</sub> O	4 988 971			4 988 971
HFCs	4 395 723			4 395 723
PFCs	31			31
Unspecified mix of HFCs and PFCs	NO, NA			NO, NA
SF <sub>6</sub>	17 514			17 514
NF <sub>3</sub>	NO, NA			NO, NA
<b>Total Annex A sources<sup>a</sup></b>	<b>63 332 784</b>			<b>63 332 784</b>
<b>Activities under Article 3, paragraph 3, of the Kyoto Protocol</b>				
AR	-1 134 473			-1 134 473
Deforestation	189 543			189 543
<b>FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol</b>				
FM		-9 533 797		-9 533 797

<sup>a</sup> The sum of the values for the individual gases and groups of gases may not match the total owing to rounding.

Table II.5

**Information to be included in the compilation and accounting database for 2016 for Bulgaria**(t CO<sub>2</sub> eq)

	<i>Original submission</i>	<i>Revised submission</i>	<i>Adjustment</i>	<i>Final value</i>
<b>Annex A emissions</b>				
CO <sub>2</sub>	45 484 310			45 484 310
CH <sub>4</sub>	6 481 041			6 481 041
N <sub>2</sub> O	5 007 486			5 007 486
HFCs	3 149 255			3 149 255
PFCs	23			23
Unspecified mix of HFCs and PFCs	NO, NA			NO, NA
SF <sub>6</sub>	18 747			18 747
NF <sub>3</sub>	NO, NA			NO, NA
<b>Total Annex A sources<sup>a</sup></b>	<b>60 140 863</b>			<b>60 140 863</b>
<b>Activities under Article 3, paragraph 3, of the Kyoto Protocol</b>				
AR	-1 071 803			-1 071 803
Deforestation	177 853			177 853
<b>FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol</b>				
FM	-9 342 520			-9 342 520

<sup>a</sup> The sum of the values for the individual gases and groups of gases may not match the total owing to rounding.

Table II.6

**Information to be included in the compilation and accounting database for 2015 for Bulgaria**(t CO<sub>2</sub> eq)

	<i>Original submission</i>	<i>Revised submission</i>	<i>Adjustment</i>	<i>Final value</i>
<b>Annex A emissions</b>				
CO <sub>2</sub>	48 260 534			48 260 534
CH <sub>4</sub>	6 642 250			6 642 250
N <sub>2</sub> O	4 676 442			4 676 442
HFCs	2 671 713			2 671 713
PFCs	28			28
Unspecified mix of HFCs and PFCs	NO, NA			NO, NA
SF <sub>6</sub>	18 066			18 066
NF <sub>3</sub>	NO, NA			NO, NA
<b>Total Annex A sources<sup>a</sup></b>	<b>62 269 033</b>			<b>62 269 033</b>
<b>Activities under Article 3, paragraph 3, of the Kyoto Protocol</b>				
AR	-1 006 597			-1 006 597
Deforestation	210 809			210 809
<b>FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol</b>				
FM	-7 848 796			-7 848 796

<sup>a</sup> The sum of the values for the individual gases and groups of gases may not match the total owing to rounding.

Table II.7

**Information to be included in the compilation and accounting database for 2014 for Bulgaria**(t CO<sub>2</sub> eq)

	<i>Original submission</i>	<i>Revised submission</i>	<i>Adjustment</i>	<i>Final value</i>
<b>Annex A emissions</b>				
CO <sub>2</sub>	45 266 301			45 266 301
CH <sub>4</sub>	6 610 744			6 610 744
N <sub>2</sub> O	4 574 563			4 574 563
HFCs	2 407 738			2 407 738

	<i>Original submission</i>	<i>Revised submission</i>	<i>Adjustment</i>	<i>Final value</i>
PFCs		33		33
Unspecified mix of HFCs and PFCs		NO, NA		NO, NA
SF <sub>6</sub>		16 878		16 878
NF <sub>3</sub>		NO, NA		NO, NA
<b>Total Annex A sources<sup>a</sup></b>		58 876 258		58 876 258
<b>Activities under Article 3, paragraph 3, of the Kyoto Protocol</b>				
AR		-952 178		-952 178
Deforestation		74 762		74 762
<b>FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol</b>				
FM		-7 712 605		-7 712 605

<sup>a</sup> The sum of the values for the individual gases and groups of gases may not match the total owing to rounding.

Table II.8

**Information to be included in the compilation and accounting database for 2013 for Bulgaria**(t CO<sub>2</sub> eq)

	<i>Original submission</i>	<i>Revised submission</i>	<i>Adjustment</i>	<i>Final value</i>
<b>Annex A emissions</b>				
CO <sub>2</sub>		42 678 602		42 678 602
CH <sub>4</sub>		6 665 794		6 665 794
N <sub>2</sub> O		4 124 717		4 124 717
HFCs		2 101 583		2 101 583
PFCs		39		39
Unspecified mix of HFCs and PFCs		NO, NA		NO, NA
SF <sub>6</sub>		20 419		20 419
NF <sub>3</sub>		NO, NA		NO, NA
<b>Total Annex A sources<sup>a</sup></b>		55 591 154		55 591 154
<b>Activities under Article 3, paragraph 3, of the Kyoto Protocol</b>				
AR		-885 061		-885 061
Deforestation		161 324		161 324
<b>FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol</b>				
FM		-7 670 968		-7 670 968

<sup>a</sup> The sum of the values for the individual gases and groups of gases may not match the total owing to rounding.

## **Annex III**

### **Additional information to support findings in table 2**

#### **Missing categories that may affect completeness**

The categories for which estimation methods are included in the 2006 IPCC Guidelines that were reported as “NE” or for which the ERT otherwise determined that there may be an issue with the completeness of the reporting in the Party’s inventory are the following:

- (a) 2.D.3 other – non-energy products from fuels and solvent use (CO<sub>2</sub>) (see ID# I.14 in table 3);
- (b) 3.G liming (CO<sub>2</sub>) (see ID# A.15 in table 3 and ID# A.17 in table 5);
- (c) 4 (V) wildfires on grassland (CH<sub>4</sub> and N<sub>2</sub>O) (see ID# L.18 in table 5);
- (d) 5.B.2 anaerobic digestion at biogas facilities (CH<sub>4</sub>) (see ID# W.8 in table 5).

## Annex IV

### Reference documents

#### A. Reports of the Intergovernmental Panel on Climate Change

IPCC. 2006. *2006 IPCC Guidelines for National Greenhouse Gas Inventories*. S Eggleston, L Buendia, K Miwa, et al. (eds.). Hayama, Japan: Institute for Global Environmental Strategies. Available at <http://www.ipcc-nggip.iges.or.jp/public/2006gl>.

IPCC. 2014. *2013 Revised Supplementary Methods and Good Practice Guidance Arising from the Kyoto Protocol*. T Hiraishi, T Krug, K Tanabe, et al. (eds.). Hayama, Japan: Institute for Global Environmental Strategies. Available at <https://www.ipcc.ch/publication/2013-revised-supplementary-methods-and-good-practice-guidance-arising-from-the-kyoto-protocol/>.

IPCC. 2014. *2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands*. T Hiraishi, T Krug, K Tanabe, et al. (eds.). Geneva: IPCC. Available at <https://www.ipcc.ch/publication/2013-supplement-to-the-2006-ipcc-guidelines-for-national-greenhouse-gas-inventories-wetlands/>.

IPCC. 2019. *2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories*. E Calvo Buendia, K Tanabe, A Kranjc, et al. (eds.). Geneva: IPCC. Available at <https://www.ipcc-nggip.iges.or.jp/public/2019rf/index.html>.

#### B. UNFCCC documents

##### Annual review reports

Reports on the individual reviews of the 2013, 2014, 2015, 2016, 2018 and 2020 annual submissions of Bulgaria, contained in documents FCCC/ARR/2013/BGR, FCCC/ARR/2014/BGR, FCCC/ARR/2015/BGR, FCCC/ARR/2016/BGR, FCCC/ARR/2018/BGR and FCCC/ARR/2020/BGR respectively.

##### Other

Aggregate information on greenhouse gas emissions by sources and removals by sinks for Parties included in Annex I to the Convention. Note by the secretariat. Available at <https://unfccc.int/documents/510888>.

Annual status report for Bulgaria for 2022. Available at [https://unfccc.int/sites/default/files/resource/asr2022\\_BGR.pdf](https://unfccc.int/sites/default/files/resource/asr2022_BGR.pdf).

#### C. Other documents used during the review

Responses to questions during the review were received from Detelina Petrova (Department of Climate Change Policy of Bulgaria), including additional material on the methodology and assumptions used. The following references may not conform to UNFCCC editorial style as some have been reproduced as received:

EMEP/EEA air pollutant emission inventory guidebook 2016 Technical guidance to prepare national emission inventories, European Environment Agency, Copenhagen 2016.

EMEP/EEA air pollutant emission inventory guidebook 2019 Technical guidance to prepare national emission inventories, European Environment Agency, Copenhagen 2019.

Koselov, Lazart. *Obtaining up-to-date data, scientific justifications, and calculations for the diet of sheep and pigs (digestible energy, average feed rations per day, amount of crude protein in the daily ration, percentage of nitrogen in it)*. Internal report.

Samaras and Zachariadis (2001). Validation of road transport statistics through energy efficiency calculations, *Department of Mechanical Engineering, Aristotle University, Thessaloniki Greece* p.467–491.

Zlatanov et al., Scaling issues in forest ecosystem management and how to address them with models, *European Journal of Forest Research*, Vienna 2013.

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