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Report on the individual review of the annual submission of Croatia submitted in 2020*

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 2020 annual submission of Croatia, 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 26 to 31 October 2020 remotely.

* In the symbol for this document, 2020 refers to the year in which the inventory was submitted, not to the year of publication.

Contents

Abbreviations and acronyms

AAU	assigned amount unit
AD	activity data
Annex A source	source category included in Annex A to the Kyoto Protocol
Annex I Party	Party included in Annex I to the Convention
AR	afforestation and reforestation
Article 8 review guidelines	"Guidelines for review under Article 8 of the Kyoto Protocol"
BEF	biomass expansion factor
B_o	maximum methane-producing capacity
C	carbon
CaO	calcium oxide
CBS	Croatian Bureau of Statistics
CER	certified emission reduction
CF_4	carbon tetrafluoride
CH_4	methane
CKD	cement kiln dust
CM	cropland management
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
CO_2	carbon dioxide
CO_2 eq	carbon dioxide equivalent
CP	commitment period
CPR	commitment period reserve
CRF	common reporting format
CRONFI	Croatian National Forest Inventory
C_2F_6	hexafluoroethane
DOC	degradable organic carbon
EF	emission factor
ERT	expert review team
ERU	emission reduction unit
ESD	European Union effort-sharing decision
EU	European Union
EU ETS	European Union Emissions Trading System
FAOSTAT	statistical database of the Food and Agriculture Organization of the United Nations
F-gases	fluorinated gases
FM	forest management
FMRL	forest management reference level
$Frac_{GasMS}$	fraction of managed livestock manure nitrogen that volatilizes as ammonia and nitrogen oxides for each livestock species or category
$Frac_{LeachMS}$	fraction of nitrogen input to managed soils that is lost through leaching and run-off
$Frac_{LossMS}$	fraction of total nitrogen loss from manure managed in each manure management system for each livestock species or category
GHG	greenhouse gas
GM	grazing land management
HFC	hydrofluorocarbon

HWP	harvested wood products
IE	included elsewhere
IEF	implied emission factor
IPCC	Intergovernmental Panel on Climate Change
IPCC good practice guidance	*Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories*
IPPU	industrial processes and product use
KP-LULUCF	activities under Article 3, paragraphs 3–4, of the Kyoto Protocol
KP reporting adherence	adherence to the reporting guidelines under Article 7, paragraph 1, of the Kyoto Protocol
Kyoto Protocol Supplement	*2013 Revised Supplementary Methods and Good Practice Guidance Arising from the Kyoto Protocol*
LKD	lime kiln dust
LULUCF	land use, land-use change and forestry
MCF	methane conversion factor
MgO	magnesium oxide
MMS	manure management system(s)
MSW	municipal solid waste
N	nitrogen
NA	not applicable
NCV	net calorific value
NE	not estimated
Nex	nitrogen excretion
NF_3	nitrogen trifluoride
NH_3	ammonia
NIR	national inventory report
NO	not occurring
NO_X	nitrogen oxides
N_2O	nitrous oxide
PFC	perfluorocarbon
QA/QC	quality assurance/quality control
RMU	removal unit
RV	revegetation
SEF	standard electronic format
SF_6	sulfur hexafluoride
SWDS	solid waste disposal site(s)
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	*2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands*
2006 IPCC Guidelines	*2006 IPCC Guidelines for National Greenhouse Gas Inventories*

I. Introduction

1. This report covers the review of the 2020 annual submission of Croatia, 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 26 to 31 October 2020 remotely[1] and was coordinated by Kyoko Miwa, Sohel Pasha and Roman Payo (secretariat). Table 1 provides information on the composition of the ERT that conducted the review for Croatia.

Table 1
Composition of the expert review team that conducted the review for Croatia

Area of expertise	*Name*	*Party*
Generalist	John David Watterson	United Kingdom
Energy	Yuriko Hayabuchi	Japan
	Hiroshi Ito	Japan
	Alexander Zahar	Australia
IPPU	Juan Luis Martin Ortega	El Salvador
	Newton Paciornik	Brazil
	Takuji Terakawa	Japan
Agriculture	Abdulkadir Bektas	Turkey
	Amnat Chidthaisong	Thailand
	Paulo Cornejo	Chile
LULUCF and KP-LULUCF	Pierre Brender	United Kingdom
	Agustín José Inthamoussu	Uruguay
	Midori Yanagawa	Japan
Waste	Veronica Jakarasi	Zimbabwe
	Takefumi Oda	Japan
Lead reviewers	Newton Paciornik	
	John David Watterson	

2. The basis of the findings in this report is the assessment by the ERT of the Party's 2020 annual submission in accordance with the UNFCCC review guidelines and the Article 8 review guidelines.

3. The ERT has made recommendations that Croatia resolve identified findings,[2] including issues designated as problems.[3] Other findings, and, if applicable, the encouragements of the ERT to Croatia to resolve related issues, are also included.

4. A draft version of this report was communicated to the Government of Croatia, 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 Croatia, including totals excluding and including LULUCF, indirect CO_2 emissions, and emissions by gas and by sector, and

[1] Owing to the circumstances related to the coronavirus disease 2019, the review had to be conducted remotely.
[2] Issues are defined in decision 13/CP.20, annex, para. 81.
[3] 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 2020 annual submission

7. Table 2 provides the assessment by the ERT of the Party's 2020 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 2020 annual submission of Croatia

Assessment			*Issue/problem ID#s in table 3 or 5*[a]
Date of submission	Original submission: NIR, 10 April 2020; CRF tables (version 1), 10 April 2020; SEF tables (SEF-CP1-2019 and SEF-CP2-2019), 10 April 2020		
Review format	Centralized review conducted remotely		
Application of the requirements of the UNFCCC Annex I inventory reporting guidelines and the Wetlands Supplement (if applicable)	Have any issues been identified in the following areas:		
	(a) Identification of key categories?	Yes	L.1
	(b) Selection and use of methodologies and assumptions?	Yes	E.1, E.6, E.7, I.20, I.22, I.25, I.29, I.34, I.40, I.42, I.47, A.10, A.23, A.25, A.26, L.3, L.8, L.14, L.15, L.17, L.18, L.26, W.8
	(c) Development and selection of EFs?	Yes	E.2, E.11, E.12, E.13, I.10, I.33, I.49, A.29, A.30, L.10
	(d) Collection and selection of AD?	Yes	E.5, I.6, I.23, I.37, I.39, I.48, I.50, A.6, A.15, A.17, L.11, L.13, W.3, W.8, W.12, W.14, W.15, KL.7
	(e) Reporting of recalculations?	Yes	G.11
	(f) Reporting of a consistent time series?	Yes	I.32, I.45, I.46, L.22, L.24
	(g) Reporting of uncertainties, including methodologies?	No	G.7, G.8, G.12, A.16, A.31, L.6, L.7, KL.3
	(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?[b]	Yes	I.35, I.38, I.41, I.43, I.51, A.12, A.13, A.19, A.28, L.19, W.5, W.7, KL.6
	(j) Application of corrections to the inventory?	No	

Assessment			*Issue/problem ID#s in table 3 or 5[a]*
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	The Party did not report any insignificant categories as "NE"
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?	Yes	G.1, G.2
	Have any issues been identified related to the national registry:		
	(a) Overall functioning of the national registry?	No	
	(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 standard independent assessment report?	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?	No	
	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?	Yes	KL.8, KL.10, KL.13
	(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.12
	(c) Reporting requirements of decision 6/CMP.9?	Yes	KL.9
	(d) Country-specific information to support provisions for natural disturbances in accordance with decision 2/CMP.7, annex, paragraphs 33–34?	Yes	KL.12
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	Croatia does not have a previously applied adjustment

Assessment			*Issue/problem ID#s in table 3 or 5*[a]
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?	Partly	
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?	Yes	Please refer to annex III for a list of the questions and issues to be considered during the in-country review
Question of implementation	Did the ERT list any questions of implementation?	No	

[a] Further information on the issues identified, as well as additional findings, may be found in tables 3 and 5.
[b] 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 3 May 2019,[4] and had not been resolved by the time of publication of the review report of the Party's 2018 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. The ERT noted that the individual review of Croatia's 2019 annual submission did not take place in 2019 owing to insufficient funding for the review process.

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

ID#	*Issue/problem classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
General			
G.1	National system (G.4, 2018) KP reporting adherence	Prioritize efforts and resources to implement projects on the use of higher-tier methods included in the annual improvement plans, starting with the implementation of projects to use higher tiers for key categories, and report on the implementation of these projects or their progress in the NIR, together with specific information on the related projects included in the annual improvement plans.	Addressing. Croatia still uses tier 1 methods for some key categories, for example for CO_2 emissions for category 1.A.2 (fuel combustion – manufacturing industries and construction (solid, liquid, gaseous and other fuels)) under the energy sector, and for CH_4 emissions for category 3.A (enteric fermentation) for all livestock categories under the agriculture sector (see ID# A.23 in table 5). The ERT notes that the Party has made some progress in implementing higher-tier methods for key categories; for example, a tier 2 method is now used to estimate CO_2 emissions from fuel combustion for some subcategories of energy industries. This tier 2 approach uses country-specific EFs for natural gas and hard coal, which are obtained for each plant (thermal power plants and combined heat and power plants) from verified EU ETS reports for 2013–2018. Croatia has also launched a project (LULUCF 3) that is expected to provide data that will enable the Party to move to a tier 2 methodology for the LULUCF sector in the future. From the Party's responses to the questions raised during the review, the ERT considers it evident that Croatia has the intention to move from the tier 1 methods that it still uses to estimate emissions for key categories to higher-tier methods. For some but not all categories, the Party set out in the NIR a clear summary of sector-specific improvement goals, for example, category-specific planned improvements for CH_4 emissions from enteric fermentation of domestic livestock (3.A) (NIR section 5.2.6, p.181). However, the ERT concludes that the recommendation has not yet been fully addressed as the ERT does not find in the NIR a coherent development plan covering all relevant categories and their prioritization.

[4] FCCC/ARR/2018/HRV. The ERT notes that the report on the individual inventory review of Croatia's 2019 annual submission has not been published yet. As a result, the latest previously published annual review report reflects the findings of the review of the Party's 2018 annual submission.

ID#	*Issue/problem classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
G.2	National system (G.5, 2018) KP reporting adherence	Prioritize efforts and resources to obtain all the AD and EFs needed for implementing higher-tier methods included in the annual improvement plans, starting with the implementation of projects to obtain AD and EFs for key categories, and report on the implementation of this work or its progress in the NIR, together with specific information on the related projects included in the annual improvement plans.	Addressing. Croatia reported recalculations, owing to the application of improved data, in chapter 10 of the NIR on recalculations and improvements and under the sections of relevant categories, such as the recalculation of CO_2 emissions and removals from settlements using the revised land-cover database (NIR section 6.8.5, pp.276–277). From the Party's responses to the questions raised during the review, the ERT considers it evident that Croatia has the intention to prioritize efforts and resources to obtain all the AD and EFs needed for implementing the higher-tier methods included in the annual improvement plans. For some but not all categories, Croatia set out in the NIR a clear summary of sector-specific improvement goals, for example, category-specific planned improvements for CH_4 emissions from enteric fermentation of domestic livestock (3.A) (NIR section 5.2.6, p.181). However, the ERT did not find in the NIR a summary of a complete, coherent and prioritized development plan covering the AD and EFs for the categories identified as requiring higher-tier methods. The ERT considers that a clear summary table including information on efforts to obtain the AD and EFs and the plan to implement higher-tier methods would help it to assess the Party's progress.
G.3	NIR (G.6, 2018) Transparency	Improve the documentation on methodologies and assumptions in the NIR for all subcategories for which documentation is missing, not complete or not to the necessary level of detail (e.g. (a) PFCs from aluminium production, (b) carbon stock changes from forest land, (c) cropland (mineral soils), (d) land converted to cropland, (e) land converted to grassland, (f) CH_4 from solid waste disposal, and (g) carbon stock changes from afforestation and deforestation), prioritizing key categories.	Addressing. Croatia made several improvements to the quality and detail of the documentation of methodologies and assumptions in the NIR, as recommended in the 2018 review report, as follows: (a) Section 4.4.3.2 (on aluminium production (category 2.C.3)): the information on the methodology used to estimate CO_2 and PFC emissions and on the default EFs used was made clearer, and now includes references to the EFs in the 2006 IPCC Guidelines (vol. 3, p.4.47, table 4.10 and p.4.54, table 4.15); (b) Section 6.4.1 (on forest land (category 4.A)): a methodological change was reported, whereby CO_2, N_2O and CH_4 emissions are now estimated for the total areas that were subject to forest fires; (c) Section 6.5.2.1 (on cropland remaining cropland (category 4.B.1)): the methodological information on the approach used to estimate emissions and removals associated with organic soils was presented, but there is no mention of mineral soils; (d) Section 6.5.2.2 (on land-use change to cropland (category 4.B.2)): methodological information on the land-use conversions of forest land to cropland (subcategory 4.B.2.1) was provided in section 6.5.2.2.1. No notable improvements have been made in the sections on grassland converted to cropland (subcategory 4.B.2.2, section 6.5.2.2.2) and N_2O emissions from soils in land converted to cropland (section 6.5.2.2.3); (e) Section 6.6.2.2 (on land-use change to grassland (category 4.C.2)): methodological details about the land-use conversions to grassland were presented;

ID#	*Issue/problem classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
			(f) Section 7.2.1 (on solid waste disposal (category 5.A)): three tables were added: 7.2-1 ("The total number of active and closed landfills (total landfilled waste) by the end of 2018"), 7.2-2 ("The total number of active and closed MSW landfills by the end of 2018") and 7.2-3 ("The total number of active industrial waste landfills by the end of 2018"). Section 7.2.2: methodological detail was added, specifically, figure 7.2-1, which shows data sources, AD, parameters, SWDS and the method for estimating CH_4 emissions for the source category 5.A (solid waste disposal). Section 7.2.2.1: more or clearer details on the sources of the AD were provided; (g) Section 11.3.1.1 (on a description of the methodologies and underlying assumptions used): the methodologies and assumptions used for estimating carbon stock changes in forests in areas under Article 3, paragraph 3 (AR and deforestation), and Article 3, paragraph 4 (forest management), of the Kyoto Protocol were explained. To resolve this issue, Croatia should ensure that each of the above sections refers clearly, as appropriate, to the specific relevant sections, equations, tables and figures in the 2006 IPCC Guidelines and the Kyoto Protocol Supplement used by Croatia. Where these full references are included, Croatia should make it clear in the NIR which changes have been made with respect to the previous NIRs. Additional improvements noted include: (1) section 3.2.4 (on energy industries (category 1.A.1)): a description of the tier 2 approach to calculating emissions was added; and (2) section 5.9.2 (on urea application (category 3.H)): table 5.9-1, presenting the amounts of urea applied to soils, was added.
G.4	NIR (G.7, 2018) Transparency	Include in the relevant paragraphs of the chapters on the agriculture, LULUCF and waste sectors the references to the relevant reports or documents that are indicated as references in chapter 12 of the NIR, where applicable, in the next annual submission.	Resolved. Croatia provided references in the relevant paragraphs of the sectoral chapters of the NIR to the documents contained in the reference list in the NIR. While the ERT considers that the recommendation has been addressed, ID# A.3 below indicates that the reference list in the NIR (p.444) for the agriculture sector was not updated to match the references in the text.
G.5	QA/QC and verification (G.1, 2018) Convention reporting adherence	Compile complete documentation on QA activities undertaken and the results thereof, in particular on sectoral QA activities, and report on these activities in annual submissions.	Not resolved. The ERT, after examining the information on QA/QC reported in the NIR 2018 and NIR 2020 (section 1.2.3 on the QA/QC and verification plan (pp.40–42) and the sections on sectoral QA/QC for individual categories), found only minor changes had been made in the latter report. During the review, in response to a question raised by the ERT, Croatia explained that QA activities are undertaken "through communication" with the National System Committee and through external audit of the authorized institution by employees of the Ministry of Environment and Energy. The Party indicated that it would put additional effort into improving the implementation of QA procedures, and that for future submissions it would include relevant documents elaborating

ID#	Issue/problem classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
			these procedures. The ERT welcomes the Party's plans to enhance its QA/QC procedures. However, noting that sectoral QA approaches should include the elements of good practice presented in chapter 6.8 of the 2006 IPCC Guidelines (vol. 1), the ERT considers that Croatia should provide in its annual submissions a clear summary of the sectoral QA work done and results of that work.
G.6	QA/QC and verification (G.2, 2018) Convention reporting adherence	Document in the NIR, at least for key categories or categories where significant methodological changes and data revisions occurred, the QC activities conducted and their outcomes, and improve the documentation on the process and data management for estimating emissions.	Not resolved. Croatia reported on QC activities at the category level; however, the information is often limited to references to general checks. The information on the QC activities conducted and their outcomes for key categories or categories for which significant methodological changes and data revisions had been made is not reported, and no improvements to the documentation of the process and data management for estimating emissions have been made in the NIR 2020 compared with the NIR 2018. During the review, in response to a question raised by the ERT, the Party explained that it is continuously working on improving this documentation. The ERT welcomes the Party's plans to enhance its documentation.
G.7	Uncertainty analysis (G.3, 2018) Convention reporting adherence	Update the uncertainty estimates for the LULUCF sector for those categories where improvements have been implemented since 2013 and report on the results of these actions in the next annual submission.	Not resolved. Croatia did not report in the NIR on the results of its work to update the uncertainty estimates for those categories of the LULUCF sector. The uncertainty estimates for the LULUCF sector currently used by Croatia are based on the results of a workshop held in 2013. During the review, in response to a question raised by the ERT, Croatia indicated that a project aiming to derive a detailed description and calculate the uncertainty of all input parameters as well as to provide the basis for key source analyses at the carbon pool level for each (sub)category would be started in 2021. The Party also indicated that the results of this project, manifested as improvements in uncertainty estimation, would be implemented for future submissions. See ID#s L.6, L.7 and KL.3 below.
G.8	Uncertainty analysis (G.3, 2018) Convention reporting adherence	Provide in the NIR information on underlying assumptions and methods, including documentation on the experts' uncertainty estimates in the IPPU and waste sectors.	Not resolved. The ERT, after examining the uncertainties assigned to the AD and EFs for the IPPU and waste sectors in the NIR 2018 and the NIR 2020 (annex 2), found no material differences between the two sets of uncertainties. During the review, the Party indicated that changes in the uncertainties were reported at the category level in the NIR; however, the ERT could not find differences in the uncertainties assigned.
Energy			
E.1	1.A Fuel combustion – sectoral approach – gaseous, liquid and solid fuels – CO_2	Implement as a priority the improvement projects for the energy sector that are included in the improvement plan for the Party's GHG inventory, addressing the methodological approach used for	Addressing. Croatia applied the results of the project reported in the NIR 2018 as the improvement plan for CO_2 emissions for subcategories 1.A.1.a.i and 1.A.1.a.ii and calculated the emissions using country-specific EFs for natural gas and hard coal, which were obtained for each plant from verified EU ETS reports for 2013–

ID#	*Issue/problem classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
	(E.10, 2018) Accuracy	emission estimates for key categories in accordance with the 2006 IPCC Guidelines, or if the Party is not able to fully implement a given project to address, for example, recommendations contained in ID#s E.2, E.3 and E.4 in the 2018 annual review report, document in the NIR the progress made in implementing the project, including any delays.	2018. For 1990–2012, average EFs based on verified reports were used (NIR p.82). Croatia also developed EFs for coal and gas under category 1.A.1.a (see ID# E.3 below). During the review, the Party informed the ERT that a project analysing the energy balance for category 1.A.2 (manufacturing industries and construction) in 1990–2003 had been completed and the results were available and would be implemented for the 2021 submission. The Party also clarified that a project for determining country-specific CO_2 EFs for subcategory 1.A.1.b (petroleum refining) was planned to be launched in 2021 and the results implemented for the 2022 submission. For other categories, the projects referred to in the recommendation are regarded by the Party as long-term goals and therefore they do not have specific implementation dates. The ERT considers that the recommendation has not yet been resolved because Croatia has not implemented as a priority the previously listed improvement projects for the energy sector addressing the methodological approaches used for emission estimates for key categories, in accordance with the 2006 IPCC Guidelines.
E.2	1.A Fuel combustion – sectoral approach – gaseous fuels – CO_2 (E.11, 2018) Accuracy	Check the CO_2 EFs for natural gas from the countries of origin for this imported natural gas, and on that basis estimate a weighted average country-specific EF and use it for emission estimates of CO_2 from natural gas consumption.	Not resolved. Croatia did not provide the information on the CO_2 EFs for imported natural gas in the NIR. During the review, Croatia clarified that it would add this issue to its improvement plan for 2021 as a long-term goal.
E.3	1.A.1.a Public electricity and heat production – liquid fuels – CO_2 (E.2, 2018) (E.15, 2016) (E.15, 2015) Accuracy	Estimate country-specific CO_2 EFs and use such EFs to estimate CO_2 emissions from public electricity and heat production.	Resolved. Croatia explained in the NIR 2019 (p.86) that it had completed a project on developing national CO_2 EFs for this subcategory (1.A.1.a) for 1990–2017. The ERT considers that the recommendation has indeed been resolved for 2019 and onward. As a result of this project, seven country-specific EFs for coal and gas were developed: four in subcategory 1.A.1.a.i and three in 1.A.1.a.ii. In the NIR 2020, the EFs were applied for 1990–2018. The recalculation resulted in reduced emissions: 1.24 per cent lower in 2016 and 0.8 per cent lower on average in 1990–2016.
E.4	1.A.2 Manufacturing industries and construction – gaseous, liquid and solid fuels – CO_2, CH_4 and N_2O (E.3, 2018) (E.8, 2016) (E.8, 2015) (22, 2014) Convention reporting adherence	Take steps to ensure the consistency of the AD for fuel use in manufacturing industries and construction.	Resolved. Croatia reported in the NIR (p.58) that the national energy balance was used for calculating emissions for this category for 1990–2018. During the review, the Party clarified that, when calculating the inventory for its 2019 submission, it carried out consistency checks between the AD for energy consumption used for the emission estimates reported in the CRF tables and the data presented in the national energy balance for 2001–2017, and no inconsistencies were found. The ERT has found no inconsistencies in the NIR 2020 and therefore considers that the issue of the apparent inconsistencies between the fuel balance and the energy consumption reported in CRF table 1.A(a) for fuel use in manufacturing industries and construction, first identified in the 2016 review report (FCCC/ARR/2016/HRV, ID# E.8), has been resolved.

ID#	*Issue/problem classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
E.5	1.A.2 Manufacturing industries and construction – gaseous, liquid and solid fuels – CO_2, CH_4 and N_2O (E.4, 2018) (E.16, 2016) (E.16, 2015) Comparability	Distribute fuel consumption and emissions from the generation of electricity and heat in manufacturing industries and construction for 1990–2000 in accordance with the detailed industrial split for stationary combustion provided in the 2006 IPCC Guidelines.	Not resolved. Croatia continues to report emissions for 1990–2000 for category 1.A.2 not divided by the appropriate industrial branches. During the review, Croatia explained that the project on improving calculations of the GHG and air pollutant emissions for the category manufacturing industries and construction for 1990–2003 and 2013 was completed. The Party provided the ERT with the report of the project published by the Energy Institute Hrvoje Požar in January 2020 and explained that the results would be implemented in the 2021 submission.
E.6	1.A.2.a Iron and steel – gaseous fuels – CO_2 (E.12, 2018) Accuracy	Remove the amount of natural gas used as a feedstock for steel production from the subcategory 1.A.2.a (iron and steel) and correspondingly revise its CO_2 emission estimates for iron and steel production by ensuring that no double counting of emissions from natural gas consumption occurs for the entire time series, in accordance with the 2006 IPCC Guidelines.	Not resolved. Croatia reported in the NIR (p.111) that emissions from the consumption of certain fuels (e.g. coke and coal) used as feedstock in various production processes are allocated to the energy sector because they have been accounted for as fuel consumption in the national energy balance. Moreover, the Party explained that, given there is no accurate information to disaggregate emissions between energy and process use, it avoids double counting by accounting CO_2 emissions from the consumption of coke, coal and other reducing agents used in cement production and in the iron and steel industry as fuel consumption and reporting them in the energy sector (category 1.A.2 (manufacturing industries and construction)) (NIR pp.58–59) (see also ID#s I.22 and 1.25 below). During the review, the Party further explained that it is currently only possible to calculate these emissions in aggregate from the national energy balance. Therefore, Croatia did not agree with moving the emissions to the IPPU sector, especially taking into consideration that they had been moved to the energy sector in accordance with the recommendation from the previous ERT, and stated that if it were to report this component of fuel consumption in the IPPU sector, a significant difference between the reference and the sectoral approach would result. The ERT considers that the explanation provided by the Party is not satisfactory, noting that CRF tables 1.A(c) and 1.A(d) provide the means to show the reason for the difference between the reference and the sectoral approach. The ERT notes that the Party's approach is not in accordance with the approach indicated in the 2006 IPCC Guidelines (vol. 3, box 1.1), namely, that CO_2 and CH_4 emissions from iron and steel production, including sinter production, are considered industrial process emissions and should be reported as such, which was the basis for the recommendation from the previous ERT. Therefore, the ERT considers that the recommendation has not yet been resolved, because while the Party has addressed the issue of double counting, it has not done so in a way that accords with the 2006 IPCC Guidelines (vol. 3, box 1.1).The ERT also considers that, even if a significant difference between the reference and the sectoral approach were to result from accounting all of the relevant emissions in aggregate under the IPPU sector, this difference would nevertheless be justified by the approach being in accordance with the 2006 IPCC Guidelines.

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E.7	1.A.2.g Other (manufacturing industries and construction) – gaseous, liquid and solid fuels, other fossil fuels and biomass – CO_2, CH_4 and N_2O (E.13, 2018) Comparability	Report emissions from cement production under subcategory 1.A.2.f (non-metallic minerals), not under 1.A.2.g.v (construction).	Not resolved. Croatia reported emissions from cement production under subcategory 1.A.2.g.v (construction). During the review, the Party clarified that the recommendation would be implemented for the 2021 submission, along with the results of a project analysing the energy balance for industry in 1990–2003 for category 1.A.2 (manufacturing industries and construction). See also ID# E.1 above.
E.8	1.A.3.b Road transportation – gaseous and liquid fuels – CO_2 and N_2O (E.14, 2018) Transparency	Confirm that there are no estimation problems in the COPERT model applied for emission estimates from road transportation, and report on the reasons for inter-annual variability in model outputs in the subsequent annual submissions, in particular those for CO_2 emissions and the IEFs for N_2O.	Resolved. Croatia reported that N_2O emissions were calculated using COPERT 5, and that vehicle categorization under all subcategories is more detailed in COPERT 5 than in COPERT 4 (NIR pp.90–91). Regarding the fluctuation in the IEFs for N_2O emissions for 1995–2006 queried by the previous ERT, the Party reported that these were directly correlated with fluctuations in the sulfur content of gasoline, which was based on data provided by INA (a Croatian oil and gas company), and that, once the sulfur content was held constant, there was no inter-annual variability (NIR pp.91–92). During the review, the Party explained that a detailed analysis of IEFs for N_2O emissions had been conducted some years ago, and that the results would be reported in a future NIR. It stated that a new analysis of N_2O fluctuations would be undertaken for a future NIR submission. The ERT considers that the issue of inter-annual variability in N_2O IEFs has been resolved because the variation was not caused by an estimation problem with COPERT and because the IEFs for the N_2O emissions reported in the 2020 submission no longer show this variation. For the issue concerning CO_2 emissions, see ID# E.9 below.
E.9	1.A.3.b Road transportation – gaseous and liquid fuels – CO_2 (E.14, 2018) Transparency	Ensure that CO_2 emissions estimated using the COPERT model are fully consistent with CO_2 emissions calculated using fuel consumption from statistics and explain any differences in the NIR.	Resolved. Croatia used a tier 1 (top-down) approach for estimating CO_2 emissions from liquid and gaseous fuels for the 2020 submission. In the NIR, the Party reported that CO_2 emissions for the whole time series were calculated on the basis of the amount of fuel consumed by type, as derived from the national energy balance. Only emissions of CH_4 and N_2O were calculated using COPERT 5, because the corresponding EFs depend on vehicle technology and operating characteristics and fuel type. In the NIR, Croatia reported a comparison of emissions calculated using a tier 1 approach and the COPERT model; for CO_2 emissions from liquid fuels, there was a difference of 0.57 per cent for combined CO_2 emissions from gasoline and diesel oil in 2013 (comprising a difference for gasoline of +3.53 per cent and a difference for diesel oil of –1.06 per cent) and a less than 1 per cent difference in the fuel balance. The ERT considers the recommendation to have been resolved because the CO_2 emission estimates calculated using a tier 1 approach based on the fuel consumption statistics and COPERT do not show significant gaps, and the

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			estimation using a tier 1 approach was done in line with the 2006 IPCC Guidelines (vol. 3, section 3.2.1). See also ID# E.8 above.
E.10	1.A.4.b Residential – gaseous, liquid and solid fuels and biomass – CO_2 (E.15, 2018) Consistency	Ensure time-series consistency in subcategory 1.A.4.b (residential) by obtaining accurate data on energy consumption from 2014 to the latest reported year and, if this is not possible, use appropriately the splicing techniques recommended by the 2006 IPCC Guidelines.	Resolved. Croatia reported that the national energy balance was used to obtain energy consumption data, including for biomass consumption, for the entire period 1990–2018 (NIR p.62). The extrapolation techniques used in the 2018 annual submission for estimating emissions for this category for 2014 onward are no longer used. The ERT noted large variations in CO_2 emissions from year to year for this subcategory (1.A.4.b), particularly in relation to emissions from biomass, but also in relation to gaseous fuels. For example, CO_2 emissions from biomass decreased by 12.0 per cent in 2014 compared with 2013 and increased by 14.7 per cent in 2015 compared with 2014. During the review, in response to a question raised by the ERT, the Party confirmed that the energy consumption data reported in the NIR are consistent with the fuel consumption for all fuels specified in the energy balance for the whole time series. Further, the Party explained that fuel consumption in the household sector in Croatia mostly depends on the number of heating days, and that if the year is cold, fuel consumption is higher. The ERT considers that this explanation resolves the issue.
E.11	1.B.2.b Natural gas – gaseous fuels – CO_2 (E.16, 2018) Accuracy	Strive to develop a country-specific CO_2 EF for 1.B.2.b.3 (natural gas – processing) (considering that CO_2 emissions from 1.B.2.b (natural gas) is a key category), taking into account data on CO_2 scrubbing provided by gas field and plant operators and, if this is not possible, use the IPCC CO_2 EF default values, avoiding the double counting of emissions from scrubbing under natural gas processing for the entire time series, and report the revised estimates of CO_2 emissions from 1.B.2.b.3 (natural gas – processing).	Addressing. Croatia reported in the NIR 2019 (pp.111–112) that while it had estimated emissions from scrubbing using a tier 1 approach based on the total amount of natural gas produced and a default EF from the 2006 IPCC Guidelines (vol. 2, table 4.2.4), in its reporting it had additionally included CO_2 emissions provided by scrubbing plant operators, leading to double counting of CO_2 emissions for subcategory 1.B.2.b.3 (natural gas – processing). This double counting had been avoided in recalculating emissions for the 2019 submission. The ERT noted that the same method and default EFs were used for the 2020 submission. Recalculations resulted in reduced CO_2 emissions for subcategory 1.B.2.b: 26.86 per cent lower in 2016 and 15.19 per cent lower in 1990. The ERT considers that the second part of the recommendation was resolved in the NIR 2019 (pp.111–112), where the corrective action taken by the Party is clearly explained. However, the first part of the recommendation has not been resolved. The Party has not explained why it has not been possible for it to develop a country-specific CO_2 EF for subcategory 1.B.2.b.3 by taking into account data on CO_2 scrubbing provided by gas field and plant operators, considering that CO_2 emissions for 1.B.2.b is a key category for the Party.
IPPU			
I.1	2. General (IPPU) – CO_2 and N_2O (I.9, 2018) Transparency	Include in the NIR a transparent description of the system established for using emission data from EU ETS reports for the national GHG inventory, including a clarification of the entities responsible	Resolved. Croatia reported in its NIR (pp.46–47) a description of the system established for using emission data from EU ETS reports. Representatives of the energy, manufacturing and aviation industries have an obligation to monitor GHG emissions in their installations and submit an annual emission report to the competent authority. These reports are verified by accredited independent verifiers.

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		and their related responsibilities, as well as data flows between them.	
I.2	2. General (IPPU) – CO_2 and N_2O (I.9, 2018) Transparency	Include in the NIR a brief description of the AD, EFs, methods and assumptions used for preparing emission data for the EU ETS reports for categories 2.A.1, 2.A.2, 2.A.3, 2.A.4, 2.B.1, 2.B.2 and 2.C.1, and specify which emissions sources are reported under the different IPPU categories. Clearly identify, for each category of the IPPU sector, when the emission data from EU ETS reports started to be used and how time-series consistency was ensured.	Resolved. Croatia reported in its NIR (p.47) that it has been participating in the EU ETS since 2013 and that the EU ETS covers data for the following categories of the IPPU sector: pig iron or steel (2.C.1), cement clinker (2.A.1), lime (2.A.2), glass (2.A.3), ceramic products (2.A.4.a), carbon black (2.B.8.f), nitric acid (2.B.2) and NH_3 (2.B.1). Descriptions of the AD, EFs, methods and assumptions for each category are included in the appropriate sections of the NIR.
I.3	2. General (IPPU) – SF_6 (I.10, 2018) Convention reporting adherence	Correct the error in NIR table ES.3.2-6, ensuring that emissions reported in this table are consistent with the SF_6 emissions reported in CRF table summary 2 and sectoral CRF tables and within the NIR.	Not resolved. Croatia did not correct NIR table ES.3.2-6; SF_6 emissions reported in this table are still inconsistent with the SF_6 emissions reported in CRF table summary 2, sectoral CRF tables and the textual part of the NIR. In NIR table ES.3.2-6, SF_6 emissions for 2018 are reported as 0.0 kt CO_2 eq, while in CRF table summary 2, SF_6 emissions of 5.53 kt CO_2 eq are reported. During the review, the Party informed the ERT that this table would be corrected in its 2021 submission.
I.4	2. General (IPPU) – CO_2 and N_2O (I.11, 2018) Transparency	Provide in the NIR explanations of the inconsistencies between emission data reported in the CRF tables and those reported in the EU ETS reports, for each category, owing to different classifications of emission categories.	Addressing. Croatia included in its NIR, for each category for which data from the EU ETS are used, information on how the data are obtained and how the emissions are allocated among sectors. The ERT considers that the recommendation has not yet been fully addressed because the Party has yet to improve the transparency of the tables in annex 5-6 to the NIR by clearly explaining for each category the reason for the differences between the emissions reported under the EU ETS and those reported in the CRF tables.
I.5	2.A.1 Cement production – CO_2 (I.12, 2018) Transparency	Provide in the NIR relevant information on the EFs applied and AD of clinker production that have not been corrected using the CKD factor.	Resolved. Croatia reported in its NIR (pp.114–118) the EFs applied (instead of the IEFs that were reported erroneously in the previous submission) and AD for clinker production that had not been corrected using the CKD factor. The unnecessary information that was previously reported, but not used in the inventory estimates, has been removed.
I.6	2.A.1 Cement production – CO_2 (I.13, 2018) Accuracy	Provide information in the NIR on carbonate and non-carbonate sources of CaO used for cement production, and confirm that all sources of CaO are correctly included in the estimation of emissions in accordance with the 2006 IPCC Guidelines.	Addressing. Croatia reported transparent information on carbonate and non-carbonate sources of CaO used for cement production in its NIR (pp.114–116). For example, it reported that the most prevalent carbonate raw materials for clinker production in the country are limestone, marl and bauxite, while the most commonly used non-carbonate CaO and MgO sources are slag, quartz sand, fly ash and certain types of waste (e.g. ceramic, brick and tile waste). However, the Party noted that non-carbonate sources of CaO and MgO are at this time only partially included in the calculations; that is, only for one plant and before 2000. For this plant, the rest of the time series (i.e. the CaO and MgO contribution from non-

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			carbonate sources for 1990–2000) was estimated on the basis of the arithmetic mean (average) of the available data for the years after 2000. For other plants it was assumed that they did not use non-carbonate sources for clinker production in 1990–2012. During the review, the Party informed the ERT that a project that will include additional investigation and collection of all available, consistent AD for non-carbonate sources of CaO and MgO for the whole time series is being developed and that all data gaps will be estimated in collaboration with experts from the cement industry. The results of the project will include revised emission estimates, which will be included in future submissions, and all revised information on AD, EFs, methods and assumptions used for estimating emissions will be included in the NIR (most likely starting from the 2022 submission) together with revised uncertainty estimates for this category. The ERT considers that the recommendation has not yet been fully addressed because the Party has estimated only partially the non-carbonate sources of CaO. As such, accuracy and time-series consistency issues remain. The ERT could not assess the accuracy of the calculations owing to confidentiality constraints (i.e. the detailed data could not be made available to the ERT during the review).
I.7	2.A.1 Cement production – CO_2 (I.14, 2018) Transparency	Provide explanations in the NIR for the significant increase in the fraction of Portland clinker used for Portland cement production from 0.736 to 0.866–0.923 in 2011–2016, or provide in the NIR corrected data on Portland clinker and Portland cement production as well as the fraction of Portland clinker used for Portland cement production and revise the estimates of CO_2 emissions from cement production in accordance with corrected AD, if necessary.	Resolved. Croatia used tier 2 and tier 3 methods to estimate and report CO_2 emissions from cement production. In its NIR 2020, Croatia did not include any data on cement production or on the fraction of clinker used in cement production that are not used in the methodology. As such, the recommendation is no longer relevant. The transparency of the description of the category, methodologies, AD and EFs has significantly improved.
I.8	2.A.1 Cement production – CO_2 (I.15, 2018) Convention reporting adherence	Justify the choice of the uncertainty value of 2 per cent for the default CKD value or revise the uncertainty analysis using a default value from the range provided in the 2006 IPCC Guidelines (25–35 per cent), including a suitable justification.	Resolved. Croatia reported in its NIR (p.117) that uncertainty estimates associated with AD and EFs amount to 2 per cent according to the default values in the 2006 IPCC Guidelines (vol. 3, pp.2.16–2.17 and table 2.3) for a tier 2 method.
I.9	2.A.2 Lime production – CO_2 (I.16, 2018) Accuracy	Estimate emissions from 2.A.2 (lime production) in accordance with the tier 2 methodology of the 2006 IPCC Guidelines, taking into account the LKD correction factor and hydrated lime production for 1990–2011.	Resolved. Croatia reported in its NIR (pp.118–119) that all production data used in the calculations, including for 2013 onward for which the emission data and methodologies used are taken from the EU ETS annual emission reports, refer to total non-hydrated lime produced in each factory and, as such, it was not necessary to apply the correction factor for hydrated lime. The NIR (p.119) also states that only one of the factories (including a pig iron manufacturer) producing lime uses a rotary kiln, but all LKD in this factory is returned to the kiln. The other factories

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			use vertical shaft kilns that generate negligible amounts of LKD; therefore, a correction factor for LKD was not used in the calculations for any of the factories.
I.10	2.A.2 Lime production – CO_2 (I.17, 2018) Accuracy	Revise the calculation of EFs for lime production taking into account working plants only and the mass of lime produced by each plant, and revise the CO_2 estimates for category 2.A.2 (lime production) for 1990–2011 using the correct EFs.	Addressing. Croatia reported in its 2019 submission recalculations of CO_2 emissions from lime production for 1990–2016 owing to the application of plant-specific EFs and revised input data (NIR 2019, p.124). Further, the Party reported in its NIR 2020 (pp.122–123) that CO_2 emissions from lime production were recalculated for 1991–2017. It also reported that all data related to lime production in sugar refineries were further investigated and, as a result, the Party established that no sugar plants produce CO_2 emissions that are released into the air; therefore, these plants were excluded from the emission calculations. Further, the Party reported that it had requested additional verification of all historical data from lime factories in the country, resulting in minor adjustments being made to the emission calculations for the three lime factories for 2005–2010. Recalculations resulted in a significant reduction in CO_2 emissions, particularly for 2001–2010 (an average reduction of 21.4 per cent). The ERT recognizes the effort the Party has made to improve its estimates but could not assess the accuracy of the calculations owing to confidentiality constraints (i.e. the detailed data could not be made available to the ERT during the review week).
I.11	2.A.2 Lime production – CO_2 (I.18, 2018) Convention reporting adherence	Provide consistent information on CO_2 emission data for category 2.A.2 (lime production) in NIR figure 4.2-2 and CRF table 2(I).	Resolved. Although figure 4.2.2 is no longer included in the NIR, all numerical information presented in the NIR tables (pp.120–122) is now consistent with CRF table 2(I).
I.12	2.A.3 Glass production – CO_2 (I.19, 2018) Transparency	Improve the description of the methods applied for estimating CO_2 emissions for category 2.A.3 (glass production) by including in the NIR information on the AD of carbonate sources for glass production and the EFs applied.	Resolved. Croatia reported detailed information on the methods applied to obtain AD for total carbonate sources and the EFs applied (NIR pp.123–126). The amount of each carbonate source used was not provided owing to confidentiality reasons (only two glass production plants operate in the country).
I.13	2.A.4 Other process uses of carbonates – CO_2 (I.20, 2018) Accuracy	Collect and revise the AD on soda ash consumption for 2016 using available plant-level data in the next annual submission and make all the necessary efforts in subsequent years to collect AD in a timely manner from companies/plants that use soda ash for estimating CO_2 emissions for category 2.A.4 (other process uses of carbonates), using actual data instead of extrapolated data.	Resolved. Croatia estimated CO_2 emissions from other uses of soda ash on the basis of national statistical data on the consumption of this carbonate for the whole time series including 2016, which was estimated by extrapolation for the 2018 submission. The Party reported in the NIR (p.129) that AD for 1990–1991 were taken from national statistics on soda ash use. The amount used in glass production was subtracted from these statistics. AD for the years since 1992 were taken from national statistics on import and export, and again soda ash use in glass production was subtracted from them. Because there is no production of soda ash in Croatia, it is assumed that all imported and not exported quantities are consumed in the same year. The ERT agrees with this approach.

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			During the review, the Party informed the ERT that an extensive investigation of data on the other uses of soda ash had been conducted since the previous submission, and that information obtained from soap and detergent manufacturers shows that all soda ash in their plants is used in a closed system, with dry mixing, and that no CO_2 emissions are released into the air. Given there are no other facilities in Croatia identified as reporting under this subcategory (2.A.4.b), emissions for this subcategory will be reported as "NO" in the next submission. The ERT notes that this approach is not in accordance with the 2006 IPCC Guidelines (vol. 3, chap. 2, p.2.33) because of the multiple uses of soda ash, most of them emissive, and may lead to a completeness issue. The ERT considers that the correct approach, if the Party identifies a non-emissive use, is to estimate the soda ash used at those plants and subtract that amount from the total consumption of soda ash in the country.
I.14	2.A.4 Other process uses of carbonates – CO_2 (I.22, 2018) Completeness	Estimate CO_2 emissions from the calcination of carbonates contained in clay used for ceramics production for 1990–2011 under category 2.A.4.a (other process uses of carbonates – ceramics) in accordance with the UNFCCC Annex I inventory reporting guidelines and the 2006 IPCC Guidelines.	Resolved. Croatia reported in its NIR (pp.126–132) detailed information on methodologies, AD and EFs for this category (2.A.4). Emissions for subcategory 2.A.4.a (other process uses of carbonates – ceramics) have been recalculated since the 2018 submission to include CO_2 emissions from the calcination of carbonates contained in clay, resulting in a significant increase in emissions for 1997–2011. During the review, the Party clarified that in previous submissions, different sets of data were used – both national statistics and data from producers, where available. After the 2018 submission, the statistical data were assessed as unreliable because the national classification of activities has changed over the years, and research into the statistical data has found that they may also contain the amount of the carbonate raw materials used in construction activities that do not generate CO_2 emissions (e.g. in concrete plants). In addition, an investigation performed since the 2018 in-country review, which included sending questionnaires to all producers, found that some clays used in ceramics production do not contain carbonates, and that other materials that do contain carbonates are used in production processes (e.g. dolomite sludge used in the production of ceramic tiles).
I.15	2.A.4 Other process uses of carbonates – CO_2 (I.21, 2018) Transparency	Include in CRF table 2(I).A-H a description of the AD used for estimating CO_2 emissions for subcategory 2.A.4.d (other process uses of carbonates – other).	Resolved. Croatia included a description of the AD for subcategory 2.A.4.d (other process uses of carbonates – other), which is the quantity of limestone and dolomite consumed, in CRF table 2(I).A-H.
I.16	2.B.2 Nitric acid production – N_2O (I.23, 2018) Transparency	Correctly identify in the NIR the tier 3 method applied for estimating N_2O emissions for category 2.B.2 (nitric acid production).	Resolved. Croatia reported in its NIR (p.137) that the methodology applied for estimating N_2O emissions from nitric acid production is a tier 3 methodology, which is consistent with the method used for the emission estimates for the 2020 submission.
I.17	2.B.2 Nitric acid production – N_2O	Include in the NIR technical explanations of the emission trends and declines and fluctuations in	Resolved. The emission trends and fluctuations of the N_2O IEFs were correctly described by Croatia in its NIR (pp.136–138). According to this information, the reduction in N_2O emissions seen since 2013 is a result of the use of abatement

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	(I.24, 2018) Transparency	the N_2O IEFs observed since 2013 for category 2.B.2 (nitric acid production).	technologies, and the causes of the fluctuation in emissions were technical problems associated with the operation of the installed selective catalytic reduction equipment (loss of catalyser and system reconstruction, as well as frequent shutdowns and start-ups of the plants).
I.18	2.B.2 Nitric acid production – N_2O (I.25, 2018) Transparency	Identify the measurement systems used for N_2O emission monitoring at nitric acid production plants and describe the systems clearly in the NIR.	Resolved. Croatia identified the measurement systems used for monitoring N_2O emissions in nitric acid production plants and reported the information in its NIR (p.137). The Party explained that the AD are collected by a survey of manufacturers. The production quantities are determined by a mass flowmeter, by calculations from designed production capacity or by quantities of NH_3 input, depending on the plant.
I.19	2.B.2 Nitric acid production – N_2O (I.26, 2018) Accuracy	Provide and use AD for nitric acid production corresponding to a concentration of 100 per cent of nitric acid in the NIR and CRF tables as required for the estimates in accordance with the 2006 IPCC Guidelines.	Resolved. Croatia reported in its NIR (p.138) and in CRF table 2(I).A-H the total annual production of nitric acid corresponding to a concentration of 100 per cent (e.g. 289.5 kt in 2018).
I.20	2.B.8 Petrochemical and carbon black production – CO_2 (I.4, 2018) (I.9, 2016) (I.9, 2015) Accuracy	Move from a tier 1 method to a higher-tier method for estimating CO_2 emissions from petrochemical and carbon black production, in accordance with the corresponding decision trees in the 2006 IPCC Guidelines.	Addressing. Croatia reported CO_2 emissions from carbon black production using a tier 2 method in accordance with the 2006 IPCC Guidelines and described the method in its NIR (p.141). For other subcategories of 2.B.8 (petrochemical and carbon black production), the Party used tier 1 methods for estimating CO_2 emissions. During the review, the Party clarified that the data required for using higher-tier methods for estimating these emissions are not currently available and that the majority of petrochemicals production ceased several years ago, which has consequently decreased the possibility of collecting the required data (i.e. because they would have to be collected from former producers). Croatia has recently reviewed the petrochemical and carbon black subsector and incorporated additional sources, using what it believes to be the best data currently available. The ERT considers that the recommendation has not yet been fully addressed because the Party has not moved to higher-tier methods for subcategories of 2.B.8 other than carbon black production.
I.21	2.B.8 Petrochemical and carbon black production – CO_2 (I.27, 2018) Transparency	Provide in the NIR a detailed description of category 2.B.8 (petrochemical and carbon black production), including information on the main sources of CO_2 emissions from petrochemical and carbon black production in the country, the types of product produced, the technologies applied and other relevant information.	Resolved. Croatia included in the NIR (pp.139–144) a more detailed description for this category, including information on the main sources of CO_2 emissions, types of product produced, technologies applied, methodologies applied, AD, EFs and other relevant information.
I.22	2.C.1 Iron and steel production – CO_2	Estimate CO_2 emissions from pig iron production for 1990–1993 using the tier 2 method of the 2006 IPCC Guidelines, based on available data on coke	Addressing. Croatia reported in CRF table 2(I).A-Hs2 the CO_2 emissions from pig iron production for 1990 and 1991 and explained in the NIR (p.144) that the production of pig iron was discontinued in 1992. The Party also explained that the

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	(I.28, 2018) Comparability	and coal consumption for pig iron production, and report these emissions under category 2.C.1 (iron and steel production) in the IPPU sector, and ensure that CO_2 emissions are not double counted under the energy and IPPU sectors.	CO_2 emissions were calculated using the tier 3 methodology for calculating emissions from the process use of carbonates (2006 IPCC Guidelines, vol. 3, chap. 2), that is, by multiplying the EF for each carbonate (expressed in t CO_2 released per t carbonate) and the annual consumption (mass) of each carbonate used. However, Croatia reported for this category (2.C.1) only the emissions corresponding to the limestone and dolomite inputs to the plant. Emissions corresponding to the coal and coke inputs were still reported under the energy sector. The ERT considers that the recommendation has not yet been fully addressed because the 2006 IPCC Guidelines (vol. 3, chap. 4, p.4.28) recommend that all CO_2 emissions from pig iron production should be reported in category 2.C.1.
I.23	2.C.1 Iron and steel production – CO_2 (I.29, 2018) Accuracy	Specify all sources of ferrous materials for steel production used in the country and provide this information in the NIR, and also revise the Party's CO_2 emission estimates from steel production if the ferrous charge materials were not accurately taken into account in the calculations.	Not resolved. Croatia did not report information on the sources of ferrous materials used for steel production in the country as it did in its NIR 2018. During the review, the Party clarified that following the recommendations of the ERT during the 2018 in-country review, all input data for this category (2.C.1) were investigated to the extent it was possible and that, as a result, revised data and methods for emission calculations were used in preparing the 2019 and 2020 inventories. The recalculation of steel production resulted in a significant reduction in CO_2 emissions for some years (e.g. 68.8 per cent for 2014 and 39.75 per cent for 2015). The ERT could not verify the accuracy of the estimates owing to the limited information provided in the NIR and the confidentiality constraints (i.e. the detailed data could not be made available to the ERT during the review week).
I.24	2.C.1 Iron and steel production – CO_2 (I.30, 2018) Transparency	Provide in the NIR relevant information on the technologies applied for steel production in the country and report disaggregated AD on the consumption of raw materials, electrodes and steel produced for each type of technology used for steel production.	Resolved. Croatia reported in its NIR (pp.144–149) information on methodologies, AD and EFs for the processes used for steel production in the country. The transparency of the reporting increased overall; however, the Party did not report any more disaggregated AD on the consumption of raw materials and electrodes than were reported in the NIR 2018. During the review, the Party informed the ERT that the description of the methodologies, EFs and AD reported in the NIR (section 4.4.1) are in line with confidentiality provisions approved by factories.
I.25	2.C.1 Iron and steel production – CO_2 (I.31, 2018) Comparability	Correctly allocate the estimates of CO_2 emissions from natural gas consumption for steel production emissions only to the IPPU sector in accordance with the 2006 IPCC Guidelines, and improve coordination among the IPPU and energy experts preparing the inventory.	Not resolved. Croatia did not report CO_2 emissions from natural gas consumption for steel production in the IPPU sector. In the NIR, the Party reported that all emissions from fuel used in this category (2.C.1) are allocated to the energy sector. During the review, the Party confirmed that the emissions were estimated under the energy sector in category 1.A.2 (manufacturing industries and construction – iron and steel production). The ERT considers that the recommendation has not yet been fully addressed because although the issue of potential double counting has been resolved, the Party did not report CO_2 emissions from natural gas consumption for steel production only in the IPPU sector, in accordance with the 2006 IPCC Guidelines (vol. 3, chap. 4, p.4.28).

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I.26	2.C.1 Iron and steel production – CO_2 (I.32, 2018) Transparency	Include in the NIR correct data, including units, for the NCV of natural gas used in the emission calculations for steel production.	Not resolved. Croatia did not report in its NIR information (AD and EFs) on each input to steel production, including natural gas (see ID# I.24 above), under the IPPU sector, and CO_2 emissions corresponding to natural gas input were reported under the energy sector (see ID# I.25 above).
I.27	2.C.1 Iron and steel production – CO_2 (I.33, 2018) Accuracy	Investigate which technology was used for steel production in the country from 1990 to 1991 other than electric arc furnaces (e.g. open-hearth furnaces), include relevant descriptions in the NIR, estimate CO_2 emissions from all steel produced in the country, as necessary, and include those emissions in the annual submissions.	Resolved. Croatia reported CO_2 emissions from all steel produced in the country using the corrected data for the total production of steel for 1990 and 1991 in its NIR (p.148).
I.28	2.C.2 Ferroalloys production – CO_2 (I.5, 2018) (I.4, 2016) (I.4, 2015) (40, 2014) (40, 2013) Transparency	Provide more details on the plans to increase the transparency and accuracy of the estimates by obtaining AD for ferroalloys production to replace the interpolated data for 1994–1996 and 1999–2001.	Resolved. Croatia reported in the NIR (p.150) that it has reverted to estimating CO_2 emissions from ferroalloys production using the tier 1 approach for the entire time series since the 2018 submission. During the review, the Party clarified that interpolations were performed in previous submissions for the tier 2 approach but were discarded after an investigation of the data used for the calculations showed that the available data were insufficient for applying the tier 2 approach. During the review, the Party explained that ferroalloys production in the country ceased over 15 years ago, meaning that producers are unlikely to be able to provide the more detailed AD required for the higher-tier approach. Therefore, the Party did not report more details on the plans to increase the transparency and accuracy of the estimates (see ID# I.29 below).
I.29	2.C.2 Ferroalloys production – CO_2 (I.6, 2018) (I.10, 2016) (I.10, 2015) Accuracy	Estimate CO_2 emissions from ferroalloys production using a higher-tier method, in accordance with the corresponding decision trees in the 2006 IPCC Guidelines and pursuant to decision 24/CP.19, annex I, paragraph 11.	Not resolved. Croatia reported CO_2 emissions from ferroalloys production using the tier 1 approach and explained the calculations and the rationale for using the tier 1 approach in its NIR (pp.149–152). During the review, the Party clarified that apart from data on ferroalloys production by type, only data on the consumption of the reducing agents coke from coal and coal electrodes used in ferroalloys production for 1990–1996 are available in the national statistics and that after this period, the separate data on the use of these materials in ferroalloys production are not available. Further, the Party explained that ferroalloys production in the country ceased over 15 years ago, which reduces the likelihood of being able to collect the more detailed AD required for the higher-tier approach from the producers. The ERT considers that the recommendation has not yet been addressed because the category is key, while acknowledging the difficulties the Party would have in implementing a higher-tier method.
I.30	2.C.3 Aluminium production – PFCs (I.34, 2018) Transparency	Provide in the NIR correct information on the EFs used for estimating PFC emissions for category 2.C.3 (aluminium production) with a relevant reference to the 2006 IPCC Guidelines.	Resolved. Croatia reported in its NIR (p.153) the correct values for EFs for estimating PFC emissions from aluminium production, that is, default values in the 2006 IPCC Guidelines (vol. 3, chap. 4, table 4.15): 1.6 kg/t aluminium for CF_4 and 0.4 kg/t aluminium for C_2F_6 for side-worked prebake.

ID#	*Issue/problem classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
I.31	2.C.3 Aluminium production – PFCs (I.35, 2018) Convention reporting adherence	Justify and document in the NIR the choice of uncertainty value for the EFs used for estimating PFC emissions from aluminium production, including when using default uncertainty values from the 2006 IPCC Guidelines for the corresponding default EFs.	Resolved. Croatia included in its NIR (p.153) a description of the possible uncertainty values associated with EFs for estimating PFC emissions from aluminium production. Given that the Party adopted IPCC default values for the EFs, the uncertainty values that it chose to adopt were also in line with default values in the 2006 IPCC Guidelines (–40 to +150 per cent) (vol. 3, chap. 4, table 4.15).
I.32	2.D.1 Lubricant use – CO_2 (I.36, 2018) Consistency	Revise the AD of lubricant use in the country for 1990–1998 using the splicing techniques provided in the 2006 IPCC Guidelines (vol. 1, chap. 5) and ensure the consistency of the AD time series and corresponding CO_2 emissions, and explain transparently in the NIR the reasons for the significant change in AD in 2003–2004 and, if appropriate, in other years.	Addressing. Croatia did not revise the AD for lubricant use for any year of the time series in its 2020 submission. During the review, the Party provided the ERT with the results of a project mentioned in its NIR (pp.156–157) that included separation of aggregated data on the total amount of fuel by type (lubricants, white spirit, paraffins and wax, ethane and other derivatives) for 1990–1998. The ERT considers that the recommendation has not yet been fully addressed as the results from the project were not included in the 2020 submission.
I.33	2.D.1 Lubricant use – CO_2 (I.38, 2018) Accuracy	Include in the NIR information on NCVs and data sources for the NCVs used for estimating CO_2 emissions from lubricants and paraffin waxes, and also justify the application of a lower NCV for lubricants and paraffin waxes (33.5 TJ/Gg) compared with the default NCV value provided in the 2006 IPCC Guidelines (40.2 TJ/Gg for lubricants and paraffin waxes). If the Party cannot justify the current NCV used, apply the default NCVs from table 1.2 of the 2006 IPCC Guidelines (vol. 2), and revise the emission estimates accordingly.	Addressing. Croatia reported in its NIR (pp.155–157) information on the NCVs used for lubricants as well as paraffins and waxes (33.5 TJ/Gg), which were determined by the Energy Institute Hrvoje Požar. During the review, the Party informed the ERT that it had carried out a project which included a review of the NCVs for lubricants as well as for paraffins and waxes, and an explanation of the methodology used. The Party provided the results of the project to the ERT and indicated that they would be included in the next submission. The ERT considers that the recommendation has not yet been fully addressed because changing the NCVs of paraffins and waxes to the IPCC default value (40.2 TJ/Gg) but not doing so for lubricants is not consistent and has not been justified. The ERT believes that future ERTs should consider this issue further to ensure that there is not an underestimation of emissions for this category. A follow-up for this recommendation is presented in ID#s E.12 and I.49 in table 5.
I.34	2.D.1 Lubricant use – CO_2 (I.39, 2018) Comparability	Separately estimate emissions from lubricant use for two-stroke engines and report those emissions under the energy sector, in accordance with the 2006 IPCC Guidelines.	Addressing. Croatia included emissions from lubricant use for two-stroke engines under the IPPU sector. During the review, the Party provided the ERT with the results of a project mentioned in its NIR (pp.156–157) that include: (1) separation of aggregated data on the total amount of fuel by type (lubricants, white spirit, paraffins and waxes, ethane and other derivatives) for 1990–1998; (2) separation of aggregated data on the total quantities of lubricants by type of use; and (3) review of the NCVs for lubricants, paraffins and waxes, with an explanation of the methodology used, including emission estimates. The Party confirmed that emissions from lubricant use for two-stroke engines would be reported under the energy sector in its next submission.
I.35	2.D.1 Lubricant use – CO_2	Confirm the balance of lubricants used in Croatia, as shown to the ERT during the review (50 per	Not resolved. Croatia reported in its NIR (pp.154–156) information on the methodology, AD and EFs used for estimating CO_2 emissions from lubricant use.

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	(I.40, 2018) Completeness	cent of lubricants is lost during the primary use), and report corresponding emissions from all lubricants oxidized during the primary use under the IPPU sector, from lubricants combusted for energy purposes under the energy sector and from the incineration of lubricants under the waste sector.	For its estimation, the Party used an overall (default) fraction of lubricants oxidized during use factor of 0.2. During the review, the Party provided the ERT with the results of a project mentioned in its NIR (pp.156–157) (see ID# I.32 above). However, the project did not cover an investigation of the full balance of lubricants used in Croatia, including the fraction of lubricants oxidized during primary use and the fraction of lubricants disposed of, which includes the incineration of lubricants under the waste sector.
I.36	2.D.3 Other (non-energy products from fuels and solvent use) – CO_2 (I.41, 2018) Convention reporting adherence	When estimating indirect CO_2 emissions from solvent use, road paving with asphalt and asphalt roofing in accordance with paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines, report these emissions in CRF table 6 (removing them from CRF table 2(I).A-H and using the notation key "IE" in this table) and separately in CRF tables summary 1.A, summary 2, table 8 and table 10, and include and exclude these indirect CO_2 emissions in the national totals in CRF tables summary 2 and table 10, and include in the corresponding section of the NIR (e.g. in chap. 9) information on which indirect emissions are reported in Croatia's GHG inventory as required by paragraph 29 of the UNFCCC Annex I inventory reporting guidelines.	Not resolved. Croatia reported CO_2 emissions from solvent use, road paving with asphalt and asphalt roofing in CRF table 2(I).A-H in its 2020 submission. During the review, the Party explained that it followed the recommendations of the European Commission, which indicated that EU member States that had reported indirect CO_2 emissions for this category in inventories submitted before 2015 (in the previous CRF table 3 ("Sectoral report for solvents and other products use") for the solvent and other product use sector) should continue reporting these emissions. The European Commission recommended reporting them in the current CRF table 2(l) under "2.D Non-energy products from fuels and solvent use", which includes a drop-down list in CRF Reporter under "2.D.3 other" for solvent use. It also recommended that member States that had been reporting indirect CO_2 emissions for category 2.A.5 (asphalt roofing) and 2.A.6 (road paving with asphalt) should continue reporting these emissions, doing so in CRF table 2(I) under "2.D Non-energy products from fuels and solvent use", which includes a drop-down list in CRF Reporter under "2.D.3 other" for asphalt roofing and road paving with asphalt. The ERT does not agree with that approach as it is not in accordance with the UNFCCC Annex I inventory reporting guidelines, which establish that indirect emissions of CO_2 should be included in CRF table 6 when the Party chooses to report indirect CO_2 emissions. As such, indirect CO_2 emissions resulting from emissions of precursors gases under category 2.D.3 should not be reported anymore in CRF table 2(I).A-H for all years of the time series.
I.37	2.F.1 Refrigeration and air conditioning – HFCs and PFCs (I.7, 2018) (I.5, 2016) (I.5, 2015) (41, 2014) (41, 2013) Transparency	Continue to conduct surveys on the status of disposal of refrigeration and air-conditioning equipment and include the results in the NIR.	Not resolved. Croatia did not provide any information on the surveys on the status of disposal of refrigeration and air-conditioning equipment in its NIR, and no emissions from equipment disposal were estimated. During the review, the Party informed the ERT of a project being prepared to improve the data on F-gases from product uses as substitutes for ozone-depleting substances and product manufacture and use. The Party explained that the project includes an extensive investigation and subsequent collection of accurate, consistent AD for estimating emissions from refrigeration and air conditioning (2.F.1) and its scope covers the disposal of equipment containing HFCs. The Party also explained that the project is at procurement stage, and the planned implementation period is nine months from the date of contracting. The Party further explained that the results of the project will include revised emission estimates, which will be reported in the 2022 submission,

ID#	*Issue/problem classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
			and all information on AD, EFs, methods and assumptions used for estimating HFC emissions will be reported in the NIR. (See also ID#s I.38–46 below.)
I.38	2.F.1 Refrigeration and air conditioning – HFCs (I.42, 2018) Completeness	Investigate and report in the NIR whether HFC emissions occur in the country from (1) manufacturing of equipment containing HFCs (e.g. at companies such as MD Frigo, Frigo Plus and Dolmacia Clima), (2) disposal of equipment containing HFCs (e.g. at special service centres for collection, recovery and destruction of HFCs) and (3) use of containers for the import of HFCs; and, if these emissions occur, collect relevant AD, estimate HFC emissions from manufacturing, disposal and recovery, and report these emissions under category 2.F.1 (refrigeration and air conditioning) for the whole time series.	Not resolved. Croatia did not report in its NIR new information on the manufacturing of equipment containing HFCs, disposal of equipment containing HFCs and use of containers for the import of HFCs, or estimate emissions from these sources. During the review, the Party informed the ERT that the project referred to in ID# I.37 above covers in its scope information on the manufacturing and disposal of equipment containing HFCs and the use of containers for the import of HFCs. The Party explained that the results of the project would be implemented in the 2022 submission. The ERT notes that the issue may be resolved with implementation of the ongoing project on F-gases and believes that future ERTs should consider this issue further to ensure that there is not an underestimation of emissions for this category.
I.39	2.F.1 Refrigeration and air conditioning – HFCs and PFCs (I.43, 2018) Accuracy	Collect accurate and reliable AD on HFCs used in Croatia for the remaining years of the time series (1995–2012) and for 2013 and 2015–2016, for which AD may still not be fully reliable, for each use or application under the category 2.F.1 (refrigeration and air conditioning) (i.e. commercial refrigeration, domestic refrigeration, industrial refrigeration, transport refrigeration, mobile air conditioning and stationary air conditioning). For the years in which AD are not reliable, estimate AD using the splicing techniques provided in the 2006 IPCC Guidelines and revise the HFC estimates for this category accordingly by applying the tier 2a method, ensuring the consistency of the time series. Document in detail the sources of actual AD used in the calculations of HFC emissions, the splicing techniques used for estimating missing AD and how the consistency of the time series was ensured, as well as document up-to-date information indicating that PFC emissions are not occurring in Croatia under category 2.F.1. If the latter is not possible, continue reporting PFC emissions under category 2.F.1 in accordance with	Addressing. Croatia reported in its NIR provisional recalculations implemented in its 2018 resubmission, including an update of the estimates of emissions for 2013–2016. A description of the methodology used for the recalculations implemented in response to the potential problem raised during the 2018 review was included in the NIR 2020 (p.164). No further recalculations were implemented in the 2020 submission. During the review, the Party informed the ERT of the project referred to in ID# I.37 above and explained that the results of the project would be implemented in the 2022 submission. The ERT notes that the issue may be resolved with implementation of the ongoing project on F-gases and believes that future ERTs should consider this issue further to ensure that there is not an underestimation of emissions for this category.

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		paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines.	
I.40	2.F.2 Foam blowing agents – HFCs (I.8, 2018) (I.13, 2016) (I.13, 2015) Accuracy	Estimate HFC-152a emissions in accordance with the type of foam (open cell or closed cell) where HFC-152a is used, consistent with the methodology prescribed in the 2006 IPCC Guidelines (vol. 3, chap. 7.4.2), and report such emissions under the appropriate subcategory.	Not resolved. Croatia did not report new information such as the emission estimates in accordance with the type of foam (open cell or closed cell) where HFC-152a is used in its NIR or recalculate the emissions reported in its 2018 submission. During the review, the Party informed the ERT that the project referred to in ID# I.37 above covers in its scope AD for estimating emissions from foam blowing agents (2.F.2). The Party explained that the results of the project will be implemented in the 2022 submission.
I.41	2.F.2 Foam blowing agents – HFCs (I.44, 2018) Completeness	Investigate whether closed-cell foams are imported and used in the country, noting that a list of subapplications for consideration is provided in the 2006 IPCC Guidelines (vol. 3, table 7.4). If closed-cells foams are used, estimate and report HFC emissions from the use and commissioning of closed-cell foams in the CRF tables and provide relevant information in the NIR.	Not resolved. Croatia did not include in its NIR information on whether closed-cell foams are imported and used in the country. During the review, the Party informed the ERT that the project referred to in ID# I.37 above covers in its scope the investigation of the potential use of closed-cells foams. The Party explained that all HFC emissions for this category would be estimated and reported in the CRF tables in the 2022 submission.
I.42	2.F.3 Fire protection – HFCs (I.45, 2018) Accuracy	Estimate emissions in accordance with the chosen tier 2a method of the 2006 IPCC Guidelines for all HFCs used in category 2.F.3 (fire protection) (HFC-125, HFC-227ea and HFC-236fa) and apply the correct EF for stationary fire protection systems for all years of the time series.	Not resolved. Croatia has not recalculated the emissions for this category (2.F.3) since the 2018 submission. During the review, the Party informed the ERT that the project referred to in ID #I.37 above covers in its scope AD for estimating emissions from fire protection (2.F.3). The Party explained that the results of the project would be implemented in the 2022 submission. The ERT notes that the issue may be resolved with implementation of the ongoing project on F-gases and believes that future ERTs should consider this issue further to ensure that there is not an underestimation of emissions for this category.
I.43	2.F.3 Fire protection – HFCs (I.46, 2018) Completeness	Estimate HFC emissions associated with the production, use and disposal of portable fire extinguishers (e.g. HFC-236fa) and report these emissions in the CRF tables under category 2.F.3 (fire protection), and provide relevant information in the NIR.	Not resolved. Croatia did not report in its NIR or CRF tables emissions from the use and disposal of portable fire extinguishers. During the review, the Party informed the ERT that the project referred to in ID# I.37 above covers in its scope AD for estimating emissions from portable fire extinguishers. The Party explained that the results of the project would be implemented in the 2022 submission. The ERT notes that the issue may be resolved with implementation of the ongoing project on F-gases and believes that future ERTs should consider this issue further to ensure that there is not an underestimation of emissions for this category.
I.44	2.F.4 Aerosols – HFCs (I.47, 2018) Transparency	Include information in the NIR on the AD, EFs, methods and assumptions used for estimating HFC emissions for category 2.F.4 (aerosols) in accordance with paragraph 50(a) of the UNFCCC Annex I inventory reporting guidelines.	Not resolved. Croatia did not provide additional information in its NIR. During the review, the Party informed the ERT that the project referred to in ID# I.37 above covers in its scope AD for estimating HFC emissions from aerosols (2.F.4). The Party explained that the results of the project would be implemented in the 2020 submission.

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I.45	2.G.1 Electrical equipment – SF_6 (I.48, 2018) Accuracy	Use consistent EFs for estimating SF_6 emissions for category 2.G.1 (electrical equipment), using available information from questionnaires of companies that use electrical equipment filled with SF_6, revise estimates of SF_6 emissions and report a consistent time series of SF_6 emissions.	Not resolved. Croatia did not revise its estimates for this category, including for 2013–2016 for which the ERT identified that emissions were underestimated. During the review, the Party informed the ERT that the project referred to in ID# I.37 above covers in its scope AD for estimating SF_6 emissions from electrical equipment (2.G.1). The Party explained that the results of the project would be implemented in the 2022 submission. The ERT notes that the issue may be resolved with implementation of the ongoing project on F-gases and believes that future ERTs should consider this issue further to ensure that there is not an underestimation of emissions for this category.
I.46	2.G.3 N_2O from product uses – N_2O (I.49, 2018) Accuracy	Implement the planned improvement regarding gathering accurate and consistent data on N_2O product uses to ensure the accuracy of AD and N_2O emission estimates for N_2O used in anaesthesia and aerosol cans under category 2.G.3 (N_2O from product uses), report a consistent time series of emissions in the CRF tables and provide relevant information in the NIR.	Not resolved. Croatia did not revise its AD for this category for the whole time series and as such, the inconsistency and accuracy issues identified in the previous review have not yet been resolved. During the review, the Party informed the ERT that the project which will include investigating and collecting accurate and consistent AD for the category N_2O from product uses (2.G.3) is currently being prepared. The Party explained that the results of the project would be implemented in future submissions.
Agriculture			
A.1	3. General (agriculture) – CH_4 and N_2O (A.8, 2018) Transparency	Include in the NIR a mapping table showing the relationship between the cattle population disaggregated into eight subcategories and the cattle population disaggregated into 11 non-dairy cattle subcategories and explain the approach used to aggregate cattle populations into the animal subcategories that are used for estimating CH_4 and N_2O emissions.	Resolved. Croatia explained in its NIR (p.180) that the methodology CBS uses for categorizing cattle has changed over the years from using 8 categories for 1990–1999 to 11 categories for 2000–2018. Currently, the Party characterizes cattle in the IPCC categories (Option B: mature dairy cattle, other mature cattle and growing cattle). NIR table 5.2-3 contains information on how CBS categories for cattle were reclassified into the appropriate IPCC categories (see also ID# A.6 below). Also, Croatia used the value of 0.85 per cent to extrapolate the estimated number of beef cattle for 1990–1999 for time-series consistency with 2000–2018.
A.2	3. General (agriculture) – CH_4 (A.9, 2018) Convention reporting adherence	Justify in the NIR the use of the notation key "NO" or otherwise use the notation key "NE" for reporting CH_4 emissions from enteric fermentation of poultry under category 3.A.4 (other livestock) (see ID# A.13 below), and justify in the NIR the use of the notation key "NA" or otherwise use the notation key "NE" for reporting CH_4 emissions for category 3.D (agricultural soils).	Addressing. While Croatia reported CH_4 emissions for category 3.D (agricultural soils) as "NE" for the entire time series in CRF table 3s2, in line with the recommendation, the issue with CH_4 emissions from enteric fermentation of poultry (under category 3.A.4 (other livestock)) persists. Croatia reported these emissions as "NE" for 1990–2013 and 2017–2018 and as "NO" for 2014–2016 in CRF table 3.As1. During the review, the Party clarified that the inconsistency in the use of notation keys is due to an error that arose when the Party entered data in the tables for using CRF Reporter. The ERT considers that the recommendation has not yet been fully addressed because the use of the "NO" notation key for CH_4 emissions from enteric fermentation of poultry for 2014–2016 has not been corrected in CRF table 3.As1. Further, the ERT notes that the Party did not include in the NIR its rationale for not estimating CH_4 emissions either from enteric fermentation of poultry or from agricultural soils (see ID# A.22 in table 5).

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A.3	3. General (agriculture) – CH_4 and N_2O (A.12, 2018) Transparency	Cite references in the agriculture chapter of the NIR to the sources of data used to estimate emissions in the agriculture sector, including, when possible, the web address of the source, and make specific references to years or other relevant information to make the source easy to identify.	Not resolved. Croatia did not update the reference list in the agriculture chapter of its NIR (p.444). During the review, the Party provided the ERT with the updated reference list and explained that it had not been updated for the NIR in error.
A.4	3.A Enteric fermentation – CH_4 (A.14, 2018) Accuracy	Clearly justify in the NIR the use of default EFs for developing countries for sheep and swine in 1990 and the use of interpolation, including information on relevant assumptions, or use the default EFs for sheep and swine for developed countries for the entire time series, ensuring the use of the correct EF for developed countries for swine.	Resolved. Croatia estimated CH_4 emissions from enteric fermentation of sheep (3.A.2) and swine (3.A.3) by applying default EFs for developed countries (8 kg CH_4/head/year for sheep and 1.5 kg CH_4/head/year for swine) for the entire time series (NIR p.178).
A.5	3.A.1 Cattle – CH_4 (A.15, 2018) Transparency	Report in the NIR the correct maintenance coefficients from the 2006 IPCC Guidelines (vol. 4, table 10.4) that were used to estimate CH_4 emissions from enteric fermentation of cattle.	Not resolved. Croatia changed its method for estimating CH_4 emissions from enteric fermentation of cattle from tier 2, applied in its 2018 submission, to tier 1 in its 2020 submission. Owing to the change in tier applied, the Party did not use – or report in its NIR – maintenance coefficients for estimating these emissions. Since CH_4 emissions from enteric fermentation of cattle is a key category, the choice of method used by the Party is discussed in ID# A.23 in table 5, and the ERT considers that this issue has not yet been resolved.
A.6	3.A.1 Cattle – CH_4 (A.16, 2018) Accuracy	Estimate CH_4 emissions from enteric fermentation and manure management consistently using, if appropriate, representative livestock subcategories from table 10.1 of the 2006 IPCC Guidelines (vol. 4, p.10.11) and report the results in the annual submission. Assumptions and documented expert judgment can be used where data gaps are observed (e.g. the population of other cows for 1990–1999 can be derived from the structure of the herd in 2000–2017 and it can be assumed that other cows mostly comprise beef cows).	Not resolved. Croatia changed its method for estimating CH_4 emissions from enteric fermentation of cattle from tier 2 in its 2018 submission to tier 1 in its 2020 submission. It used national data on cattle from CBS and default EFs from the 2006 IPCC Guidelines (117 kg CH_4/head/year for mature dairy cattle and 57 CH_4/head/year for other mature cattle and growing cattle). The CBS categorization of cattle changed over the years from 8 categories for 1990–1999 to 11 categories for 2000–2018; therefore, Croatia expects that the CBS categorization will be uniform across the data set over time (NIR p.180) (see also ID# A.1 above). However, the ERT noted that the change in tier method applied (from tier 2 to tier 1) led to a decrease in the estimated CH_4 emissions for cattle for the entire time series in the 2020 submission compared with those in the 2018 submission, for example by 4.8 per cent for 2007 and 17.1 per cent for 1996. The ERT believes that future ERTs should consider this issue further to ensure that emissions for this category have not been underestimated. The choice of method used by the Party is discussed in ID# A.23 in table 5, and the ERT considers that this issue has not yet been resolved.
A.7	3.A.1 Cattle – CH_4	Report the feeding situation for cattle in CRF table 3.A (e.g. stall, pasture) instead of reporting activity	Not resolved. Croatia changed its method for estimating CH_4 emissions from enteric fermentation of cattle from tier 2, applied in its 2018 submission, to tier 1 in

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	(A.17, 2018) Transparency	coefficients, and include in the NIR a description of the approach used to derive activity coefficients for estimating net energy for each activity, based on equation 10.4 of the 2006 IPCC Guidelines (vol. 4), for mature dairy and non-dairy cattle.	its 2020 submission. Owing to the change in tier applied, the Party did not implement country-specific EFs for estimating these emissions or report parameters used in deriving its country-specific EF (i.e. net energy for animal activity). Since CH_4 emissions from enteric fermentation of cattle is a key category and thus Croatia should move towards implementing a higher-tier method in line with the 2006 IPCC Guidelines (see ID# A.23 in table 5), the ERT considers that this issue has not yet been resolved.
A.8	3.B Manure management – CH_4 (A.18, 2018) Transparency	Report in CRF table 3.B(a) (sheet 1) under "allocation by climate region" appropriate data for sheep, goats, market swine and poultry under cool climate.	Resolved. Croatia corrected the allocation of its livestock populations in CRF table 3.B(a)s1, where 100 per cent of sheep, goats, market swine and poultry are now allocated to cool climate with a median temperature of 10–11 °C (NIR p.178).
A.9	3.B Manure management – N_2O (A.19, 2018) Transparency	Include in the NIR a description of the method, data and assumptions used to estimate country-specific Nex values for cattle as well as weight data and the assumptions used to derive default Nex values for other livestock categories, with supporting references, and also report Nex rates in CRF table 3.B(b) disaggregated by other mature cattle and growing cattle subcategories, as required when reporting under Option B, instead of using a single aggregated Nex rate for both above-mentioned animal subcategories.	Not resolved. Croatia changed the tier of the method applied for estimating N_2O emissions from manure management for all livestock categories from tier 2 in its 2018 submission to tier 1 in its 2020 submission. Owing to the change in tier applied, the Party did not use parameters such as gross energy intake of animals, daily N intake per head and fraction of N intake that is retained for estimating annual Nex rates; instead, it used default values for Nex rates for all livestock categories and country-specific values for typical animal mass only for cattle. Since N_2O emissions from manure management is a key category and thus Croatia should move towards implementing a higher-tier method in line with the 2006 IPCC Guidelines (see ID# A.26 in table 5), the ERT considers that this issue has not yet been resolved.
A.10	3.B.1 Cattle – CH_4 (A.21, 2018) Accuracy	Follow the guidance in the decision tree in the 2006 IPCC Guidelines (vol. 4, chap. 10, p.10.36, figure 10.3) for estimating CH_4 emissions from manure management of cattle, including the use of currently available data on gross energy and feed digestibility for estimating country-specific VS values, and report the results in the next annual submission.	Not resolved. Croatia calculated CH_4 emissions from manure management of cattle using default VS and B_o rates for Western European countries from the 2006 IPCC Guidelines (tables 10A-1 to 10A-9) and national data for MMS ratios (NIR p.182). The ERT notes that Croatia plans, as a midterm or long-term improvement, to review the methodology for developing country-specific EFs (NIR p.184).
A.11	3.B.1 Cattle – CH_4 (A.21, 2018) Transparency	Describe in the NIR the method used to estimate country-specific VS values for cattle that are either derived using equation 10.24 of the 2006 IPCC Guidelines or result from the project to improve the emission estimates in the agriculture sector.	Resolved. Croatia reported the method, VS, B_o rates and EFs used for estimating CH_4 emissions in its NIR (pp.182–183).

ID#	*Issue/problem classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
A.12	3.B.2 Sheep – CH_4 (A.22, 2018) Accuracy	Revise CH_4 emission estimates from sheep manure management for the entire time series using the correct default VS and B_o data for developed countries from table 10.A.9 of the 2006 IPCC Guidelines (0.40 kg/head/year and 0.19 m^3/kg VS, respectively) in the next annual submission.	Resolved. Croatia corrected in CRF table 3.B(a)s1 the VS and B_o values for sheep, applying default EFs for developed countries from table 10.A.9 of the 2006 IPCC Guidelines (vol. 4): 0.40 kg/head/year for B_o and 0.19 m^3/kg for VS.
A.13	3.B.4 Other livestock – CH_4 and N_2O (A.20, 2018) Completeness	Estimate CH_4 and N_2O emissions from manure management of rabbits under category 3.B.4 (other livestock) using default EFs and parameters from tables 10.16 and 10.A.9 (vol. 4, chap. 10, pp.10.41 and 10.83, respectively) and Nex value from table 10.19 (vol. 4, chap. 10, p.10.59) of the 2006 IPCC Guidelines, or ensure that the related cells in CRF tables 3, 3.A, 3.B(a) and 3.B(b) are filled in with the corresponding notation keys.	Not resolved. Croatia did not report CH_4 and N_2O emissions from manure management of rabbits under category 3.B.4 or provide a justification for not estimating these emissions in its 2020 submission. Furthermore, it used "NO" in CRF tables 3.B(a)s1 and 3.B(b) to report manure management for other animal categories. The Party did, however, report in its NIR (pp.184 and 186) that collecting AD for rabbits and estimating emissions from manure management of rabbits is part of the category-specific improvement plan. This improvement is planned to be implemented in the short-term (one year). During the review, the Party explained that the complete data set (1990–2018) for the rabbit population was not ready in time to be implemented in preparing the 2020 submission, and indicated that it would include emissions from manure management of rabbits for whole time series in its 2021 submission. The ERT notes that the issue can be resolved only with implementation of the collected data and believes that future ERTs should consider this issue further to ensure that there is not an underestimation of emissions for this category.
A.14	3.B.5 Indirect N_2O emissions – N_2O (A.23, 2018) Completeness	Considering that the 2006 IPCC Guidelines do not provide a default value for $Frac_{leachMS}$, but instead indicate a typical range (1–20 per cent), make efforts to obtain country-specific data on $Frac_{leachMS}$. If this is not possible for the next annual submission, use a value from the typical range (1–20 per cent) provided in the 2006 IPCC Guidelines and justify the use of the selected value in the NIR or use the notation key "NE" for reporting N lost through leaching and run-off and indirect N_2O emissions from N leaching and run-off in CRF table 3.B(b).	Resolved. Croatia, in CRF table 3.B(b), reported N lost through leaching and run-off and indirect N_2O emissions from N leaching and run-off as "NE", without providing the rationale for doing so. The ERT noted that the approach used by the Party is in accordance with the 2006 IPCC Guidelines (vol. 4, p.10.65) which states that equation 10.28 (N losses due to leaching from manure management systems) should only be used where there is country-specific information available on the fraction of N loss due to leaching and run-off from manure management systems. During the review, the Party explained that use of a tier 2 method for estimating N lost through leaching and run-off, with country-specific data for $Frac_{leachMS}$, and use of equations 10.28 and 10.29 from the 2006 IPCC Guidelines (vol. 4) is a planned improvement. The Party indicated that if country-specific data are not available for the next submission, values from neighbouring countries would be used.
A.15	3.D Direct and indirect N_2O emissions from agricultural soils – N_2O (A.4, 2018) (A.7, 2016) (A.7, 2015) (59, 2014) Accuracy	Correct the error concerning the N content of dry matter used to estimate emissions and improve QA/QC for the data received from the Croatian Environment Agency.	Not resolved. Croatia continued to report an unrealistically high value of 11.0 per cent for the N content of dry matter of sewage sludge for 2005–2008. During the review, the Party clarified that the recommendation had not been implemented as the updated AD were not yet available, but that correcting this error is a planned improvement.

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A.16	3.D.a Direct N_2O emissions from managed soils – N_2O (A.24, 2018) Convention reporting adherence	Justify in the NIR the assumptions used to derive the uncertainty value of ±30 per cent for the EF_1 for mineral fertilizers, N-fixing crops and crop residues and ±50 per cent for animal manure, or use the appropriate uncertainty range for the default EF_1 from table 11.1 of the 2006 IPCC Guidelines (0.003–0.03 kg N_2O-N/kg N) in the Monte Carlo uncertainty analysis.	Addressing. Croatia used the uncertainty range for the default EF_1 in table 11.1 of the 2006 IPCC Guidelines (vol. 4) (0.003–0.03 kg N_2O-N/kg N, or percentage range –70 to +200 per cent) for inorganic N fertilizers (3.D.a.1) and crop residues (3.D.a.4). However, it used the range –50 to +150 per cent for urine and dung deposited by grazing animals (3.D.a.3) (NIR p.198). During the review, the Party explained that the range for urine and dung deposited by grazing animals was selected by mistake; the –70 to +200 per cent range will be applied in the uncertainty estimates and reported in the NIR for the next submission. The ERT considers that the recommendation has not yet been fully addressed because Croatia has not yet corrected the uncertainty percentage range for urine and dung deposited by grazing animals. In addition, the ERT notes that NIR annex table A2:3-1 shows Croatia applied an uncertainty percentage range of ±30 per cent for EF_1 for organic N fertilizers (3.D.a.2) and mineralization/immobilization associated with loss/gain of soil organic matter (3.D.a.5). This range is not in line with the ranges for default values of EF_1 in table 11.1 of the 2006 IPCC Guidelines (see ID# A.31 in table 5).
A.17	3.D.a Direct N_2O emissions from managed soils – N_2O (A.25, 2018) Accuracy	Investigate the reasons for the substantial discrepancies observed between data from producing companies and statistical data on the consumption of inorganic N fertilizers in the country for 2006–2016 (e.g. by analysing production, export and import data), including relevant data from the Food and Agriculture Organization of the United Nations in the comparison analysis, revise the estimates for the consumption of inorganic N fertilizers for 2006–2016 on the basis of the investigation and using the most reliable source of data, if appropriate, while ensuring time-series consistency, and report the results in the next annual submission.	Addressing. Croatia recalculated N_2O emissions from inorganic N fertilizers (3.D.a.1) using AD from various sources: for 1992–1999, data were provided by companies that produce synthetic fertilizers; for 1990 and 1991, data were estimated by extrapolation using the pattern from 1992 to 1999; and for 2000–2018, data were provided by CBS. Using the new data from CBS, Croatia recalculated N_2O emissions from inorganic N fertilizers for 2006–2018. The ERT notes that the value for mineral N fertilizer consumption used by Croatia is consistent with the data reported on the CBS website and thus considers that reliable data have been applied in estimating N_2O emissions from inorganic N fertilizers. However, the ERT considers that the recommendation has not yet been fully addressed because the Party has not explained the reasons for the similarities and differences in the time-series consistency between two data sources, namely fertilizer producers and CBS.
A.18	3.D.a Direct N_2O emissions from managed soils – N_2O (A.25, 2018) Accuracy	Ensure that the data used on the amount of synthetic N fertilizers consumed in the country are consistent with the data used in the calculations of direct N_2O emissions from N inputs to managed soils for the LULUCF sector.	Resolved. Croatia estimated N_2O emissions from inorganic N fertilizers only for the agriculture sector. The AD used are based on the amount of N in mineral fertilizer that is consumed annually in the country, a figure that was obtained from CBS (NIR p.188). In addition, Croatia reported in its NIR (p.284) that N_2O emissions from N fertilization of cropland and grassland are reported under the agriculture sector and that no fertilizers are applied to forest land.
A.19	3.D.a.2.b Sewage sludge applied to soils – N_2O (A.26, 2018) Completeness	Considering the increasing trend in the amount of sludge applied during 2005–2016, make all the necessary efforts to obtain reliable data on sludge applied during 1990–2008. If this is not possible,	Not resolved. Croatia did not introduce any change or improvement to its estimation of N_2O emissions from sewage sludge applied to soils in its 2020 submission compared with its 2018 submission (i.e. the use of extrapolation or another splicing technique from the 2006 IPCC Guidelines). Emissions of N_2O for 1990–2004 are

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		extrapolate the values for 2009–2016 or use another, more appropriate splicing technique recommended by the 2006 IPCC Guidelines to derive the amount of sludge applied to soils for 2005–2008 and report the resulting N_2O emissions for subcategory 3.D.a.2.b (sewage sludge applied to soils). Also investigate and confirm whether sludge application occurred in earlier years of the time series (1990–2004) and, if so, use the same splicing technique to expand the period and report N_2O emissions for subcategory 3.D.a.2.b for the complete time series.	reported as "NA", while identical AD sources and a default EF (0.01 kg N_2O-N/kg N) were used for 2005–2018. The ERT notes that Croatia included in its improvement plan the verification of the amount of sludge applied to soils for 2005–2008, and the investigation and confirmation of whether sludge application occurred in earlier years of the time series (1990–2004) (NIR p.200). This improvement is planned to be implemented in the short term (one year). During the review, the Party clarified that corrected data for the amount of sludge applied are expected to be available in time for preparation of the next submission.
A.20	3.D.a.5 Mineralization/ immobilization associated with loss/gain of soil organic matter – N_2O (A.27, 2018) Accuracy	Revise, in the next annual submission, estimates of N_2O emissions due to loss/gain of soil organic matter for the entire time series by using data from the results of the project "Carbon stock changes in the soils and calculating the trends of total nitrogen and carbon in soil and the ratio of C:N", report the results in line with the UNFCCC Annex I inventory reporting guidelines, and ensure consistency with carbon stock changes in mineral soils estimated under the LULUCF sector.	Resolved. Croatia revised and recalculated its N_2O emissions from mineralization/ immobilization associated with the loss/gain of soil organic matter for the entire time series applying new official data from the CORINE Land Cover inventory (https://www.eea.europa.eu/data-and-maps/data/copernicus-land-monitoring-service-corine) and a default EF (0.01 kg N_2O-N/kg N) from table 11.1 of the 2006 IPCC Guidelines (vol. 4, chap. 11, p.11.11) (NIR pp.197, 199, 223 and 252). The average annual loss of soil carbon from perennial cropland converted to annual cropland (–22.89 kt C) was estimated consistently with carbon stock changes in mineral soils from the LULUCF sector (CRF table 4.B) while a C:N ratio of 11:1 was estimated based on an investigation done by the Croatian Geological Institute.
A.21	3.H Urea application – CO_2 (A.28, 2018) Convention reporting adherence	Use only a value of –50 per cent uncertainty for the default EF, if used for emission estimates from urea fertilization in the Monte Carlo uncertainty analysis.	Resolved. Croatia used only a value of –50 per cent for CO_2 for the default EF for urea application in the Monte Carlo uncertainty analysis (NIR p.206, and NIR annexes, p.44).
LULUCF			
L.1	4. General (LULUCF) – CO_2, CH_4 and N_2O (L.3, 2018) (L.12, 2016) (L.12, 2015) Convention reporting adherence	Determine which carbon pools and subcategories are significant in each key category based on the guidance provided in the 2006 IPCC Guidelines, and provide detailed information on the results of such determination in the NIR.	Addressing. Croatia reported in NIR table 6.1-1 a summary of its key category analysis for the LULUCF sector, which included information on which subcategories are significant in terms of both level and trend assessments based on the assessments presented in more detail in annex 1 to the NIR. The analysis did not, however, include details about the carbon pools that have a significant impact on total national emissions and removals, and their trend or uncertainty. During the review, the Party clarified that significant pools would be identified and described in the next NIR.
L.2	4. General (LULUCF) – CO_2, CH_4 and N_2O (L.20, 2018)	Provide in the NIR a clear, documented and complete description of the methodologies used, in particular for forest land, cropland (mineral soils),	Addressing. Croatia added to its NIR descriptions of the equations used to calculate changes in the biomass pool in forest land and land converted to cropland (sections 6.4.2.1–6.4.2.2 and 6.5.2.2.1, respectively). The descriptions of the methodologies

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	Convention reporting adherence	land converted to cropland, and grassland, including the identification of all equations, references and sources of information used in the specific IPCC methodologies, and provide a clear indication of which parameters used are default or country-specific for all categories.	used for estimating emissions for most LULUCF activities were not significantly modified in other sections of the NIR 2020 compared with the NIR 2018. For example, there is no clear, complete description for cropland converted to grassland, although this conversion was given as an example of conversions for which transparency needs to be enhanced in the 2018 review report (FCCC/ARR/2018/HRV, ID# G.6). During the review, the Party indicated that this issue would be resolved in the 2021 submission.
L.3	4. General (LULUCF) – CO_2, CH_4 and N_2O (L.21, 2018) Convention reporting adherence	Use "NA" for reporting a specific carbon pool for which an IPCC default method is applied that assumes that no net carbon stock changes occur, accompanied by an explanation in the information box of the corresponding CRF table stating that "NA" indicates a tier 1 estimate.	Not resolved. Croatia reported "NO" for specific carbon pools for which an IPCC default method was applied that assumes no net carbon stock changes occur, and the information box of the corresponding CRF table was left empty. During the review, the Party indicated that this issue would be resolved in the 2021 submission.
L.4	4. General (LULUCF) – CO_2, CH_4 and N_2O (L.22, 2018) Convention reporting adherence	(a) Include in NIR table 6.4-5 a column with data on the annual carbon stock in litter; (b) Report carbon stock changes in soil organic carbon in mineral soils instead of annual carbon stock changes (p.258 of the NIR); (c) Report total carbon stocks in above-ground biomass in perennial cropland instead of annual stock changes (p.267 of the NIR); (d) Correct the indication that existing carbon pools are not occurring (section 6.8 of the NIR); and (e) Improve and fully implement QC activities in the LULUCF sector to avoid such types of error in the NIR.	Addressing. For point (a) of the previous recommendation, the issue has been resolved because Croatia inserted additional columns in NIR table 6.4-5 to report carbon stock changes in litter and deadwood. For point (c), the issue has not been resolved because in section 6.5.2.1.A of the NIR (p.251), the Party has kept the same description of its assumptions and continues to explain that the "IPCC default value of 63 t C/ha annually was used for the above-ground biomass carbon stock", which would read better as "IPCC default value of 63 t C/ha was used for the above-ground biomass carbon stock". For point (e), the issue has not yet been resolved because the QC activities do not seem to have been improved as several sections of the NIR contain text that does not correspond to the current version of the inventory (see ID#s L.5, L.11 and L.19 in table 3 and ID# L.21 in table 5). There are also various inconsistencies between the NIR and the CRF tables. For example, there is an inconsistency in the carbon stock changes reported for deadwood between NIR table 6.4-5 and CRF table 4.A (forest land), for which the changes were reported to be about three times greater in the NIR table than in the CRF table for all years of the time series). During the review, the Party clarified that the correct data are reported in CRF table 4.A (forest land) and that higher values were entered by mistake in NIR table 6.4-5. For points (b) and (d) of the previous recommendation, the ERT was not able to assess whether the Party has addressed them in the 2020 submission.
L.5	4. General (LULUCF) – CO_2, CH_4 and N_2O (L.4, 2018) (L.13, 2016) (L.13, 2015) Convention reporting adherence	Correct all the inconsistencies identified in the NIR and between the NIR and the CRF tables, and further improve the QA/QC system's effectiveness by enhancing related QA/QC procedures such as internal audits, and corrective and preventive activities following the national QA/QC plan, in order to be able to identify and correct such	Not resolved. The values reported in NIR table 6.4-1 are still inconsistent with those in CRF table 4.A (forest land). During the review, in response to a question raised by the ERT, Croatia explained that this error arose when entering values of 'out of yield' forests in the CRF tables.

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		inconsistencies during the inventory preparation process in the future.	
L.6	Land representation – CO_2, CH_4 and N_2O (L.23, 2018) Convention reporting adherence	Review the uncertainty estimations in forest land remaining forest land, land converted to forest land, grassland and land-use changes to and from cropland and, if the uncertainty ranges are confirmed, undertake improvements to the approaches used to reduce the uncertainty of the estimates, taking into account and focusing on the identified significant sources of uncertainties associated with the use of approaches 1, 2 and 3 for land representation as well as those related to the use of the tier 1 parameters from the 2006 IPCC Guidelines. In the case that uncertainties are lower than the current estimated uncertainty ranges, focus efforts on improving the quality of the approach used for tracking land-use changes to and from grassland and land-use changes to and from cropland and the related parameters used in the estimates.	Not resolved. Croatia has not reviewed the uncertainty estimations of the land-use categories forest land remaining forest land, land converted to forest land, grassland and land-use changes to and from cropland since the 2018 submission, and the relative uncertainty values used in the 2018 submission have been applied in the 2020 submission. During the review, the Party indicated that it intends to launch a project at the end of 2020 for calculating and defining uncertainties in the LULUCF sector, which will encompass all LULUCF land-use categories and Kyoto Protocol activities. See ID# G.12 in table 5.
L.7	Land representation – CO_2, CH_4 and N_2O (L.23, 2018) Accuracy	Report in the NIR a detailed description of the method implemented to estimate uncertainties in AD, in particular regarding the assumptions and expert judgment used.	Not resolved. Croatia made no additions in the NIR to the description of the method used for estimating uncertainties in AD for land representation categories, particularly the assumptions and expert judgment applied. During the review, the Party explained that this issue would be addressed through the planned project (see also ID# L.6 above). Further, the ERT noted that the changes in AD used for some categories in the latest inventory were not fully reflected in the uncertainty analysis. For example, new CORINE Land Cover data were used for estimating emissions from conversion to and from cropland in the 2020 submission; however, the uncertainty for those land-use changes is still based on assumptions made in 2013. See ID# G.12 in table 5.
L.8	4.A Forest land – CO_2 (L.24, 2018) Accuracy	If the next CRONFI will not be undertaken in the short term, develop alternative methods to collect data that can be used to estimate and report carbon stock changes in all carbon pools of category 4.A (forest land) (in particular the (above-ground) living biomass and deadwood pools), as the LULUCF 1 project did in the past.	Addressing. Croatia reported in the NIR (section 6.8.2.1.1) that it applied a tier 2 method for estimating the carbon stock change in the deadwood pool for land converted to forest land by adapting information from the CRONFI data to fulfil the provisions of the UNFCCC Annex I inventory reporting guidelines. However, the Party continues to use the tier 1 default assumptions of the absence of changes in deadwood, litter and soils for forest land remaining forest land (and a combination of tier 1 and tier 2 assumptions for above-ground biomass), although a higher-tier methodology is encouraged by the 2006 IPCC Guidelines (vol. 4, chap. 4.2.2.1) for "countries experiencing significant changes in their management

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			regimes", as is the case for Croatia because of the impacts of the war that occurred in the country in the 1990s.
L.9	4.A Forest land – CO_2 (L.24, 2018) Accuracy	If the next CRONFI will not be undertaken in the short term, analyse options for making the data of the first CRONFI compatible with the reporting under the Convention and improve the accuracy of the estimation of carbon stock changes in all pools.	Resolved. Croatia provided in the NIR (section 11.1) some explanation of the reason why the majority of methods used for the CRONFI process differ from the methods used for forests plan and programme development, and it concluded that the only data from the current CRONFI that could be used to improve the accuracy of the estimated carbon stock changes in all pools were those on deadwood stock that are now used to report changes in this pool within afforested or deforested areas. Results of the work on deadwood are included in section 6.8.2.1.1 of the NIR.
L.10	4.A Forest land – CO_2 (L.25, 2018) Accuracy	Develop country-specific BEFs and ratios of below-ground biomass to above-ground biomass to fully implement the tier 2 method for this key category, in line with the 2006 IPCC Guidelines, and report on this in the next annual submission.	Not resolved. Croatia continues to use the default BEF_1 and BEF_2 values for forest land from the IPCC *Good Practice Guidance for Land Use, Land-Use Change and Forestry* (table 3.A.1.10, p.3.178, corrected with the percentage of wood that remains in forest after harvesting operations). The ratios of below-ground biomass to above-ground biomass were obtained from table 4.4 of the 2006 IPCC Guidelines (vol. 4, chap. 4, p.4.49). During the review, the Party explained that it had launched in 2020 a project (LULUCF 3), one of whose aims is to define basic preconditions for developing country-specific BEFs. The ERT noted, however, that the development of country-specific BEFs may not be part of the project. The ERT considers that the transparency of the reporting would be enhanced if the Party explicitly mentioned under the section on planned improvements in the NIR, or at least in annex 3.2, the contribution of the LULUCF 3 project to defining country-specific BEFs.
L.11	4.A.1 Forest land remaining forest land – CO_2 (L.9, 2018) (L.15, 2016) (L.15, 2015) Accuracy	Collect data in order to estimate and report carbon stock losses from the living biomass pool in 'out of yield' forest land remaining forest land.	Addressing. Croatia collected data relevant to the estimation of losses in the biomass pool from forest fires for 'out of yield' forests (the data are presented in section 6.4.5 of the NIR). The ERT considers that the Party should also include in the NIR an assessment of other sources of losses of biomass, such as windthrows, pests and informal harvesting. In addition, during the review, the Party noted that when entering data for CRF Reporter, an error occurred that resulted in incorrect information being included for losses from the living biomass pool in 'out of yield' forests under CRF table 4.A.1 for forest land remaining forest land.
L.12	4.A.2 Land converted to forest land – CO_2 (L.10, 2018) (L.16, 2016) (L.16, 2015) Completeness	Estimate and report emissions and removals associated with carbon stock changes in the deadwood pool.	Resolved. Croatia reported changes in the deadwood pool for land converted to forest land for the entire time series in its 2019 and 2020 submissions.
L.13	4.A.2 Land converted to forest land – CO_2 (L.10, 2018) (L.16,	Provide detailed information on the analysis of the data from CRONFI to check their usefulness for the GHG inventory, and clarify whether the	Addressing. Some information on the data from CRONFI is included in section 11.1 of and annex 3.2 to the NIR; a report has also been published (in Croatian) and is referenced in the NIR (p.414, section 11.3.1.1 B). The NIR does not include

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	2016) (L.16, 2015) Transparency	CRONFI data cover both the deadwood and the litter pools.	a clear indication that the CRONFI data cannot be used to update estimates for the litter pool.
L.14	4.B.1 Cropland remaining cropland – CO_2 (L.11, 2018) (L.5, 2016) (L.5, 2015) (69, 2014) (72, 2013) Accuracy	Implement the tier 2 approach for perennial cropland remaining perennial cropland as soon as possible.	Addressing. Croatia applied the tier 1 approach for perennial cropland remaining perennial cropland, but in section 6.5.6 of the NIR mentioned a project (LULUCF 3) that has commenced and that will gather data on the biomass in perennial cropland and on rotation periods. During the review, the Party clarified that it expects the project to be completed in mid-2021 and its results to be used to implement the tier 2 approach for the 2022 submission.
L.15	4.B.2 Land converted to cropland – CO_2 (L.12, 2018) (L.6, 2016) (L.6, 2015) Accuracy	Improve the cropland biomass estimates to enable implementation of a tier 2 method for estimating cropland biomass in this category as soon as possible.	Addressing. Croatia did not improve the estimates of carbon stock changes in cropland with perennial woody vegetation, such as vineyards, olive groves and fruit orchards, but in section 6.5.6 of the NIR mentioned a project (LULUCF 3) that has commenced and that will gather data on the biomass in perennial cropland and on rotation periods. During the review, the Party clarified that it expects the project to be completed in mid-2021 and its results to be used to implement the tier 2 approach for the 2022 submission.
L.16	4.B.2 Land converted to cropland – CO_2 (L.13, 2018) (L.17, 2016) (L.17, 2015) Completeness	Estimate and report carbon stock changes in the deadwood pool in forest land converted to cropland by using national data (as a preference) or by using data from neighbouring countries with a similar ecology and climate and similar management practices.	Resolved. Croatia reported, for the first time in its 2019 submission and also in its 2020 submission, carbon stock changes in the deadwood pool in forest land converted to cropland using national data on carbon stocks in the deadwood pool of forests.
L.17	4.C.2 Land converted to grassland – CO_2 (L.15, 2018) (L.8, 2016) (L.8, 2015) (72, 2014) Accuracy	Improve the cropland biomass estimates to enable implementation of a tier 2 method for estimating cropland biomass under the land converted to grassland category as soon as possible.	Addressing. Croatia applied tier 1 assumptions for biomass in cropland converted to grassland, but in section 6.6.6 of the NIR mentioned a project (LULUCF 3) that has commenced and that will conduct an investigation to determine the expansion factor from yield to total biomass of annual cropland and a survey of existing data to determine the biomass in perennial cropland and rotation periods. During the review, the Party clarified that it expects the project to be completed in mid-2021 and its results to be used to implement the tier 2 approach for the 2022 submission.
L.18	4.E.2.2 Cropland converted to settlements – CO_2 (L.17, 2018) (L.10, 2016) (L.10, 2015) (73, 2014) Accuracy	Improve the cropland biomass estimates to enable implementation of the tier 2 approach for estimating cropland biomass estimates under the cropland converted to settlements category as soon as possible.	Addressing. In section 6.8.6 of the NIR, Croatia reported that further investigation of the determination of biomass stocks and growth rates in settlements are being made as part of an ongoing project (LULUCF 3). During the review, the Party clarified that it expects the project to be completed in mid-2021 and its results to be used to implement the tier 2 approach for the 2022 submission.
L.19	4(IV) Indirect N2O emissions from managed soils – N_2O	Estimate indirect N_2O emissions associated with the loss of soil organic matter resulting from a change in land use or management of mineral soils	Not resolved. As in the 2018 submission, Croatia did not report indirect N_2O emissions associated with the loss of soil organic matter resulting from a change in land use or management of mineral soils in CRF table 4(IV). Indirect N_2O

ID#	*Issue/problem classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
	(L.18, 2018) (L.18, 2016) (L.18, 2015) Completeness	and report these emissions in CRF table 4(IV), following the guidance in footnotes 2 and 4 of that table as well as in the 2006 IPCC Guidelines.	emissions associated with atmospheric deposition and N leaching and run-off were reported as "IE" and indicated as "Direct and indirect N_2O emissions from agricultural soils" in CRF table 3.D. In the NIR (section 6.14), the Party reported that no such emissions occur in the country. During the review, the Party acknowledged that text in the NIR (section 6.14) is inconsistent with the information in the CRF tables and indicated that it would correct the description in the NIR for the next submission. Croatia explained that according to the latest expert judgment, indirect N_2O emissions associated with the loss of soil organic matter resulting from a change in land use or management of mineral soils from leaching and run-off do occur in the country, and clarified that those emissions are reported under the agriculture sector, consistently with the notation keys that were used in CRF table 4(IV).
L.20	4(V) Biomass burning – CO_2 (L.26, 2018) Completeness	Use 100 per cent of the area effectively burned to estimate CO_2 emissions and make the necessary recalculations for the whole time series.	Resolved. Croatia recalculated in its 2019 submission its estimates of CO_2 emissions from biomass burning on the basis of 100 per cent of the area effectively burned for 1990–2017.
Waste			
W.1	5.A Solid waste disposal on land – CH_4 (W.1, 2018) (W.1, 2016) (W.1, 2015) (77, 2014) (76, 2013) Transparency	Provide information on the type of waste disposed of in SWDS and ensure that all types of solid waste, including industrial waste, sludge, and construction and demolition waste, disposed of in SWDS are included in the emission estimates.	Addressing. Croatia provided information on the types of waste disposed in SWDS – including industrial waste and sludge, which were included in the emission estimates – in its NIR (pp.305–306). However, the Party did not clearly explain in the NIR whether construction and demolition waste was included in the CH_4 emission estimates. During the review, the response from the Party to a question raised by the ERT on this matter confirmed that this type of waste was included in the estimates (see ID# W.13 in table 5).
W.2	5.A Solid waste disposal on land – CH_4 (W.8, 2018) Transparency	Provide comprehensive information on solid waste management practices in the NIR, if possible in tabular format, covering the number of active and closed SWDS (including unofficial ones), the type of SWDS, and management practices used at all landfills in the country (including unofficial ones), including the type of waste and amounts disposed of.	Addressing. Croatia reported in its NIR information on the number of active and closed SWDS (p.298), the management practices at each SWDS (p.308) and the amount disposed of each waste type (MSW, industrial waste and sludge) (p.305). However, it is unclear whether these descriptions include unofficial sites. Further, in the NIR, the Party indicated that the comprehensive research regarding AD and parameters to improve the accuracy, completeness and transparency of the reporting of solid waste disposal in the inventory is a long-term plan (NIR p.381). During the review, the Party clarified that the descriptions of solid waste disposal in the NIR do not cover data for unofficial sites in which the waste is improperly discarded into the environment because data for such sites are not available. See ID# W.14 in table 5. The ERT notes that the issue can be resolved only with implementation of the collected data for unofficial sites and believes that future ERTs should consider this issue further to ensure that there is not an underestimation of emissions for this category.

ID#	*Issue/problem classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
W.3	5.A Solid waste disposal on land – CH_4 (W.9, 2018) Accuracy	Continue the efforts to obtain accurate country-specific historical AD and parameters, in particular on population, waste generation per capita and the percentage of waste disposed of at SWDS for different periods of time from 1955 to 1990, with the aim of estimating CH_4 emissions for the entire time series for category 5.A (solid waste disposal), and document these comprehensively in the NIR, including a description of improvements made to the assumptions, in particular by referring to the annual increases in population, waste generation per capita and the percentage of waste disposed of at SWDS for different periods of time from 1955 to 1990.	Addressing. Croatia provided a detailed description of how it obtained historical data (1955–1999) for MSW in its NIR (pp.300–304). In the NIR, the Party indicated its intention to improve the accuracy of AD, and explained that its research plan aiming to further develop accurate country-specific historical AD and parameters is a long-term challenge.
W.4	5.B Biological treatment of solid waste – CH_4 and N_2O (W.10, 2018) Transparency	Provide in the NIR information on the official source of AD for composting and anaerobic digestion and the period for which AD are available, including information on when these activities started in the country.	Addressing. Croatia reported in its NIR (p.317) that the official source of AD for composting and anaerobic digestion is the Ministry of Environment and Energy. The Party indicated in the NIR that the AD for composting are available only for 2007–2018. Therefore, for composting (5.B.1), "NE" is reported for 1990–2006. The Party also reported that it plans to collect AD for the entire reporting period 1990–2018 (p.321). For anaerobic digestion, the Party indicated that CH_4 emissions at biogas facilities are included under the energy sector because CH_4 is used for electricity generation (p.321).
W.5	5.C.1 Waste incineration – CO_2 (W.7, 2018) (W.6, 2016) (W.6, 2015) (table 3 and 82, 2014) Completeness	Extrapolate back in order to estimate CO_2 emissions from the incineration of plastic waste between 1990 and 2006 to improve the consistency of the time series and transparency.	Not resolved. Croatia did not extrapolate back in order to estimate CO_2 emissions from the incineration of plastic waste between 1990 and 2006 in its 2020 submission. During the review, the Party stated that this issue is included in the annual data collection plan, defined as a short-term goal for the next submission.
W.6	5.C.1 Waste incineration – CO_2, CH_4 and N_2O (W.11, 2018) Transparency	Provide information in the NIR on the systems and amounts of plastic waste disposed of and/or incinerated for the entire time series, including information on plastic waste that is not collected and recycled and total AD for plastic waste that is generated in the country.	Not resolved. Croatia did not provide information in the NIR on the systems and amounts of plastic waste disposed of and/or incinerated for the entire time series. During the review, the Party stated that this issue is included in the annual data collection plan, defined as a short-term goal for the next submission.
W.7	5.D.1 Domestic wastewater – CH_4 (W.12, 2018) Completeness	Collect more detailed and complete information on domestic wastewater treated in various systems in the country, in particular individual wastewater treatment systems, and use this information to	Not resolved. Croatia did not report detailed and complete information on domestic wastewater treated in various systems in the NIR. During the review, the Party stated that this issue is included in the annual data collection plan, defined as a long-term goal, which will take more than one year to achieve.

ID#	*Issue/problem classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
		estimate and improve the accuracy of the CH_4 emissions from domestic wastewater.	The ERT notes that the issue can be resolved only with implementation of the results of the annual data collection plan and believes that future ERTs should consider this issue further to ensure that there is not an underestimation of emissions for this category.
W.8	5.D.1 Domestic wastewater – CH_4 (W.13, 2018) Accuracy	Provide in the NIR transparent descriptions and accurate data for the whole time series (1990–2016) related to the occurrence in the country of (1) anaerobic domestic wastewater installations, (2) anaerobic industrial wastewater installations, (3) aerobic domestic wastewater installations and (4) aerobic industrial wastewater installations.	Not resolved. Croatia did not report information related to the occurrence of wastewater installations in the country (i.e. anaerobic domestic, anaerobic industrial, aerobic domestic or aerobic industrial). During the review, the Party stated that this issue is included in the annual data collection plan, defined as a short-term goal for the next submission.
W.9	5.D.1 Domestic wastewater – CH_4 (W.13, 2018) Accuracy	Provide information in the NIR on how sludge produced is treated and disposed of in the country or used in other applications, and use this information to accurately estimate and report CH_4 emissions from wastewater treatment for each treatment pathway or system, avoiding a double counting of the degradable organic component of sludge removed and applied in other applications, and report correctly in CRF table 5.D the amount of the degradable organic component of sludge removed.	Resolved. In order to avoid double counting of the degradable organic component of sludge removed and applied for other purposes, the Party reported the amount of the degradable organic component of sludge removed in CRF table 5.D and recalculated CH_4 emissions from domestic wastewater treatment for 1990–2016 in the 2019 submission, which reduced the CH_4 emissions from domestic wastewater for the time series (e.g. by 26.00 per cent for 1990 and by 49.55 per cent for 2016). The NIR 2020 includes an explanation that the organic component removed as sludge that is disposed of in landfills and used for other purposes (i.e. composting, agriculture applications) was excluded from the total organic product in estimating CH_4 emissions for this category (NIR p.327). The ERT considers that the Party reported appropriately the amount of sludge removed.
W.10	5.D.2 Industrial wastewater – CH_4 and N_2O (W.14, 2018) Transparency	Provide in the NIR a transparent description of the industrial wastewater treatment systems used in the country and the amounts of industrial wastewater treated aerobically and anaerobically.	Not resolved. Croatia reported that insufficient information on industrial wastewater treatment systems is currently available (NIR p.335). During the review, the Party stated this issue is included in the annual data collection plan, defined as a long-term goal.
KP-LULUCF			
KL.1	General (KP-LULUCF) – CO_2 (KL.4, 2018) (KL.5, 2016) (KL.5, 2015) Transparency	Use the notation key "NR" (not reported) in CRF table NIR-1 and the notation key "NE" in CRF table 4(KP-I)A.1 for the deadwood pool in AR activities.	Resolved. Carbon stock changes in the deadwood pool in afforested areas were estimated, included in the CRF tables and explained in the NIR. Therefore, using the notation key "R" (reported) in table NIR-1 was correct, and notation keys were not used for reporting the deadwood pool in CRF table 4(KP-I)A.
KL.2	General (KP-LULUCF) – CO_2, CH_4 and N_2O (KL.12, 2018) Transparency	Ensure that a clear, documented and complete description of the methodologies used in the emission estimates is provided in the NIR, including the identification of equations, references and sources of information used in the specific IPCC methodologies and a clear	Not resolved. For most KP-LULUCF activities, Croatia did not significantly modify the description of the methodology used for estimating emissions in the NIR 2020 compared with the NIR 2018. For example, the equations from the 2006 IPCC Guidelines that were used to estimate carbon stock changes in biomass in afforested and deforested areas are still not clearly referenced in section 11.3.1.1, although they were raised as an example where further transparency is needed in

ID#	Issue/problem classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
		indication of which parameters used are default or country-specific, in particular regarding methodologies used to estimate carbon stock changes in biomass in afforestation and deforestation.	the 2018 review report (FCCC/ARR/2018/HRV, ID#s G.6 and KL.12). During the review, the Party stated that information is provided in relevant chapters of the NIR 2020. However, the ERT could not find complete information and therefore considers that the recommendation has not yet been addressed.
KL.3	General (KP-LULUCF) – CO_2 (KL.13, 2018) KP reporting adherence	Reassess the uncertainty analysis using appropriate uncertainty values for AD and parameters used and revising the assumptions made and, if the resulting uncertainty values are high and confirmed, use this information to set priorities in the planned improvements to the estimates of KP-LULUCF activities, in particular improvements related to the parameters used in the estimates. In the case that uncertainties are lower than the current estimated uncertainty ranges, focus efforts on improving the quality of the estimates for AR and deforestation and the related parameters used in the estimates. Also, report in the NIR a detailed description of the method implemented to estimate uncertainties for KP-LULUCF activities, in particular regarding the assumptions and expert judgment used.	Not resolved. Croatia has not reassessed the relative uncertainty for AD and parameters since the 2018 submission. Croatia explained that the same assumptions were therefore used in the uncertainty analysis as for reporting under the Convention; however, the results for KP-LULUCF activities were not included in the NIR. During the review, the Party informed the ERT that it intends to launch, at the end of 2020, a project on calculating and defining uncertainties in the LULUCF sector, which will cover all LULUCF land categories and Kyoto Protocol activities.
KL.4	Article 3.3 activities – CO_2 (KL.15, 2018) Completeness	Provide verifiable information that demonstrates that deadwood was not a net source in AR and deforestation activities, in accordance with decision 2/CMP.8, annex II, paragraph 2(e), and estimate and report net emissions from the deadwood pool for AR activities in perennial cropland. If this carbon pool is not reported, use the correct notation key "NE" in CRF table 4(KP-I)A.1 (instead of "NO").	Resolved. In its 2019 submission, Croatia reported for the first time emissions and removals from the deadwood pool for both AR and deforestation activities. For 2018, the Party reported in its 2020 submission an increase in carbon stock change in the deadwood pool of 1.02 kt C for AR areas and a decrease in carbon stock change of 0.03 kt C for deforested areas.
KL.5	AR – CO_2 (KL.14, 2018) KP reporting adherence	Resolve the inconsistencies identified in the information provided in the NIR and in CRF table 4(KP-I)A.1 regarding the reporting of carbon stock losses in afforestation lands in the next annual submission.	Resolved. Croatia reported consistent data between the NIR and CRF table 4(KP-I)A.1. The Party continued to assume that no harvesting occurs in afforested areas, which was consistently reported in section 11.3.1.2 of the NIR (p.416) and CRF table 4(KP-I)C, while the loss of biomass reported for afforested land was consistent with CRF table 4.A, where such losses were reported for grassland and cropland converted to forest land. For instance, a loss of 2.3 kt C of biomass was reported for 2018 in CRF table 4(KP-1)A.1, a value consistent with the reporting in CRF table 4.A for land converted to forest land.

ID#	*Issue/problem classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
KL.6	Deforestation – CO_2 (KL.16, 2018) Completeness	Report in CRF table 4(KP-I)A.2 the corresponding carbon stock losses by deforestation in 'out of yield' forests for the above-ground biomass pool and confirm the completeness and correctness of the estimates made for the below-ground biomass pool.	Addressing. Croatia reported carbon stock losses from deforestation in 'out of yield' forests for above-ground biomass and below-ground biomass pools in section 11.4 (p.436) of the NIR, but below-ground biomass data are not included in the CRF tables. As a consequence, Croatia reported losses of below-ground biomass from deforestation of 0.28 to 6.18 kt C per year in 2013–2018 in the NIR and only of 0.08 to 1.69 kt C per year in CRF table 4(KP-I)A.2. During the review, the Party clarified that the omission of the data for below-ground biomass losses from CRF table 4(KP-I)A.2 was an error that arose when entering above-ground biomass and below-ground biomass data for 2008–2018 in the CRF tables.
KL.7	FM – CO_2 (KL.9, 2018) (KL.6, 2016) (KL.6, 2015) Transparency	Collect data in order to estimate and report carbon stock losses from the living biomass pool in 'out of yield' forests under the activity FM.	Addressing. Croatia reported carbon stock losses in living biomass from forest fires in 'out of yield' forests under FM for the first time in the NIR 2019. In the NIR 2020 (section 11.3.1.2, pp.416–422), the Party explained that the legal framework of Croatia protects maquis and shrub forests from harvesting and includes preservation measures such as a ban on goat-keeping in such forests since the 1950s. Further, in the same section of the NIR, Croatia explained that given species of small diameter at breast height prevail in these forests, their exploitation for firewood consumption would require more time and resources than the exploitation of wood in forests with larger diameter at breast height species, and that there are forests with tree species providing high-quality firewood in the vicinity of the Lika region – both of these factors contribute to the preservation of maquis and shrub forests. During the review, Croatia explained that its estimation in the 2020 submission was the result of the best use of available forest data (measured and country-based official forestry data) and expert judgment. The Party further explained that, in order to estimate carbon losses from 'out of yield' forests caused by pests, informal harvesting or consumption of biomass by wild animals, the use of scientific models would be required. The additional explanation provided by Croatia during the review justifies that biomass extraction is likely to be minimal in 'out of yield' forests and that there were no unreported losses of biomass due to other causes (e.g. windthrows and pests). This information should be transparently reported in the NIR.
KL.8	FM – CO_2 (KL.17, 2018) Completeness	Report carbon stock changes in the deadwood and litter pools under FM or provide in the NIR verifiable information that demonstrates that these pools were not a net source of GHG emissions in accordance with decision 2/CMP.8, annex II, paragraph 2(e). If Croatia does not report these carbon pools, it should use the correct notation key "NE" in CRF table 4(KP-I)B.1 (instead of "NO").	Addressing. Croatia reported carbon stock changes in the deadwood and litter pools under FM as "NE" in CRF table 4(KP-I)B.1 and provided, in the NIR (section 11.3.1.2), information suggesting that these pools are not a source, namely, the steady increase in biomass over the last two decades although harvesting increased; standard harvesting practices and regulation under which wood of less than 7 cm in diameter and three to five years old, dying trees per hectare must be left in the forest; and the ban on the extraction of leaves. During the review, Croatia confirmed the information in the NIR and shared additional information with the ERT, namely its Forest Management Plan for 2016–2025 and extracts from its National Forestry Accounting Plan. The ERT considers that, while the NIR includes corroborating presumptions, there is no demonstration that these

ID#	Issue/problem classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
			pools were not a net source of GHG emissions, and that Croatia's reporting is therefore not in accordance with decision 2/CMP.8, annex II, paragraph 2(e), which requires "verifiable information that demonstrates that these unaccounted pools were not a net source of anthropogenic GHG emissions". To demonstrate that the soil and litter pools are not sources, Croatia could for instance plan a repetition of the soil survey presented in Pilaš et al. (2013) and/or adapt a soil and litter model to its forestry-inventory-based model presented in the National Forestry Accounting Plan, HS-MODEL, and reflect through simulations the likely net effect of the complex range of changes to Croatia's forest age-class structure and harvest on the litter and soil pools, as system responses are likely to be complex considering the inter-annual variability in harvest and non-linearities in system responses.
KL.9	FM – CO_2 (KL.18, 2018) Transparency	Report in the CRF table on accounting for KP-LULUCF activities the correct value of the FM cap as 8,737.30 kt CO_2 eq, which is fixed in accordance with paragraph 12 of decision 6/CMP.9 for the second commitment period of the Kyoto Protocol.	Addressing. Croatia reported in the CRF table on accounting for KP-LULUCF activities the FM cap as 8,737.30 kt CO_2 eq. According to the report on the review of the report to facilitate the calculation of the assigned amount for the second commitment period of the Kyoto Protocol of Croatia (FCCC/IRR/2016/HRV), the final value of the cap should be rounded down to the nearest tonne for the purposes of inclusion in the compilation and accounting database, so the final value is 8,737,296 t CO_2 eq. To increase the transparency of its reporting, the ERT suggests that Croatia report the value of the FM cap with higher precision in the CRF table on accounting for KP-LULUCF activities and in the NIR.
KL.10	HWP – CO_2 (KL.11, 2018) (KL.8, 2016) (KL.8, 2015) KP reporting adherence	Exclude from the reporting HWP originating from deforestation events on the basis of instantaneous oxidation (to 'zero' the net contribution to the national net CO_2 emissions), and exclude emissions from HWP already accounted for during the first commitment period of the Kyoto Protocol on the basis of instantaneous oxidation, in accordance with decision 2/CMP.7, annex, paragraphs 16 and 31.	Addressing. Croatia excluded emissions from HWP originating from deforestation from the reporting on the basis of instantaneous oxidation in its 2019 and 2020 submissions (NIR 2019, p.440 and NIR 2020, p.432). However, emissions from HWP originating from HWP already accounted for during the first commitment period of the Kyoto Protocol have not been excluded from the accounting in accordance with decision 2/CMP.7, annex, paragraph 16 (NIR 2019, p.440 and NIR 2020, p.432). During the review, the Party explained that this reporting would be corrected in the NIR 2022 as the Party recognizes that decision 2/CMP.7, annex, paragraph 16, clarifies this point.

[a] 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.

[b] The report on the review of the 2019 annual submission of Croatia was not available at the time of this review. Therefore, the recommendations reflected in this table are taken from the 2018 annual review report. For the same reason, 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 2020 annual submission of Croatia, 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 Croatia

ID#	*Previous recommendation for the issue*	*Number of successive reviews issue not addressed*[a]
General	No issues identified.	
Energy		
E.5	Distribute fuel consumption and emissions from the generation of electricity and heat in manufacturing industries and construction for 1990–2000 in accordance with the detailed industrial split for stationary combustion provided in the 2006 IPCC Guidelines.	3 (2015/2016–2020)
IPPU		
I.20	Move from a tier 1 method to a higher-tier method for estimating CO_2 emissions from petrochemical and carbon black production, in accordance with the corresponding decision trees in the 2006 IPCC Guidelines.	3 (2015/2016–2020)
I.29	Estimate CO_2 emissions from ferroalloys production using a higher-tier method, in accordance with the corresponding decision trees in the 2006 IPCC Guidelines and pursuant to decision 24/CP.19, annex I, paragraph 11.	3 (2015/2016–2020)
I.37	Continue to conduct surveys on the status of disposal of refrigeration and air-conditioning equipment and include the results in the NIR.	5 (2013–2020)
I.40	Estimate HFC-152a emissions in accordance with the type of foam (open cell or closed cell) where HFC-152a is used, consistent with the methodology prescribed in the 2006 IPCC Guidelines (vol. 3, chap. 7.4.2), and report such emissions under the appropriate subcategory.	3 (2015/2016–2020)
Agriculture		
A.15	Correct the error concerning the N content of dry matter used to estimate emissions and improve QA/QC for the data received from the Croatian Environment Agency.	4 (2014–2020)
LULUCF		
L.1	Determine which carbon pools and subcategories are significant in each key category based on the guidance provided in the 2006 IPCC Guidelines, and provide detailed information on the results of such determination in the NIR.	3 (2015/2016–2020)
L.5	Correct all the inconsistencies identified in the NIR and between the NIR and the CRF tables, and further improve the QA/QC system's effectiveness by enhancing related QA/QC procedures such as internal audits, and corrective and preventive activities following the national QA/QC plan, in order to be able to identify and correct such inconsistencies during the inventory preparation process in the future.	3 (2015/2016–2020)

ID#	*Previous recommendation for the issue*	*Number of successive reviews issue not addressed*[a]
L.11	Collect data in order to estimate and report carbon stock losses from the living biomass pool in 'out of yield' forest land remaining forest land.	3 (2015/2016–2020)
L.13	Provide detailed information on the analysis of the data from CRONFI to check their usefulness for the GHG inventory, and clarify whether the CRONFI data cover both the deadwood and the litter pools.	3 (2015/2016–2020)
L.14	Implement the tier 2 approach for perennial cropland remaining perennial cropland as soon as possible.	5 (2013–2020)
L.15	Improve the cropland biomass estimates to enable implementation of a tier 2 method for estimating cropland biomass in this category as soon as possible.	3 (2015/2016–2020)
L.17	Improve the cropland biomass estimates to enable implementation of a tier 2 method for estimating cropland biomass under the land converted to grassland category as soon as possible.	4 (2014–2020)
L.18	Improve the cropland biomass estimates to enable implementation of the tier 2 approach for estimating cropland biomass estimates under the cropland converted to settlements category as soon as possible.	4 (2014–2020)
L.19	Estimate indirect N_2O emissions associated with the loss of soil organic matter resulting from a change in land use or management of mineral soils and report these emissions in CRF table 4(IV), following the guidance in footnotes 2 and 4 of that table as well as in the 2006 IPCC Guidelines.	3 (2015/2016–2020)
Waste		
W.1	Provide information on the type of waste disposed of in SWDS and ensure that all types of solid waste, including industrial waste, sludge, and construction and demolition waste, disposed of in SWDS are included in the emission estimates.	5 (2013–2020)
W.5	Extrapolate back in order to estimate CO_2 emissions from the incineration of plastic waste between 1990 and 2006 to improve the consistency of the time series and transparency.	4 (2014–2020)
KP-LULUCF		
KL.7	Collect data in order to estimate and report carbon stock losses from the living biomass pool in 'out of yield' forests under the activity FM.	3 (2015/2016–2020)
KL.10	Exclude from the reporting HWP originating from deforestation events on the basis of instantaneous oxidation (to 'zero' the net contribution to the national net CO_2 emissions), and exclude emissions from HWP already accounted for during the first commitment period of the Kyoto Protocol on the basis of instantaneous oxidation, in accordance with decision 2/CMP.7, annex, paragraphs 16 and 31.	3 (2015/2016–2020)

[a] Reports on the reviews of the 2017 and 2019 annual submissions of Croatia have not yet been published. Therefore, 2017 and 2019 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 2020 annual submission

10. Table 5 presents findings made by the ERT during the individual review of the 2020 annual submission of Croatia that are additional to those identified in table 3.

Table 5
Additional findings made during the individual review of the 2020 annual submission of Croatia

ID#	*Finding classification*	*Description of the finding with recommendation or encouragement*	*Is finding an issue/problem?*[a]
General			
G.9	Inventory planning	Croatia provided a summary of category-specific planned improvements for some categories in its NIR, for example for CH_4 emissions from enteric fermentation (section 5.2.6) and for forest land (section 6.4). Croatia also reported on some sector-specific projects that include improvements for many individual categories (e.g. the LULUCF 3 project (NIR p.258)). The ERT, noting that many recommendations were made in the 2018 review report (FCCC/ARR/2018/HRV), considers that a coordinated effort is required for the Party to make effective use of its limited resources to improve, inter alia, the accuracy and completeness of its inventory. The ERT noted a reference to an inventory improvement plan in the NIR (p.40): "Improvement Plan is document which defines objectives related to the improvement of National Inventory." The NIR states that the plan takes into account the key category analysis and recommendations outlined in the annual review report, and that it is prepared annually. Paragraph 50(b) of the UNFCCC Annex I inventory reporting guidelines states that the NIR shall include "an indication of the level of complexity (IPCC tier) applied and a description of any national methodology used by the Annex I Party, as well as information on anticipated future improvements". However, the ERT did not find evidence that the "anticipated future improvements" in the inventory improvement plan are being implemented in a timely manner. During the review, the Party explained that decisions on priorities for inventory development, including on planning and implementation of improvement projects, are made at meetings of the experts and stakeholders who are involved in NIR preparation. Croatia emphasized that these priorities are determined in accordance with the urgency and importance of the problems, while taking into consideration whether they could be resolved in a satisfactory manner within a reasonable time as well as, importantly, with available financial resources and staff capacity. The ERT considers that Croatia should develop a master inventory development plan containing all inventory developments needed and improvement activities being undertaken and planned. This will ensure coherence, facilitate coordination, enhance transparency and facilitate inventory planning. The inventory agency should have oversight of the plan, maintain the plan and ensure the plan is kept up to date. The plan should identify the resources required to implement each inventory improvement or group of improvements. A summary of the plan, and the status of the inventory improvement work proposed, should be presented in the NIR.	Not an issue/problem
G.10	QA/QC and verification	Croatia reported a small amount of information on the role of sectoral experts in implementing the QA/QC plan of the inventory in section 1.2.3 of the NIR. This section provides a summary of the QA/QC plan and activities, with a table stating that sectoral experts have a role in the QA/QC plan and text referring to an improvement plan. Information on the QA/QC plan in the 2006 IPCC Guidelines (vol. 1, chap. 6.5) states that the plan should, in general, outline the QA/QC and verification activities that will be implemented and the institutional arrangements and responsibilities for implementing those activities. During the review, the Party provided additional documents	Not an issue/problem

ID#	*Finding classification*	*Description of the finding with recommendation or encouragement*	*Is finding an issue/problem?*[a]
		that include the QA/QC plan prepared by the Ministry of Environment and Energy and the improvement plan for preparation of the NIR prepared by the Croatian Agency for the Environment and Nature. Information on the roles of individual sectoral experts is also provided in those documents. The ERT encourages Croatia to improve the transparency of its reporting by increasing the level of detail in the NIR on the QA/QC and verification undertaken by sectoral experts to implement the Party's inventory improvement plan. The details could include specific activities that will be carried out and the institutional arrangements and responsibilities for them.	
G.11	Recalculations	Croatia included a clear explanation of the reasons for some of the recalculations in the NIR (e.g. sections 3.2.4.2 and 3.2.5.2), but other explanations of recalculations have limited detail (e.g. section 3.3.2.5, p.109, wherein the explanation is "Small differences appear in CO_2 eq emissions due to the change of data provider for the amount of oil transported by pipelines. For the 2020 submission data provider is the CBS"). The ERT notes that recalculations shall be reported in the NIR, with explanatory information and justifications for them in accordance with paragraph 44 of the UNFCCC Annex I inventory reporting guidelines. During the review, the Party clarified that until 2020, the data provider for the amount of oil transported by pipelines was JANAF (a Croatian company specializing in crude oil transportation). JANAF had no obligation to provide these data to the relevant ministry and did so on a voluntary basis. The Party was notified by CBS that collection and verification of these data was under its jurisdiction, and CBS was able to provide verified data for the whole period. The ERT recommends that Croatia report recalculations following paragraphs 43–44 of the UNFCCC Annex I inventory reporting guidelines. Croatia should describe differences in emissions resulting from the recalculations it carried out and provide a brief explanation of the reasons for the recalculations. For example, for the recalculations reported in section 3.3.2.5 of the NIR 2020, the Party should explain why it chose to use oil transport data from CBS, which resulted in a recalculation.	Yes. Transparency
G.12	Uncertainty analysis	Croatia reported an assessment of the uncertainty of its GHG inventory in section 1.6 (pp.49–50) and in annex 2 to its NIR (p.35). The Party applied both approach 1 and 2 for estimating its uncertainties both including and excluding LULUCF. For the 2020 submission, the Party used higher-tier methods for some categories for which tier 1 methods had been used in the 2018 submission. For example, a tier 2 method was used to estimate CO_2 emissions for some subcategories of energy industries under fuel combustion (1.A.1.a.i and 1.A.1.a.ii) using country-specific EFs for natural gas and hard coal (see ID# G.1 in table 3). However, in annex 2, there is no clear indication that Croatia revised its uncertainty analysis to update the uncertainties for those categories for which methodological changes had been made since the previous submission. The ERT noted that this is not in accordance with the 2006 IPCC Guidelines (vol. 1, chap. 3.1.7, p.3.13), which indicate that the choice of methodological tier for estimating emissions and removals can affect the uncertainty analysis. This means moving to higher-tier methods may affect the associated uncertainties, so the uncertainties should be reassessed. During the review, the Party clarified that it had not updated the uncertainty analysis, including for CO_2 emissions for subcategories 1.A.1.a.i and 1.A.1.a.ii, and that it would be updated for the next submission. The ERT recommends that Croatia review and revise the uncertainties associated with the AD and EFs used for all categories that have moved to using a higher-tier method for estimating emissions since the previous submission, and update the approach 1 and approach 2 uncertainty analyses accordingly.	Yes. Convention reporting adherence

ID#	*Finding classification*	*Description of the finding with recommendation or encouragement*	*Is finding an issue/problem?*[a]
Energy			
E.12	Fuel combustion – reference approach – liquid fuels – CO_2, CH_4 and N_2O	Croatia reported in CRF table 1.A(b) of the 2018 submission that the NCV for both bitumen and lubricants is 33.5 TJ/kt. This value is at the lower limit of the 95 per cent confidence interval for NCVs specified in table 1.2 of the 2006 IPCC Guidelines (vol. 2), which is for bitumen 33.5–41.2 TJ/kt and for lubricants 33.5–42.3 TJ/kt. For bitumen, the apparent consumption reported in the CRF tables is consistently about 14 per cent lower than that reported to the International Energy Agency as a result of the use of different NCVs. During the review, the Party clarified that, following a recommendation made by the previous ERT during the 2018 in-country review, a project aimed at reviewing the NCVs for lubricants, paraffin, wax and bitumen was conducted. The Party informed the ERT that the results of that project would be included in its 2021 submission, and offered to provide the ERT with the results of the project upon request. The ERT requested and received the project report from the Party (Energy Institute Hrvoje Požar, 2020). The ERT noted the report states (in an unofficial translation from the Croatian) that "the analysis of the operation of refineries concluded that it is not possible to increase this value [of 33.5 TJ/kt for lubricants] because such a correction would lead to a disturbed ratio of input and output energy in refineries in certain years". The ERT recommends that Croatia undertake additional research to determine the NCVs of bitumen and lubricants and use those values when calculating emissions from fuel combustion in order to avoid possible underestimation of emissions.	Yes. Accuracy
E.13	1.A.3.b Road transportation – gaseous and liquid fuels – CO_2	Croatia reported in the NIR (pp.90–91) that CO_2 emissions from liquid and gaseous fuels for subcategory 1.A.3.b (road transportation) were calculated on the basis of the amount and type of fuel combusted using the tier 1 approach; that the amounts of all types of liquid and gaseous fuels consumed in 1990–2018 were extracted from the national energy balance; and that the EFs used for calculating CO_2 emissions from liquid and gaseous fuels are from the 2006 IPCC Guidelines (vol. 2, table 3.2.1). During the review, the ERT asked the Party to explain the use of the tier 1 approach and default EFs for this key category of CO_2 emissions. Croatia replied that the measurement of the carbon content of liquid fuels is still unregulated at the EU level and there is no legislation in Croatia creating an obligation for this measurement. The Party added that measuring the carbon content of liquid fuels suffers from some technical problems, but it did not specify what these are. Lastly, the Party stated that the development of country-specific EFs for CO_2 emissions from road transportation is a long-term goal. The ERT recommends that Croatia develop country-specific EFs for CO_2 emissions from fuels combusted in road transportation, thereby allowing it to use a tier 2 method for estimating these emissions, given that CO_2 emissions from road transportation is a key category and that the 2006 IPCC Guidelines (vol. 2, figure 3.2.2) suggest it is good practice to apply a tier 2 method.	Yes. Accuracy
IPPU			
I.47	2.B.8 Petrochemical and carbon black production – CO_2 and CH_4	Croatia reported CO_2 and CH_4 emissions from methanol production as "IE" for the whole time series in its 2020 submission. In its 2018 submission, the Party had reported "NO" for 1990–2002 and actual emissions for 2003–2016. Croatia stated in its NIR 2020 (p.140) that "since default feedstock in the 2006 IPCC Guidelines is natural gas, and since methanol production is not included in the energy balance under the 'non-energy use' category, to avoid double counting, emissions from this subcategory were reported as 'IE' in this submission and are considered to be included in the energy sector". The ERT noted that this is not in accordance with the 2006 IPCC Guidelines	Yes. Accuracy

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		(vol. 3, chap. 1, p.1.8, box 1.1), which recommend that all emissions from fuels and other input materials be reported under the IPPU sector. During the review, the Party clarified that it reviewed the subcategories under 2.B.8 (petrochemical and carbon black production) prior to the 2019 submission. Clarifications were sought from the Energy Institute Hrvoje Požar, which is in charge of compiling national energy statistics, analysing energy flows, collecting energy data and developing the national energy balance. The Party concluded that in the energy balance, under non-energy use, the "petrochemical industry" category includes only consumption of natural gas at one plant, which produces NH_3, nitric acid, sulfuric acid, ammonium phosphate, NPK fertilizers (comprising N, phosphorus and potassium), urea and carbon black. The rest of the natural gas consumption in Croatia is included under the energy sector. Therefore, the Party assumed that natural gas consumed in methanol production is also included under the energy sector. The Party acknowledged that 2.B.8 has been identified as a key category and that not all of the emissions covered by this category, including those from methanol production, have been estimated using the tier 2 or higher approach. Because only nationally aggregated statistical data on methanol production were collected, additional research covering individual producers is needed. The Party explained that this matter is included in the data collection plan, and depending on the available resources, a further investigation of it will be made. The Party also explained that this issue is currently categorized as a long-term plan for improvement. The ERT recommends that Croatia collect input data for methanol production from individual producers to allow the use of a tier 2 method for estimating emissions from methanol production or, if this information is not available, continue to apply a tier 1 method, reporting all emissions for category 2.B.8 (petrochemical and carbon black production), including from natural gas use, under the IPPU sector, not under the energy sector.	
I.48	2.B.8 Petrochemical and carbon black production – CO_2, CH_4 and N_2O	Croatia reported in its NIR (p.140) that data on the type of feedstock and processes used for the production of ethylene dichloride in the country are currently not available – only nationally aggregated production quantities of ethylene dichloride are available. For this reason, Croatia applied a tier 1 method using the default EF from the 2006 IPCC Guidelines to estimate emissions from ethylene dichloride production. The Party explained in the NIR that upon investigating the national energy statistics, it concluded that fuels that are likely used in ethylene production, as described in the 2006 IPCC Guidelines (which identify naphtha as the default feedstock in the default steam cracking process) (vol. 3, chap. 3, p.3.59), are not reported in the national energy statistics; that is, these emissions are not included under the energy sector. During the review, the Party clarified that in the energy sector, category 1.A.2 (manufacturing industries and construction) includes emissions from fuel used in various industries, including the petrochemical industry. Fuel consumption in this subsector does not include naphtha. In the energy balance, the consumption of naphtha is included only in energy transformations. The ERT recommends that Croatia further investigate the types of feedstock and their quantities used for ethylene production; if fuels are used as feedstock, investigate why they are not included in the energy balance, and if emissions from ethylene production are also reported under the energy sector, subtract these emissions from the energy sector to avoid double counting.	Yes. Accuracy
I.49	2.D.2 Paraffin wax use – CO_2	Croatia reported CO_2 emissions from paraffin wax use in its NIR (pp.157–159) and in CRF tables 2(I)s2 and 2(I).A-Hs2. The NCV used for paraffin wax (33.5 TJ/Gg) is lower than the default value (40.2 TJ/Gg) and outside the range of NCVs (33.7–48.2 TJ/Gg) in the 2006 IPCC Guidelines (vol. 2, chap. 1, table 1.2). During the review, the Party explained that it had conducted a project that included the review of the NCV for lubricants and paraffin wax and provided the report of the project (Energy Institute Hrvoje Požar, 2020 (in	Yes. Accuracy

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		Croatian)) to the ERT (see also ID# E.12 above). In line with the results, the Party decided to increase the NCV of paraffin wax to 40.2 TJ/Gg for the next submission. The ERT recommends that Croatia undertake additional research to determine the NCV of paraffin wax through analysis of the product, and use that value when calculating emissions for this category; or, if further research is not possible, use the default EF to calculate emissions for this category.	
I.50	2.G.1 Electrical equipment – SF_6	Croatia reported in its NIR (p.171) that owing to the unavailability of the data needed to calculate SF_6 emissions from electrical equipment for 2017 and 2018, a recalculation was performed by linear extrapolation (using the time series 2014–2016), which the ERT noted is not a good practice in accordance with the extrapolation methods provided in the 2006 IPCC Guidelines (vol. 1, chap. 5, p.5.12). During the review, the Party provided the ERT with the details of the extrapolation method used for the 2020 submission and acknowledged that it had already found an error in the extrapolation calculation of the emissions reported for 2017 and 2018. The Party informed the ERT of its intention to report a recalculation in the next submission. Further, Croatia noted the project referred to in ID# I.37 in table 3 will include all information on AD, EFs, methods and assumptions used for estimating SF_6 emissions from electrical equipment. The Party informed the ERT that it intends to implement the results of the project for the 2022 submission. The ERT recommends that Croatia prioritize the collection of AD for calculating SF_6 emissions from electrical equipment and, if necessary, use provisional data for the most recent years and correctly apply the methods described in the 2006 IPCC Guidelines (vol. 1, chap. 5).	Yes. Accuracy
I.51	2.G.1 Electrical equipment – SF_6	Croatia reported SF_6 emissions only from leakage and maintenance losses in existing equipment stocks. Emissions from SF_6 filled into new products were reported as "NO", with no explanation included in the NIR, as was the case for emissions of SF_6 from the decommissioning of equipment. The ERT noted that this is not in accordance with the 2006 IPCC Guidelines (vol. 3, equation 8.1). During the review, the Party clarified that at the time of the preparation of the submission, AD on the amount of SF_6 filled into new products and the amount of SF_6 remaining in products at decommissioning were not available. The Party informed the ERT of the project referred to in ID# I.37 in table 3. As part of this project, all missing and incomplete information and AD are expected to be collected and included in emission calculations for all activities that occurred in the country under this source category during the whole time series. The ERT notes that the issue may be resolved with implementation of the ongoing project on F-gases and believes that future ERTs should consider this issue further to ensure that there is not an underestimation of emissions for this category. The ERT recommends that Croatia collect the AD required to allow estimates of emissions from SF_6 filled into new electrical equipment and SF_6 emissions from the decommissioning of electrical equipment to be made, and report these emissions.	Yes. Completeness
Agriculture			
A.22	3. General (agriculture) – CH_4	Croatia reported as "NE" CH_4 emissions from enteric fermentation of poultry (CRF table 3.As1) and CH_4 emissions from agricultural soils (CRF table 3s2) without providing an explanation in its NIR as to why it did not estimate the emissions for these categories. During the review, the Party explained that CH_4 emissions from enteric fermentation of poultry and from agricultural soils were not estimated because an estimation method for these	Yes. Transparency

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		categories has not been developed and no default EFs for the tier 1 methodology are provided in the 2006 IPCC Guidelines. The ERT recommends that Croatia improve the transparency of its reporting by explicitly including in the NIR the rationale for not estimating CH_4 emissions from enteric fermentation of poultry and CH_4 emissions from agricultural soils as well as for any other categories of the agriculture sector for which emissions were not estimated.	
A.23	3.A Enteric fermentation – CH_4	Croatia estimated CH_4 emissions from enteric fermentation for all livestock categories by applying a tier 1 method and default EFs from the 2006 IPCC Guidelines (vol. 4, table 10.11) (NIR p.178). National data on animal populations were provided by CBS and the Croatian Agricultural Agency and, where national data were not available, FAO data were used. The ERT noted that Croatia reported in its 2018 submission that a tier 2 method was applied for estimating CH_4 emissions from enteric fermentation of cattle, sheep and swine through the use of country-specific values for average gross energy intake and average CH_4 conversion rate to estimate country-specific EFs. Owing to the change from the tier 2 to the tier 1 approach in the 2020 submission (see ID# A.6 in table 3), CH_4 emissions from cattle decreased for the entire time series in the range of 4.8–17.1 per cent, while CH_4 emissions from sheep and swine increased for the entire time series in the range of 1.5–60.0 per cent and 7.1–50.0 per cent, respectively. During the review, in response to a question raised by the ERT about the rationale for the tier method change, the Party explained that several issues were detected during the 2018 in-country review that resulted in the calculated country-specific EF for tier 2 for enteric fermentation of cattle falling below the range of the tier 1 default EF for Western European countries (117 kg CH_4 $head^{-1}$ yr^{-1} for dairy cattle and 57 kg CH_4 $head^{-1}$ yr^{-1} for other cattle), as indicated in the 2006 IPCC Guidelines (vol. 4, table 10.11). The reasons behind this low EF include the use of methodologies from the IPCC good practice guidance, the lack of necessary historical national data for 1990–2000 and the cattle categorization that does not meet the requirements for a tier 2 method. Croatia emphasized in the NIR and during the review that the use of a tier 1 method for all livestock categories is a temporary measure and that it is working on a planned upgrade to a higher-tier method for estimating CH_4 emissions from enteric fermentation. These emissions have been identified as a key category, and the ERT notes that the decision tree for CH_4 emissions from enteric fermentation in the 2006 IPCC Guidelines (vol. 4, figure 10.2) states that a tier 2 method is to be used when an animal species is significant and as a rule of thumb, a livestock species is significant if it accounts for 25–30 per cent or more of emissions of the source category. The ERT recommends that Croatia prioritize efforts and resources to apply a higher-tier methodology for estimating emissions from enteric fermentation, and report the estimates obtained from using that methodology as well as a description of country-specific parameters (i.e. gross energy and CH_4 conversion rate), at least for cattle, which represent 81 per cent of CH_4 emissions from enteric fermentation, in line with the decision tree for CH_4 emissions from enteric fermentation in the 2006 IPCC Guidelines.	Yes. Accuracy
A.24	3.B Manure management – CH_4	Croatia reported in CRF table 3.B(a)s2 the following notation keys for MCF: “NE” for mature dairy cattle – anaerobic lagoon, cool climate region; “NO” for other mature cattle – anaerobic lagoon, cool climate region; “NE” for market swine – solid storage and dry lot, cool climate region; and “NE” for horses – solid storage, dry lot, and pasture, range and paddock, cool climate region. However, Croatia reported the Nex rate for each MMS in CRF table 3.B(b) for all animal categories for which the MMS applied. During the review, the Party explained that notation keys in CRF table 3.B(a)s2 had been entered incorrectly.	Yes. Convention reporting adherence

ID#	*Finding classification*	*Description of the finding with recommendation or encouragement*	*Is finding an issue/problem?*[a]
		The ERT recommends that Croatia report in CRF table 3.B(a)s2 appropriate MCF data for animal categories allocated to MMS in the cool climate region: mature dairy cattle – anaerobic lagoon; other mature cattle – anaerobic lagoon; market swine – solid storage and dry lot; and horses – solid storage, dry lot, and pasture, range and paddock.	
A.25	3.B Manure management – CH_4	Croatia used an MCF for its liquid systems (22 per cent) that is within the range of the IPCC default for liquid/ slurry without crust cover in cool climate (17–25 per cent). The Party also used the same MCF value (22 per cent) for anaerobic lagoons. The MCF value for anaerobic lagoons is lower than the IPCC default range for cool climate (66–73 per cent) (see NIR table 5.3-1 and table 10.17 of the 2006 IPCC Guidelines (vol. 4)). During the review, the Party explained that the MCFs of 22 per cent for liquid systems and anaerobic lagoons were proposed by the EU during its review of member States' GHG inventories for the NIR 2016, where anaerobic lagoons were characterized with similar conditions to those of liquid systems owing to a combination of a cool temperature and the environmental legislation of Croatia. Noting the cool temperature conditions of Croatia and the available scientific information on anaerobic lagoons for manure management (e.g. the Wastewater Technology Fact Sheet prepared by the United States Environmental Protection Agency (https://cfpub.epa.gov/si/si_public_record_Report.cfm?Lab=OW&dirEntryID=23812), the ERT considers the use of an MCF of 22 per cent for anaerobic lagoon MMS to be reasonable. However, the ERT also considers that this must be scientifically justified by the Party. The ERT recommends that Croatia include in its NIR a detailed rationale for using MCFs of 22 per cent for both liquid systems and anaerobic lagoons or revise the estimates of CH_4 emissions from these MMS using the default MCF values from the 2006 IPCC Guidelines (i.e. 17–25 per cent for liquid systems without crust cover and 66–73 per cent for anaerobic lagoons).	Yes. Transparency
A.26	3.B Manure management – N_2O	Croatia estimated direct N_2O emissions from manure management for all livestock categories by applying a tier 1 method from the 2006 IPCC Guidelines (vol. 4) and using national animal population data from CBS, the Croatian Agricultural Agency and FAOSTAT; default values for Nex rate for all livestock categories (table 10.19 in the 2006 IPCC Guidelines); default values for typical animal mass for all livestock categories (tables 10A-4 to 10A-9 in the 2006 IPCC Guidelines) except for cattle, for which country-specific typical animal mass values were used (562.8 kg for mature dairy cattle, 529.1 kg for other mature cattle and 301.6 kg for growing cattle); and a country-specific MMS distribution and default EFs for manure management systems (table 10.21 in the 2006 IPCC Guidelines) (NIR p.185). The ERT noted that Croatia reported in its 2018 submission that a tier 2 method was applied for estimating direct N_2O emissions from manure management for all livestock categories through the use of country-specific values for annual Nex rates, a country-specific MMS distribution and default EFs. Owing to the change from the tier 2 to the tier 1 approach, direct N_2O emissions from manure management decreased by an average of 2.2 per cent for the entire time series. During the review, in response to a question raised by the ERT about the rationale for the tier method change, the Party explained that several issues were detected during the 2018 in-country review regarding the Nex rates estimated (e.g. the use of the same averaged Nex rates for young cattle and non-dairy cattle categories, the use of default values from the IPCC good practice guidance), which indicated the need to develop and revise country-specific EFs and implement country-specific Nex rates with the tier 2 approach in line with the 2006 IPCC Guidelines. Croatia considers that the change from tier 2 to tier 1 is a temporary change until old country-specific EFs are revised and new country-specific EFs are developed. Croatia continued using a country-specific value for typical animal mass for cattle and a country-specific MMS distribution	Yes. Accuracy

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		to improve the accuracy of the direct N_2O emissions estimated. Taking into account that direct N_2O emissions from manure management were identified as a key category, the ERT notes that the decision tree for N_2O emissions from manure management in the 2006 IPCC Guidelines (vol. 4, figure 10.4) states that a tier 2 method is to be used if N_2O from manure management is a key category or when an animal species is significant and as a rule of thumb, a livestock species is significant if it accounts for 25–30 per cent or more of emissions of the source category. The ERT recommends that Croatia apply a tier 2 method with collected data to develop and revise the Nex rates and country-specific EFs for typical animal mass and a country-specific MMS distribution and report in the NIR a description of the country-specific parameters used, especially for cattle and poultry, which represent 52.8 and 28.7 per cent of direct N_2O emissions from manure management, respectively, in line with the decision tree for N_2O emissions from manure management in the 2006 IPCC Guidelines.	
A.27	3.B.1 Cattle – CH_4	The ERT noted that the total percentage of growing cattle allocated to MMS is 98.8 per cent (CRF table 3.B(a)s2), thus 1.2 per cent of the animal population was not assigned to a specific MMS. During the review, Croatia explained that the remaining 1.2 per cent of growing cattle was allocated to anaerobic lagoons. The ERT notes that this is an error only in the CRF metadata; emissions were calculated correctly and attributed to this MMS. The ERT recommends that Croatia revise and report in the CRF tables the correct percentages of growing cattle allocated to each MMS for the cool climate region, ensuring that the allocation totals 100 per cent.	Yes. Convention reporting adherence
A.28	3.B.2 Sheep – N_2O	Croatia reported the total amount of direct N_2O emissions from manure management as 0.138 kt N_2O (40.99 kt CO_2 eq) in CRF table 3.B(b). The ERT noted that the total amount is different when N_2O emissions by livestock category are aggregated – the aggregate figure is 0.151 kt N_2O (44.9 kt CO_2 eq). Further, the ERT noted that Croatia did not include the amount of N volatilized as NH_3 and NO_X from the solid storage MMS of sheep in the total amount of N volatilized as NH_3 and NO_X from all MMS for all livestock categories in its estimates reported in CRF table 3.B(b) (see ID# A.29 below). During the review, the Party provided the ERT with the spreadsheet used in estimating direct N_2O emissions from manure management. Croatia estimated total annual direct N_2O emissions from manure management as 137,280.8 kg N_2O (135,147.2 kg N_2O for solid storage MMS and 2,133.6 kg N_2O for other MMS). However, the ERT noted that the annual direct N_2O emissions from manure management do not include direct N_2O emissions from solid storage MMS of sheep, which amounted to 13,540.9 kg N_2O/year. In response to a question raised by the ERT about the rationale for not including these emissions, Croatia explained that the omission is attributable to an error in the spreadsheet; that is, direct N_2O emissions from solid storage MMS of sheep should have been included in the total. The ERT considers that this omission results in a potential underestimation of the total direct N_2O emissions from manure management reported in the 2020 submission. Using the spreadsheet provided by Croatia, the ERT estimated an amount of 0.151 kt N_2O (44.9 kt CO_2 eq) for total annual direct N_2O emissions from manure management including direct N_2O emissions from solid storage MMS of sheep. The ERT notes that the difference of 4.0 kt CO_2 eq is below the significance threshold (0.05 per cent of national total emissions without LULUCF). The ERT recommends that Croatia report revised direct N_2O emissions from manure management that include the direct N_2O emissions from solid storage MMS of sheep, and ensure that all direct N_2O emissions from manure management of all livestock categories are included in the total amount in order to avoid a potential underestimation of emissions.	Yes. Completeness

ID#	*Finding classification*	*Description of the finding with recommendation or encouragement*	*Is finding an issue/problem?*[a]
A.29	3.B.5 Indirect N_2O emissions – N_2O	Croatia reported the total N volatilized as NH_3 and NO_X as 12,209,771.4 kg N/year in CRF table 3.B(b). The ERT noted that, in the spreadsheet used in estimating the emissions, which was provided by the Party during the review, the estimated amount was 18,215,665.6 kg N/year, which is higher than the amount reported in CRF table 3.B(b). During the review, in response to a question raised by the ERT about the rationale for different N amounts being estimated and reported, the Party explained that the spreadsheet contains values revised following the ESD technical correction by the EU related to the incorrect use of $Frac_{GasMS}$ and $Frac_{LossMS}$. The revisions implemented resulted in a change in the total N volatilized as NH_3 and NO_X in CRF table 3.B(b). On the other hand, the ERT noted that Croatia did not include the amount of N volatilized as NH_3 and NO_X from the solid storage MMS of sheep (206,806.9 kg N/year) in the total amount of N volatilized as NH_3 and NO_X from all MMS for all livestock categories (18,215,665.6 kg N/year) in its estimates reported in CRF table 3.B(b) (see ID# A.28 above). Further, in response to a question on the reason why the IEF for N volatilization and re-deposition reported in CRF table 3.B(b) (0.0251 kg N_2O-N/kg N) is higher than the default EF_4 (0.01 kg N_2O-N) from table 11.3 of the 2006 IPCC Guidelines (vol. 4), the Party explained that a conversion of N_2O-N emissions to N_2O emissions (conversion factor: 44/28) was performed twice in estimating emissions for the 2020 submission, resulting in an overestimation of emissions and a high IEF. Using the spreadsheet provided by Croatia, the ERT estimated an amount of 18,422,472.5 kt N/year as total N volatilized as NH_3 and NO_X – including the amount of N volatilized from the solid storage MMS of sheep. When the appropriate default EF_4 (0.01 kg N_2O-N) is applied, the result is an amount of 0.289 kt N_2O (86.3 kt CO_2 eq), which is lower than the 0.307 kt N_2O (91.4 kt CO_2 eq) reported by Croatia in its CRF table 3.B(b). The ERT concludes that even though Croatia underestimated the amount of N volatilized, the indirect N_2O emissions from atmospheric deposition were overestimated owing to the error in the conversion factor of N_2O-N emissions to N_2O emissions, which was applied twice. The ERT recommends that Croatia correct its estimation of total N volatilized as NH_3 and NO_X by including the amount of N volatilized as NH_3 and NO_X from the solid storage MMS of sheep, and by revising the conversion of N_2O-N emissions to N_2O emissions.	Yes. Accuracy
A.30	3.D Direct and indirect N2O emissions from agricultural soils – N_2O	Croatia reported N input from animal manure applied to soils as 30,214,097.1 kg N/year in CRF table 3.D. However, the ERT noted that in the spreadsheet used in estimating emissions from animal manure applied to soils provided by the Party during the review, N input from manure applied to soils was indicated as 24,693,615.3 kg N/year, which is lower than the amount reported in CRF table 3.D. In response to a question raised by the ERT about the rationale for different N amounts being estimated and reported, Croatia explained that the spreadsheet contains values revised following the ESD review findings related to the incorrect use of $Frac_{GasMS}$ and $Frac_{LossMS}$. The revisions implemented resulted in a change in the total N input from manure applied to soils. The ERT noted that applying the N input from animal manure applied to soils corrected by the ESD review would result in lower N_2O emissions – that is, 0.388 kt N_2O (115.6 kt CO_2 eq) – than those reported in CRF table 3.D (0.475 kt N_2O, or 141.5 kt CO_2 eq). The ERT recommends that Croatia increase the accuracy of the estimated direct N_2O emissions from animal manure applied to soils by applying $Frac_{GasMS}$ and $Frac_{LossMS}$ in accordance with the 2006 IPCC Guidelines (vol. 4, tables 10.22 and 10.23) for each animal category in each manure management system used in the country. The ERT also recommends that the Party revise indirect N_2O emissions from animal manure applied to soils due to changes	Yes. Accuracy

ID#	Finding classification	Description of the finding with recommendation or encouragement	Is finding an issue/problem?[a]
		in N input from manure applied to soils that directly affect indirect N_2O emissions from atmospheric deposition and N leaching and run-off.	
A.31	3.D.a Direct N2O emissions from managed soils – N_2O	Croatia performed an uncertainty analysis using approach 2, and reported the use of uncertainty values for the default EF_1 that is within the uncertainty range of −70 to +200 per cent for mineral fertilizers and N-fixing crops and crop residues and within the combined uncertainty range of −50 to +150 per cent for urine and dung deposited by grazing animals (NIR p.198). However, the ERT noted that in NIR annex table A2:3-1, an uncertainty value of ±30 per cent was used for organic N fertilizers and mineralization/immobilization associated with loss/gain of soil organic matter. This range is not in line with the uncertainty ranges for the default values of EF_1 (0.003–0.03 kg N_2O-N/kg N) in table 11.1 of the 2006 IPCC Guidelines (vol. 4). During the review, the Party acknowledged the issue, stated that the range of −70 to +200 per cent should be applied to organic N fertilizers and mineralization/immobilization associated with loss/gain of soil organic matter, and indicated that this issue would be corrected in the uncertainty estimates reported in the next NIR. The ERT recommends that Croatia apply the appropriate uncertainty range for the default EF_1 from the 2006 IPCC Guidelines (0.003–0.03 kg N_2O-N/kg N) and report the results.	Yes. Convention reporting adherence
LULUCF			
L.21	4. General (LULUCF) – CO_2, CH_4 and N_2O	Croatia reported in its NIR that an extrapolation of the CORINE Land Cover inventory data trend for 2006−2012 was applied for cropland (section 6.3.2), grassland (section 6.3.3), wetlands (section 6.3.4) and settlements (section 6.3.5), although this is no longer the approach applied by the Party. A clear description of the changes implemented in the methodology used to represent land-use changes was also not provided in the sections of the NIR on category-specific recalculations (6.5.5, 6.6.5, 6.7.5 and 6.8.5). In those sections, Croatia only provided generic text flagging the fact that changes in AD had resulted in significant differences in emissions/removals. Only in the sections on planned improvements (6.5.6, 6.6.6, 6.7.5 and 6.8.6) and in the overview table of recalculations (10.4-2) did Croatia explicitly mention that CORINE Land Cover inventory data for 2012−2018 were used to improve the land-use change matrix included in the submission. The ERT noted that this is not in accordance with paragraph 48 of the UNFCCC Annex I inventory reporting guidelines, which states that the NIR should ensure transparency and contain sufficiently detailed information to enable the inventory to be reviewed. During the review, the Party confirmed that the description of the methodology used to represent land-use change in the NIR did not reflect the latest improvements to the methodology. The ERT recommends that Croatia transparently explain in its NIR which data have been used to construct the land-use change matrices.	Yes. Transparency
L.22	Land representation – CO_2, CH_4 and N_2O	Croatia did not systematically report the final area from the previous year as the initial area for the next year in its land-transition matrices (CRF table 4.1). More specifically, the initial area of grassland included in the land-transition matrices for 1991, 1997−2004 and 2006−2007 does not match the final area of grassland reported in the previous years. The time series of areas of other land contained inconsistencies of equivalent magnitude and opposite sign, because they are calculated by Croatia as the difference between the total land area and the sum of all other land uses. The ERT noted that this is not in accordance with the 2006 IPCC Guidelines (vol. 4, chap. 3) because the land-transition matrices should allow tracking of all land transitions occurring between two successive years. During the review, the Party clarified that the issue arose from its approach to reconciling the time series of	Yes. Consistency

ID#	*Finding classification*	*Description of the finding with recommendation or encouragement*	*Is finding an issue/problem?*[a]
		cropland using time series data from CBS and CORINE Land Cover inventory data to define areas converted to or from cropland in 1980–1990, 1990–2006, 2006–2012 and 2012–2018. Croatia tried to resolve the problem of missing areas in some years under cropland by only modifying the areas within land converted to grassland. The ERT recommends that Croatia improve the consistency of the land-transition matrices, for instance by adjusting the time series for not only cropland converted to grassland but also grassland converted to cropland to reflect the net change between both categories according to the most reliable information available for that purpose (which, according to Croatia, as reported in its NIR 2020, is currently CORINE Land Cover inventory data).	
L.23	Land representation – CO_2, CH_4 and N_2O	Croatia reported in section 6.5.2.2.2 of the NIR that land-use change to cropland is from grassland and in section 6.6.2.2.5 (which is erroneously labelled 6.5.2.2.5 in the NIR) that land-use change to grassland is from cropland. However, the NIR does not contain a clear explanation of how gross flux in either direction of the cropland–grassland land-use change is estimated. The ERT noted that this is not in accordance with paragraph 48 of the UNFCCC Annex I inventory reporting guidelines, which states that the NIR should ensure transparency and contain sufficiently detailed information to enable the inventory to be reviewed. During the review, the Party clarified that CORINE Land Cover data were used to characterize both gross fluxes for 1980–1990, 1990–2006, 2006–2012 and 2012–2018. The ERT notes that the approach used by the Party was to use the area of cropland converted to grassland as a variable to match the inter-annual variability in the total cropland area reported in the CBS cropland statistics, while the conversion of grassland to cropland was assumed to occur at a constant rate within each of the periods covered by the CORINE Land Cover data. The ERT recommends that Croatia transparently report in its NIR the data used and assumptions made in estimating the gross fluxes of land-use change between cropland and grassland.	Yes. Transparency
L.24	4.A.1 Forest land remaining forest land – CO_2, CH_4 and N_2O	Croatia reported a large change in forest land composition between 2014 and 2015 in CRF table 4.A without explaining in the NIR the reasons for the difference. The share of broadleaf forests was reported to have been reduced by 2.4 per cent in 2015, and these forests were assumed to have been replaced by 'out of yield' forests, whose share increased by 2.1 per cent in that same year, and conifer forests, whose share increased by 0.3 per cent. During the review, the Party clarified that the reported change in forest land composition is attributable to a difference in the stratification used for national reporting and for reporting under the Convention in accordance with the UNFCCC Annex I inventory reporting guidelines, and that the difference did not result in any error in reported emissions and removals. The Party also clarified that it is aware that recalculation of areas of all forest types starting from 1990 is needed as a result of implementation of the new FM plan for the whole country for 2016–2025. Croatia informed the ERT that these recalculations are planned to be included in the 2022 submission. The ERT recommends that Croatia ensure time-series consistency of the AD used to estimate the forest land sink.	Yes. Consistency
L.25	4.G HWP – CO_2	In CRF table 4.Gs1, Croatia reported gains and losses of HWP in kt C but according to the table legend, these values should be reported in t C. The ERT considers that this error arose as a result of the Party not implementing sufficient QC procedures, and noted that this is not in accordance with paragraph 19 of the UNFCCC Annex I inventory reporting guidelines, which states that each Annex I Party shall elaborate an inventory QA/QC plan and implement general inventory QC procedures in accordance with its QA/QC plan following the 2006 IPCC Guidelines. During the review, the ERT raised the question with a mention of the issue to the Party; however, Croatia did not comment on this issue in its response.	Yes. Convention reporting adherence

ID#	*Finding classification*	*Description of the finding with recommendation or encouragement*	*Is finding an issue/problem?*[a]
		The ERT recommends that Croatia verify and report the correct amount of gains and losses of HWP in t C as required in CRF table 4.Gs1.	
L.26	4.G HWP – CO_2	Croatia applied equation 2.8.1 from the Kyoto Protocol Supplement (chap. 2, section 2.8) for estimating the annual fraction of the feedstock from domestic harvesting). The Party reported HWP gains from domestic wood production in CRF table 4.Gs1 by adjusting the statistics on semi-finished product using a coefficient reflecting the share of industrial roundwood from domestic harvesting, as described in section 6.10.2 of the NIR (p.283). The ERT noted that this is not in accordance with the methodologies in the 2006 IPCC Guidelines (vol. 4, chap. 12, equation 12.3). According to decision 24/CP.19, annex, paragraph 10, Annex I Parties may use national methodologies which they consider better able to reflect their national situation, provided that these methodologies are compatible with the 2006 IPCC Guidelines and are well documented and scientifically based. However, the ERT considers that the approach taken by the Party is not in accordance with equation 2.8.4 of the Kyoto Protocol Supplement to estimate annual HWP amounts produced from domestic harvesting because the Party does not take into account the fraction of domestically produced wood pulp as feedstock for paper and paperboard production, a parameter that also has to be taken into account when calculating the inputs to the paper and paperboard pool as required by the methodology provided in the Kyoto Protocol Supplement. During the review, the Party noted that it needs to perform checks of the AD used for estimating the emissions from HWP now that it has been made aware of the scale of the import and export of wood pulp as a feedstock for paper and paperboard production, and indicated that it would try to resolve this issue for the next submission. The ERT recommends that Croatia either implement methodologies from the 2006 IPCC Guidelines to determine inputs to HWP pools for its reporting under the Convention or, if it uses an equation from the Kyoto Protocol Supplement for this purpose, explain why it considers this equation better reflects its national circumstances than an equation from the 2006 IPCC Guidelines. The ERT also recommends that the Party, if it continues to report the import and export of roundwood as input to HWP on the basis of equations 2.8.1 and 2.8.4 of the Kyoto Protocol Supplement, apply equation 2.8.4 correctly by taking into account the import–export balance of wood pulp for the paper and paperboard pool.	Yes. Accuracy
Waste			
W.11	5.A Solid waste disposal on land – CH_4	Croatia reported DOC for MSW on the basis of waste composition and the DOC value of each waste type in its NIR (p.312). However, the Party did not report DOC values for industrial waste and sludge treated at landfill sites. During the review, the Party clarified that, in estimating CH_4 emissions from SWDS, default DOC values from the 2006 IPCC Guidelines (IPCC waste model) were applied: 0.15 for industrial waste and 0.05 for sludge. The ERT recommends that Croatia provide in the NIR the DOC values not only for MSW but also for industrial waste and sludge.	Yes. Transparency
W.12	5.A Solid waste disposal on land – CH_4	In the NIR, Croatia explained that a calculation of CH_4 emissions was performed using a tier 2 method and the IPCC first-order decay model, with a combination of country-specific data and default parameters. During the review, Croatia clarified that in estimating CH_4 emissions from SWDS, default DOC values from the 2006 IPCC Guidelines were applied: 0.15 for industrial waste and 0.05 for sludge (see ID# W.11 above). The ERT notes that the tier 2 method in the 2006 IPCC Guidelines for this category requires default parameters and good-quality country-specific AD to apply the IPCC first-order decay method (vol. 5, chap. 3, p.3.7). The ERT considers that the	Yes. Accuracy

ID#	*Finding classification*	*Description of the finding with recommendation or encouragement*	*Is finding an issue/problem?*[a]
		country-specific AD should be the amount of each waste type (e.g. paper/cardboard, textiles, food waste, wood), not the total amount of industrial waste disposed of. The ERT recommends that Croatia revise its estimates of CH_4 emissions from industrial waste by using the amount of each waste type (e.g. paper/cardboard, textiles, food waste, wood) rather than the total amount of industrial waste disposed of.	
W.13	5.A Solid waste disposal on land – CH_4	Croatia reported in the NIR (p.294) that a certain part of construction and demolition waste can be disposed of in landfills, but it did not report whether construction and demolition waste is included in industrial waste as AD for this category (5.A). During the review, the response from the Party to a question raised by the ERT confirmed that this type of waste was included in the estimates (see ID# W.1 in table 3). The ERT recommends that Croatia clearly report in its NIR that construction and demolition waste is included in industrial waste as AD for this category (5.A).	Yes. Transparency
W.14	5.A Solid waste disposal on land – CH_4	Croatia reported CH_4 emissions from SWDS in CRF table 5.A, calculating those emissions from data on managed and unmanaged SWDS (NIR p.307). However, it is unclear if reported CH_4 emissions from SWDS include those from unofficial sites. During the review, the Party explained that the reported data – for both the total number of active and closed landfills and the total amount of landfilled waste – do not include data for unofficial sites at which waste is improperly discarded into the environment because data for such sites are unavailable (see ID# W.2 in table 3). The ERT recommends that Croatia investigate the amount of waste disposed of at unofficial sites and include the emissions from those sites in the estimates for the category.	Yes. Accuracy
W.15	5.B.1 Composting – CH_4 and N_2O	Croatia recalculated CH_4 and N_2O emissions from composting by changing from dry weight basis EFs to wet weight basis EFs in the 2019 submission in order to correct the inconsistent use of the combination of wet weight basis AD with dry weight basis EFs. In its 2020 submission, the Party again reported wet weight basis AD for composting in the NIR (p.319) and the same values for the total amount of waste composted for 2007–2016 as in the 2019 submission in CRF table 5.B. As a result of the recalculation, the CH_4 and N_2O emissions for 2016 reported in the 2020 submission increased by 36.6 per cent compared with those reported in the 2018 submission. The ERT noted that Parties are required to report dry weight basis AD for composting in CRF table 5.B. During the review, the Party explained that wet weight basis AD were entered instead of dry in CRF table 5.B in the 2019 and 2020 submissions in error, but that wet weight basis AD and EFs had been consistently used in the emission estimates; therefore, the error did not affect the reported emissions. The ERT recommends that Croatia correctly report AD for composting on a dry weight basis.	Yes. Convention reporting adherence
W.16	5.C.1 Waste incineration – N_2O	Croatia reported N_2O emissions from the incineration of industrial waste in CRF table 5.C and explained in its NIR (p.322) that it used the default N_2O EF for industrial waste. However, the NIR does not include a value for this EF. During the review, the Party clarified that it used the default N_2O EF of 100 g N_2O/t waste for industrial waste (all types of incineration) from table 5.6 in the 2006 IPCC Guidelines (vol. 5). The ERT recommends that Croatia report in its NIR the value of the default N_2O EF for industrial waste used for estimating N_2O emissions from waste incineration, that is, 100 g N_2O/t waste.	Yes. Transparency

ID#	*Finding classification*	*Description of the finding with recommendation or encouragement*	*Is finding an issue/problem?*[a]
KP-LULUCF			
KL.11	General (KP-LULUCF) – CO_2, CH_4 and N_2O	Croatia reported information on harvesting in m^3 with an offset of two years in CRF table 4(KP-I)C, and it did not report on the FM cap with the correct rounding in the accounting spreadsheet (reporting the cap as 8,727.30 kt CO_2 eq when it should have been 8,737.296 kt CO_2 eq). Further, the NIR contains several sections that have not been updated to reflect the methods used in preparing the latest GHG inventory. For instance, in section 11.3.1.3, Croatia discussed whether the emissions from natural disturbances exceeded the background level from 2013 to 2017 but not for 2018. The ERT considers that these issues arose as a result of the Party not implementing sufficient QC procedures in the CRF tables and the NIR, and noted that this is not in accordance with decision 19/CMP.1, annex, paragraph 7, which states that national systems should be operated to ensure the quality of the inventory, including by implementing QC procedures and carrying out procedures for the verification of the inventory data at the national level. The ERT recommends that Croatia further develop its QC procedures for KP-LULUCF reporting in accordance with the annex to decision 19/CMP.1.	Yes. KP reporting adherence
KL.12	FM – CO_2, CH_4 and N_2O	Croatia has not updated the technical correction to the FMRL since the 1990–2014 inventory submitted in 2016 (and section 11.3.1.8 of the NIR has not been changed since 2016) although the FM sink has been subject to small adjustments that affect the calculation of emissions and removals for 2005–2009, which was used as the reference period in calculating the technical correction. Similarly, the background and margin for natural disturbances (for both afforestation and FM) has been kept constant, although it should have been updated to reflect the change in reporting of emissions from fires in 'out of yield' forests. The ERT noted that according to decision 2/CMP.7, annex, paragraph 15, if the reported data on FM or forest land remaining forest land used to establish the reference level are subject to recalculations, a technical correction shall be applied to include in the accounting the impact of the recalculations on the reported data that have been used by the Party to set the reference level. During the review, the Party clarified that it intends to update its calculation of the technical correction to the FMRL for its 2022 submission. The ERT recommends that Croatia update both the technical correction to the FMRL, in line with decision 2/CMP.7, and its calculation of the background and margin for natural disturbances to maintain consistency with the reported emissions.	Yes. KP reporting adherence
KL.13	HWP – CO_2	Croatia reported slightly different gains and losses of HWP for 1990 in CRF table 4(KP-I)C and table 4.Gs1, though those gains and losses should have matched up exactly because of the absence of deforestation in that year. Notwithstanding that difference, the Party reported HWP gains from domestic wood production in both tables by adjusting the statistics on semi-finished product using a coefficient reflecting the share of industrial roundwood from domestic harvesting, as described in section 6.10.2 of the NIR (p.283). The ERT noted that this is not in accordance with the Kyoto Protocol Supplement (equations 2.8.3 and 2.8.4). Regarding the application of equation 2.8.3, the estimation of the annual fraction of feedstock for HWP originating from forest activities under Article 3 and Article 4 should be defined for each year separately, and the activity deforestation includes only post-1990 deforestation (so the fraction of FM should be 1 before 1990). Regarding the application of equation 2.8.4, Croatia did not take into account the fraction of domestically produced wood pulp as feedstock for paper and paperboard production, a parameter that also has to be taken into account when calculating the inputs to the paper and paperboard pool for reporting under Article 3, paragraphs 3–4, of the Kyoto Protocol. During the review, the Party	Yes. Accuracy

ID#	*Finding classification*	*Description of the finding with recommendation or encouragement*	*Is finding an issue/problem?*[a]
		clarified that AD for FM (production of HWP) are influenced by the conversion factor used to transform data related to forest land into data related to FM. The conversion factors are calculated on the basis of the share of HWP from deforestation to the share of HWP from forest land. Since 1990, Croatia has been collecting data, but for the years before 1990, conversion factors are calculated as an average ratio of AR, deforestation and FM from 1990–2018 data, and AD for HWP from FM are extrapolated back, so there are differences before 1990 between CRF table 4(KP-I)C and table 4.Gs1. The Party also noted that it would try to reflect in its next submission the impact of import and export of wood pulp as a feedstock for paper and paperboard on its estimation of carbon stock changes in the HWP pool. The ERT recommends that Croatia correctly apply equations 2.8.3 and 2.8.4 from the Kyoto Protocol Supplement in its reporting of HWP for KP-LULUCF activities.	

[a] 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 2020 annual submission of Croatia.

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

12. Croatia elected commitment period accounting and therefore the issuance and cancellation of units for KP-LULUCF is not applicable to the 2020 review.

VIII. Questions of implementation

13. No questions of implementation were identified by the ERT during the individual review of the Party's 2020 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 Croatia in its 2020 annual submission

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

Table I.1

Total greenhouse gas emissions for Croatia, base year[a]–2018

(kt CO_2 eq)

	Total GHG emissions excluding indirect CO_2 emissions		*Total GHG emissions including indirect CO_2 emissions[b]*		*Land-use change (Article 3.7 bis as contained in the Doha Amendment)[c]*	*KP-LULUCF (Article 3.3 of the Kyoto Protocol)[d]*	*KP-LULUCF (Article 3.4 of the Kyoto Protocol)*	
	Total including LULUCF	*Total excluding LULUCF*	*Total including LULUCF*	*Total excluding LULUCF*			*CM, GM, RV, WDR*	*FM*
FMRL								–6 289.00
Base year	25 454.40	31 875.85	NA	NA	NA		NA	
1990	25 454.40	31 875.85	NA	NA				
1995	13 784.87	22 739.43	NA	NA				
2000	18 758.46	25 708.82	NA	NA				
2010	21 107.73	28 033.73	NA	NA				
2011	21 984.34	27 707.92	NA	NA				
2012	20 609.98	25 887.46	NA	NA				
2013	18 403.46	24 463.77	NA	NA		–34.62	NA	–7 070.99
2014	17 611.01	23 697.28	NA	NA		–63.61	NA	–6 967.67
2015	19 003.17	24 125.31	NA	NA		–67.46	NA	–6 310.85
2016	19 095.63	24 275.34	NA	NA		–199.27	NA	–6 288.76
2017	20 542.48	25 032.08	NA	NA		–157.40	NA	–5 536.30
2018	18 698.57	23 792.80	NA	NA		–246.09	NA	–5 473.97

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

[a] "Base year" refers to the base year under the Kyoto Protocol, which is 1990 for all gases except NF_3, for which the base year is 2000. Croatia 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.

[b] The Party did not report indirect CO_2 emissions in CRF table 6.

[c] 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 report to facilitate the calculation of the assigned amount for the second commitment period of the Kyoto Protocol of the Party.

[d] Activities under Article 3, para. 3, of the Kyoto Protocol, namely AR and deforestation.

Table I.2
Greenhouse gas emissions by gas for Croatia, excluding land use, land-use change and forestry, 1990–2018
(kt CO_2 eq)

	CO_2[a]	*CH_4*	*N_2O*	*HFCs*	*PFCs*	*Unspecified mix of HFCs and PFCs*	*SF_6*	*NF_3*
1990	23 329.25	4 382.44	2 913.47	NO	1 240.24	NO	10.45	NO
1995	16 926.34	3 471.37	2 301.28	29.32	NO	NO	11.12	NO
2000	19 694.45	3 425.73	2 429.11	147.90	NO	NO	11.62	NO
2010	21 050.86	4 145.18	2 449.83	378.87	0.03	NO	8.95	NO
2011	20 682.44	4 095.33	2 524.57	396.20	0.02	NO	9.37	NO
2012	19 114.78	4 048.49	2 317.71	397.28	0.03	NO	9.18	NO
2013	18 454.62	3 812.17	1 721.74	469.19	NO	NO	6.05	NO
2014	17 704.99	3 854.51	1 656.26	474.76	NO	NO	6.77	NO
2015	17 840.75	3 946.53	1 850.32	482.50	NO	NO	5.22	NO
2016	18 105.04	4 085.02	1 595.35	483.53	NO	NO	6.39	NO
2017	18 737.69	4 069.11	1 730.57	489.00	NO	NO	5.71	NO
2018	17 718.65	3 888.72	1 685.85	494.05	NO	NO	5.53	NO
Percentage change 1990–2018	**–24.1**	**–11.3**	**–42.1**	**NA**	**NA**	**NA**	**–47.1**	**NA**

Note: Emissions and removals reported in the sector other (sector 6) are not included in this table.
[a] Croatia did not report indirect CO_2 emissions in CRF table 6.

Table I.3
Greenhouse gas emissions by sector for Croatia, 1990–2018
(kt CO_2 eq)

	Energy	*IPPU*	*Agriculture*	*LULUCF*	*Waste*	*Other*
1990	21 731.26	4 669.70	4 423.45	–6 421.45	1 051.44	NO
1995	16 033.19	2 461.83	3 075.44	–8 954.56	1 168.98	NO
2000	18 194.81	3 132.26	3 042.36	–6 950.36	1 339.39	NO
2010	19 749.48	3 317.09	3 056.27	–6 926.00	1 910.88	NO
2011	19 499.55	3 156.62	3 109.89	–5 723.58	1 941.87	NO
2012	18 077.21	2 879.42	2 989.72	–5 277.48	1 941.11	NO
2013	17 323.06	2 626.15	2 723.67	–6 060.32	1 790.90	NO
2014	16 386.24	2 751.94	2 650.31	–6 086.28	1 908.79	NO
2015	16 625.21	2 823.19	2 722.28	–5 122.14	1 954.64	NO

	Energy	*IPPU*	*Agriculture*	*LULUCF*	*Waste*	*Other*
2016	17 009.50	2 488.96	2 678.79	–5 179.72	2 098.10	NO
2017	17 388.08	2 738.02	2 805.05	–4 489.61	2 100.93	NO
2018	16 443.04	2 590.90	2 720.30	–5 094.23	2 038.55	NO
Percentage change 1990–2018	**–24.3**	**–44.5**	**–38.5**	**–20.7**	**93.9**	**NA**

Notes: (1) Croatia did not report emissions or removals in the sector other (sector 6); (2) Croatia did not report indirect CO_2 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[a]–2018, for Croatia

(kt CO_2 eq)

	Article 3.7 bis as contained in the Doha Amendment[b]	*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*
FMRL				–6 289.00				
Technical correction				904.83				
Base year	NA				NA	NA	NA	NA
2013		–88.52	53.90	–7 070.99	NA	NA	NA	NA
2014		–97.35	33.74	–6 967.67	NA	NA	NA	NA
2015		–136.05	68.60	–6 310.85	NA	NA	NA	NA
2016		–235.24	35.98	–6 288.76	NA	NA	NA	NA
2017		–186.69	29.29	–5 536.30	NA	NA	NA	NA
2018		–276.66	30.57	–5 473.97	NA	NA	NA	NA
Percentage change base year–2018					**NA**	**NA**	**NA**	**NA**

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

[a] Croatia 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.

[b] The value reported in this column relates to 1990.

2. Table I.5 provides an overview of key relevant data from Croatia's reporting under Article 3, paragraphs 3–4, of the Kyoto Protocol.

Table I.5
Key relevant data for Croatia under Article 3, paragraphs 3–4, of the Kyoto Protocol from its 2020 annual submission

Parameter	*Data values*
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	1 092.162 kt CO_2 eq (8 737.296 kt CO_2 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	NA
2. Deforestation	NA
3. FM	NA

Note: Values in this table reflect the difference in 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 between this report and the previously published review report for the Party.

Annex II

Information to be included in the compilation and accounting database

Tables II.1–II.6 include the information to be included in the compilation and accounting database for Croatia. 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 2018, including on the commitment period reserve, for Croatia
(t CO_2 eq)

	Original submission	*Revised submission*	*Adjustment*	*Final value*
CPR	146 043 977	–	–	146 043 977
Annex A emissions				
CO_2	17 718 646	–	–	17 718 646
CH_4	3 888 723	–	–	3 888 723
N_2O	1 685 850	–	–	1 685 850
HFCs	494 050	–	–	494 050
PFCs	NO	–	–	NO
Unspecified mix of HFCs and PFCs	NO	–	–	NO
SF_6	5 527	–	–	5 527
NF_3	NO	–	–	NO
Total Annex A sources	**23 792 796**	–	–	**23 792 796**
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	–276 659	–	–	–276 659
Deforestation	30 566	–	–	30 566
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	–5 473 966	–	–	–5 473 966

Table II.2
Information to be included in the compilation and accounting database for 2017 for Croatia
(t CO_2 eq)

	Original submission	*Revised submission*	*Adjustment*	*Final value*
Annex A emissions				
CO_2	18 737 689	–	–	18 737 689
CH_4	4 069 111	–	–	4 069 111
N_2O	1 730 570	–	–	1 730 570
HFCs	488 999	–	–	488 999
PFCs	NO	–	–	NO
Unspecified mix of HFCs and PFCs	NO	–	–	NO
SF_6	5 714	–	–	5 714
NF_3	NO	–	–	NO
Total Annex A sources	**25 032 082**	–	–	**25 032 082**
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	–186 690	–	–	–186 690
Deforestation	29 286	–	–	29 286
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	–5 536 297	–	–	–5 536 297

Table II.3
Information to be included in the compilation and accounting database for 2016 for Croatia
(t CO_2 eq)

	Original submission	*Revised submission*	*Adjustment*	*Final value*
Annex A emissions				
CO_2	18 105 044	–	–	18 105 044
CH_4	4 085 023	–	–	4 085 023
N_2O	1 595 353	–	–	1 595 353
HFCs	483 534	–	–	483 534
PFCs	NO	–	–	NO
Unspecified mix of HFCs and PFCs	NO	–	–	NO
SF_6	6 391	–	–	6 391
NF_3	NO	–	–	NO
Total Annex A sources	**24 275 345**	–	–	**24 275 345**
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	–235 242	–	–	–235 242
Deforestation	35 975	–	–	35 975
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	–6 288 760	–	–	–6 288 760

Table II.4
Information to be included in the compilation and accounting database for 2015 for Croatia
(t CO_2 eq)

	Original submission	*Revised submission*	*Adjustment*	*Final value*
Annex A emissions				
CO_2	17 840 751	–	–	17 840 751
CH_4	3 946 531	–	–	3 946 531
N_2O	1 850 322	–	–	1 850 322
HFCs	482 496	–	–	482 496
PFCs	NO	–	–	NO
Unspecified mix of HFCs and PFCs	NO	–	–	NO
SF_6	5 216	–	–	5 216
NF_3	NO	–	–	NO
Total Annex A sources	**24 125 315**	–	–	**24 125 315**
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	–136 053	–	–	–136 053
Deforestation	68 596	–	–	68 596
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	–6 310 851	–	–	–6 310 851

Table II.5
Information to be included in the compilation and accounting database for 2014 for Croatia
(t CO_2 eq)

	Original submission	*Revised submission*	*Adjustment*	*Final value*
Annex A emissions				
CO_2	17 704 985	–	–	17 704 985
CH_4	3 854 512	–	–	3 854 512
N_2O	1 656 255	–	–	1 656 255
HFCs	474 765	–	–	474 765
PFCs	NO	–	–	NO
Unspecified mix of HFCs and PFCs	NO	–	–	NO
SF_6	6 765	–	–	6 765

	Original submission	*Revised submission*	*Adjustment*	*Final value*
NF_3	NO	–	–	NO
Total Annex A sources	**23 697 283**	–	–	**23 697 283**
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	–97 346	–	–	–97 346
Deforestation	33 739	–	–	33 739
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	–6 967 674	–	–	–6 967 674

Table II.6
Information to be included in the compilation and accounting database for 2013 for Croatia
(t CO_2 eq)

	Original submission	*Revised submission*	*Adjustment*	*Final value*
Annex A emissions				
CO_2	18 454 622	–	–	18 454 622
CH_4	3 812 172	–	–	3 812 172
N_2O	1 721 742	–	–	1 721 742
HFCs	469 186	–	–	469 186
PFCs	NO	–	–	NO
Unspecified mix of HFCs and PFCs	NO	–	–	NO
SF_6	6 052	–	–	6 052
NF_3	NO	–	–	NO
Total Annex A sources	**24 463 774**	–	–	**24 463 774**
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	–88 525	–	–	–88 525
Deforestation	53 905	–	–	53 905
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	–7 070 994	–	–	–7 070 994

Annex III

Additional information to support findings in table 2

A. Missing categories that may affect completeness

1. 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.1 lubricant use (CO_2) (see ID# I.35 in table 3);

(b) 2.F.1 refrigeration and air conditioning – manufacturing and disposal (HFCs) (see ID# I.38 in table 3);

(c) 2.F.2 foam blowing agents (HFCs) (see ID# I.41 in table 3);

(d) 2.F.3 fire protection (HFCs) (see ID# I.43 in table 3);

(e) 2.G.1 electrical equipment – new electrical equipment filling and decommissioning (SF6) (see ID# I.51 in table 5);

(f) 3.B.2 sheep (N_2O) (see ID# A.28 in table 5);

(g) 3.B.4 other livestock – rabbits (CH_4 and N_2O) (see ID# A.13 in table 3);

(h) 3.D.a.2.b sewage sludge applied to soils (N_2O) (see ID# A.19 in table 3);

(i) 4(IV) indirect N_2O emissions from managed soils (N2O) (see ID# L.19 in table 3);

(j) 5.C.1 waste incineration (CO_2) (see ID# W.5 in table 3);

(k) 5.D.1 domestic wastewater (CH_4) (see ID# W.7 in table 3);

(l) 4(KP-I)A.2 deforestation – above-ground biomass and below-ground biomass (CO_2) (see ID# KL.6 in table 3);

(m) 4(KP-I)B.1 FM – deadwood and litter (CO_2) (see ID# KL.8 in table 3).

B. Recommendation for an in-country review: list of issues

2. The ERT recommends that the next review for Croatia be conducted as an in-country review.

3. During the review, the ERT was unable to assess many issues identified in previous review reports as well as estimations for categories that have undergone substantial recalculations, particularly categories of the IPPU sector (see ID#s I.10 and I.23 in table 3), as it did not have access to the data used in the calculations. The Party informed the ERT that owing to the difficulties in handling confidential information during centralized reviews conducted remotely, it would not be able to provide the requested information. The Party and the ERT tried to find another way in which the ERT could access the confidential information; however, it was concluded that access that would allow the ERT to closely check data and calculations was not possible.

4. In accordance with decision 13/CP.20, annex, paragraph 64, the ERT has set out below a list of questions and issues additional to those identified in tables 3 and 5 that should be addressed during the in-country review. Key areas that the next ERT conducting the in-country review should consider are:

(a) The calculations and the AD, EFs and other parameters that are considered by the Party to be confidential in order to review whether the estimations are correct for the following categories:

(i) 2.A.1 cement production (see ID# I.6 in table 3);

(ii) 2.A.2 lime production (see ID# I.10 in table 3);

(iii) 2.A.3 glass production;

(iv) 2.A.4.b consumption of soda ash (see ID# I.13 in table 3);

(v) 2.C.1 iron and steel production (see ID# I.23 in table 3);

(b) The allocation of emissions between the energy and IPPU sectors, including the identification of which non-energy uses of fuels are considered in the energy balance and which feedstocks are not included in the energy balance, and the split of the emissions included in the reports of the EU ETS between the energy and IPPU sectors (see ID#s E.6 and I.25 in table 3).

5. In addition, the ERT identified multiple cross-cutting and sector-specific issues concerning errors or inconsistencies that affect the accuracy and transparency of reporting in the NIR and the CRF tables (see ID#s E.1, E.2, E.6, E.11, I.3, I.23, I.29, I.37, I.38, I.40, I.41, I.42, I.43, I.44, I.45, I.46, A.3, A.6, A.10, L.3, L.4, L.5, L.11, L.19, W.6, W.9, KL.2 and KL.3 in table 3, and ID#s A.22, A.23, L.21, L.22, W.11, W.15, KL.11 and KL.13 in table 5). These issues suggest problems with the QC system. Key areas that the next ERT conducting the in-country review should consider are:

(a) The methods used to check the accuracy, transparency and completeness of reporting of the methodologies, AD, EFs and estimates of emissions in the NIR and the CRF tables;

(b) The methods used to check the internal consistency of the reported methodologies, AD, EFs and estimates of emissions between the NIR and the CRF tables;

(c) The completeness of the inventory improvement plan and whether the plan is up to date;

(d) The resourcing of the QC system, in particular whether it is sufficient to ensure the quality of the inventory.

Annex IV

Reference documents

A. Reports of the Intergovernmental Panel on Climate Change

IPCC. 2000. *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories.* J Penman, D Kruger, I Galbally, et al. (eds.). Hayama, Japan: IPCC/Organisation for Economic Co-operation and Development/International Energy Agency/Institute for Global Environmental Strategies. Available at https://www.ipcc.ch/publication/good-practice-guidance-and-uncertainty-management-in-national-greenhouse-gas-inventories/.

IPCC. 2003. *Good Practice Guidance for Land Use, Land-Use Change and Forestry.* J Penman, M Gytarsky, T Hiraishi, et al. (eds.). Hayama, Japan: Institute for Global Environmental Strategies. Available at https://www.ipcc-nggip.iges.or.jp/public/gpglulucf/gpglulucf.html.

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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/.

B. UNFCCC documents

Annual review reports

Reports on the individual reviews of the 2013, 2014, 2015, 2016 and 2018 annual submissions of Croatia, contained in documents FCCC/ARR/2013/HRV, FCCC/ARR/2014/HRV, FCCC/ARR/2015/HRV, FCCC/ARR/2016/HRV and FCCC/ARR/2018/HRV, 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/sites/default/files/resource/AGI%202020_final.pdf.

Annual status report for Croatia for 2020. Available at https://unfccc.int/sites/default/files/resource/asr2020_HRV.pdf.

C. Other documents used during the review

Responses to questions during the review were received from Tatjana Antolić (Ministry of Economy and Sustainable Development of Croatia), including additional material on the methodology and assumptions used. The following references have been reproduced as received:

European Environment Agency. 2016. *Final review report, 2016 comprehensive review of national greenhouse gas inventory data pursuant to Article 19(1) of Regulation (EU) No 525/2013. Croatia*, Umweltbundesamt GmbH, Austria.

The Environmental Protection and Energy Efficiency Fund. 2019. *Project Assignment, Construction of prerequisites for the application of higher levels of the intermediate body on Climate Change (IPCC) methodology in the calculation of Greenhouse Gas outflows / emissions in the sector of Use (LULUCF 3 PROJECT)*. Zagreb.

Branko Vuk, et. al (Energy Institute Hrvoje Požar), 2020. *Improvement of the GHG and air pollutant emissions calculation for the sectors of industry and construction for the period 1990 - 2003 and the year 2013, Elaborate: Allocation of energy consumption from industrial cogeneration and heating plants to the industrial sector*. For EKONERG – Energy Research and Environmental Protection Institute. Zagreb.

Energy Institute Hrvoje Požar. 2020. *Stručne podloge za poboljšanje izračuna emisija stakleničkih plinova iz Sektora 2. Industrijski procesi, podsektora 2.D. Neenergetska uporaba goriva i otapala za potrebe izrade Inventara emisija stakleničkih plinova (Expert basis for improving emission calculations greenhouse gases from Sector 2. Industrial processes, subsector 2.D. Non-energy use fuels and solvents for the purposes of compiling the Emission Inventory greenhouse gases*. For Ministry of Economy and sustainable development. Zagreb.

Pilaš et al. 2013. *Estimation of soil organic carbon stocks and stock changes in Croatia (1980–2006) – use of national soil database and the Corine Land Cover*. Periodicum biologorum Vol.115, No. 3 pp.339-347. Available online at https://hrcak.srce.hr/file/163074.

Republic of Croatia, the Ministry of Agriculture. Šumskogospodarska osnova 2016–2025. (General Forest Management Plan of the Republic of Croatia 2016-2025). Available online at https://poljoprivreda.gov.hr/istaknute-teme/sume-112/sumarstvo/sumskogospodarska-osnova-2016-2025/250.

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