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Report on the individual review of the annual submission of Croatia submitted in 2018*

Note by the expert review team

Summary

Each Party included in Annex I to the Convention must submit an annual greenhouse gas inventory covering emissions and removals of greenhouse gas emissions 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 inventory review of the 2018 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 17 to 22 September 2018 in Zagreb.

* In the symbol for this document, 2018 refers to the year in which the inventory was submitted, not to the year of publication.

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Contents

	<i>Paragraphs</i>	<i>Page</i>
Abbreviations and acronyms		3
I. Introduction	1–6	5
II. Summary and general assessment of the 2018 annual submission.....	7	6
III. Status of implementation of issues and/or problems raised in the previous review reports.....	8	8
IV. Issues identified in three successive reviews and not addressed by the Party	9	19
V. Additional findings made during the individual review of the 2018 annual submission.....	10	20
VI. Application of adjustments.....	11	58
VII. Accounting quantities for activities under Article 3, paragraph 3, and, if any, activities under Article 3, paragraph 4, of the Kyoto Protocol	12	58
VIII. Questions of implementation	13	58
Annexes		
I. Overview of greenhouse gas emissions and removals for Croatia for submission year 2018 and data and information on activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, as submitted by Croatia in its 2018 annual submission.....		59
II. Information to be included in the compilation and accounting database		63
III. Additional information to support findings in table 2		65
IV. Documents and information used during the review		66

Abbreviations and acronyms

2006 IPCC Guidelines	<i>2006 IPCC Guidelines for National Greenhouse Gas Inventories</i>
AAU	assigned amount unit
AD	activity data
Annex A sources	source categories included in Annex A to the Kyoto Protocol
AR	afforestation and reforestation
Article 8 review guidelines	“Guidelines for review under Article 8 of the Kyoto Protocol”
BEF	biomass expansion factor
B ₀	maximum methane production capacity
C	carbon
CAEN	Croatian Agency for Environment and Nature
CaO	calcium oxide
CER	certified emission reduction
CF ₄	carbon tetrafluoride
C ₂ F ₆	hexafluoroethane
CH ₄	methane
CKD	cement kiln dust
CM	cropland management
CO ₂	carbon dioxide
CO ₂ eq	carbon dioxide equivalent
CPR	commitment period reserve
CRF	common reporting format
CRONFI	Croatian National Forest Inventory
DE	digestibility of feed
DOM	dead organic matter
EAF	electric arc furnace
EF	emission factor
ERT	expert review team
ERU	emission reduction unit
EU ETS	European Union Emissions Trading System
FM	forest management
FMRL	forest management reference level
FOD	first order decay
Frac _{leachMS}	percentage of managed manure nitrogen losses due to run-off and leaching during solid and liquid storage of manure
GE	gross energy
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
IPPU	industrial processes and product use
KP-LULUCF activities	activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol
LKD	lime kiln dust
LULUCF	land use, land-use change and forestry
MMS	manure management system

MSW	municipal solid waste
N	nitrogen
N ₂ O	nitrous oxide
NA	not applicable
NCV	net calorific value
NE	not estimated
Nex	nitrogen excretion rate
NF ₃	nitrogen trifluoride
NIR	national inventory report
NO	not occurring
NR	not reported
PFC	perfluorocarbon
QA/QC	quality assurance/quality control
RMU	removal unit
RV	revegetation
SCR	selective catalytic reduction
SEF	standard electronic format
SF ₆	sulfur hexafluoride
SIAR	standard independent assessment report
SWDS	solid waste disposal sites
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 solids
WDR	wetland drainage and rewetting
Wetlands Supplement	<i>2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands</i>
Ym	methane conversion factor

I. Introduction¹

1. This report covers the review of the 2018 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” (decision 13/CP.20). The review took place from 17 to 22 September 2018 in Zagreb and was coordinated by Mr. Javier Hanna Figueroa (secretariat). Table 1 provides information on the composition of the ERT that conducted the review of Croatia.

Table 1

Composition of the expert review team that conducted the review of Croatia

<i>Area of expertise</i>	<i>Name</i>	<i>Party</i>
Generalist	Mr. Harry Vreuls	Netherlands
Energy	Mr. Amit Garg	India
IPPU	Mr. Roman Kazakov	Russian Federation
Agriculture	Mr. Yuri Pyrozhenko	Ukraine
LULUCF	Mr. Walter Oyhantçabal	Uruguay
Waste	Mr. Excellent Hachileka	Zambia
Lead reviewers	Mr. Garg	
	Mr. Vreuls	

2. The basis of the findings in this report is the assessment by the ERT of the Party’s 2018 annual submission in accordance with the Article 8 review guidelines. The ERT notes that the individual inventory review of Croatia’s 2017 annual submission did not take place during 2017 owing to insufficient funding for the review process.

3. The ERT has made recommendations that Croatia resolve the findings related to issues,² including issues designated as problems.³ Other findings, and, if applicable, the encouragements of the ERT to Croatia to resolve them, 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 shows annual GHG emissions for Croatia, including totals excluding and including the LULUCF sector, indirect CO₂ emissions and emissions by gas and by sector. Annex I also contains background data related to emissions and removals from KP-LULUCF activities, if elected, by gas, sector and activity for Croatia.

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

¹ At the time of publication of this report, Croatia had submitted its instrument of ratification of the Doha Amendment; however, the Amendment had not yet entered into force. The implementation of the provisions of the Doha Amendment is therefore considered in this report in the context of decision 1/CMP.8, paragraph 6, pending the entry into force of the Amendment.

² Issues are defined in decision 13/CP.20, annex, paragraph 81.

³ Problems are defined in decision 22/CMP.1, annex, paragraphs 68 and 69, as revised by decision 4/CMP.11.

II. Summary and general assessment of the 2018 annual submission

7. Table 2 provides the assessment by the ERT of the 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 inventory of Croatia

<i>Assessment</i>	<i>Issue or problem ID#(s) in table 3 and/or 5^a</i>		
Dates of submission	Original submission: 12 April 2018 (NIR), 12 April 2018, Version 1 (CRF tables), 12 April 2018 (SEF tables) Revised submission: 24 May 2018 (NIR), 24 May 2018, Version 2, and 5 November 2018, Version 3 (CRF tables) Unless otherwise specified, the values from the latest submission are used in this report		
Review format	In country		
Application of the requirements of the UNFCCC Annex I inventory reporting guidelines and Wetlands Supplement (if applicable)	1. Have any issues been identified in the following areas:		
	(a) Identification of key categories	Yes	L.3
	(b) Selection and use of methodologies and assumptions	Yes	E.10, E.12, E.16, I.4, I.6, I.8, I.16, I.28, I.31, I.39, I.45, A.21, L.11, L.12, L.15, L.17, L.23, W.13
	(c) Development and selection of EFs	Yes	E.2, E.11, I.17, A.14, A.22, L.25
	(d) Collection and selection of AD	Yes	E.4, I.5, I.7, I.20, I.26, I.29, I.33, I.38, I.43, I.49, A.4, A.16, A.25, A.27, L.24, W.9, W.12
	(e) Reporting of recalculations	No	
	(f) Reporting of a consistent time series	Yes	E.3, E.15, I.36, I.48, I.49
	(g) Reporting of uncertainties, including methodologies	Yes	G.3, I.15, I.35, A.24, A.28, L.23, KL.13
	(h) QA/QC	QA/QC procedures were assessed in the context of the national system (see para. 2 in this table)	
	(i) Missing categories/completeness ^b	Yes	I.22, I.40, I.42, I.44, I.46, A.20, A.23, A.26, L.9, L.10, L.13, L.18, L.24, L.26, W.7, W.12, KL.9, KL.15, KL.16, KL.17
	(j) Application of corrections to the inventory	No	

<i>Assessment</i>	<i>Issue or problem ID#(s) in table 3 and/or 5^a</i>		
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?	The Party did not report “NE” for any insignificant categories	
Description of trends	Did the ERT conclude that the description in the NIR of the trends for the different gases and sectors is reasonable?	No	I.24
Supplementary information under the Kyoto Protocol	2. Have any issues been identified related to the national system:		
	(a) The 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.4, G.5, L.4, L.22
	3. 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 technical standards for data exchange	No	
	4. Have any issues been identified related to reporting of information on ERUs, CERs, AAUs and RMUs and on discrepancies reported in accordance with decision 15/CMP.1, annex, chapter I.E, in conjunction with decision 3/CMP.11, taking into consideration any findings or recommendations contained in the SIAR?	No	
	5. 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 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	
	6. Have any issues been identified related to the reporting of LULUCF activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, as follows:		
	(a) Reporting requirements in decision 2/CMP.8, annex II, paragraphs 1–5	Yes	KL.11, KL.15, KL.17
(b) Demonstration of methodological consistency between the reference level and reporting on FM in accordance with decision 2/CMP.7, annex, paragraph 14	No		
(c) Reporting requirements of decision 6/CMP.9	Yes	KL.18	
(d) Country-specific information to support provisions for natural disturbances, in accordance with decision 2/CMP.7, annex, paragraphs 33 and 34	No		

<i>Assessment</i>			<i>Issue or problem ID#(s) in table 3 and/or 5^a</i>
CPR	Was the CPR reported in accordance with the annex to decision 18/CP.7, the annex to decision 11/CMP.1 and decision 1/CMP.8, paragraph 18?	Yes	
Adjustments	Has the ERT applied an adjustment under Article 5, paragraph 2, of the Kyoto Protocol?	No	
	Did the Party submit a revised estimate to replace a previously applied adjustment?	NA	Croatia does not have a previously applied adjustment
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 the assessment of conformity with the UNFCCC Annex I inventory reporting guidelines and any further guidance adopted by the Conference of the Parties?	Yes	
Recommendation for an exceptional in-country review	On the basis of the issues identified, does the ERT recommend that the next review be conducted as an in-country review?	No	
Question of implementation	Did the ERT list any question of implementation?	No	

^a The ERT identified additional issues and/or problems in the energy, IPPU, agriculture, LULUCF and waste sectors and for KP-LULUCF activities that are not listed in this table but are included in table 3 and/or 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 issues and/or problems raised in the previous review reports

8. Table 3 compiles all the recommendations made in previous review reports that were included in the previous review report, published on 28 March 2017.⁴ For each issue and/or problem, the ERT specified whether it believes the issue and/or problem has been resolved by the conclusion of the review of the 2018 annual submission and provided the rationale for its determination, which takes into consideration the publication date of the previous review report and national circumstances.

Table 3

Status of implementation of issues and/or problems raised in the previous review reports of Croatia

<i>ID#</i>	<i>Issue and/or problem classification^{a, b}</i>	<i>Recommendation made in previous review report</i>	<i>ERT assessment and rationale</i>
General			
		No recommendations on general issues were identified in the 2016 annual review report.	
Energy			
E.1	Fuel combustion – reference approach – liquid fuels –	Correct the errors made for liquid fuels when comparing the IPCC reference approach with the sectoral approach by	Resolved. The errors made for liquid fuels have been corrected. Although the difference in CO ₂ emissions between the reference approach and

⁴ FCCC/ARR/2015/HRV and FCCC/ARR/2016/HRV. The ERT notes that the individual inventory review of Croatia's 2017 annual submission did not take place during 2017. As a result, the latest published annual review reports reflect the findings of the review of the Party's 2015 and 2016 annual submissions.

<i>ID#</i>	<i>Issue and/or problem classification^{a, b}</i>	<i>Recommendation made in previous review report</i>	<i>ERT assessment and rationale</i>
	CO ₂ (E.14, 2016) (E.14, 2015) Accuracy	taking into account the relevant fuel consumption figures by fuel type.	the sectoral approach has been less than 2 per cent since 2003 (e.g. 0.50 per cent for 2016), Croatia provided an explanation for the observed differences in its NIR (chapter 3.2.1).
E.2	1.A.1.a Public electricity and heat production – gaseous, liquid and solid fuels – CO ₂ (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.	Addressing. The Party has an improvement plan, which was provided as an additional document to the ERT during the review. The estimation of country-specific CO ₂ EFs for subcategory 1.A.1.a public electricity and heat production is an activity that has been included in the plan for the past three years; however, the ERT noted that the results of this activity are not yet available (see ID# E.10 in table 5). The ERT considers that information that can be used to estimate country-specific CO ₂ EFs could be readily available from the information collected under the EU ETS, because all power generation installations are included in this system.
E.3	1.A.2 Manufacturing industries and construction – gaseous, liquid and solid fuels – CO ₂ , CH ₄ and N ₂ O (E.8, 2016) (E.8, 2015) (22, 2014) Adherence to the UNFCCC Annex I inventory reporting guidelines	Take steps to ensure the consistency of the AD for fuel use in manufacturing industries and construction.	Not resolved. Based on the recommendations made in previous review reports, the project to solve this issue has been included in the Party's improvement plan for the past three years; however, the ERT noted that this activity has not yet been implemented and the issue regarding the consistency of AD persists. The ERT noted that the splicing techniques provided in the 2006 IPCC Guidelines (vol. 1, chapter 5 on time-series consistency) could be deployed to solve this issue in those cases where AD in a given year seem to be incorrect in the primary source of information.
E.4	1.A.2 Manufacturing industries and construction – gaseous, liquid and solid fuels – CO ₂ , CH ₄ and N ₂ O (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 the period 1990–2000, in accordance with the detailed industrial split for stationary combustion provided in the 2006 IPCC Guidelines.	Not resolved. Based on the recommendations made in previous review report, the project to solve this issue has been included in the Party's improvement plan for the past three years; however, this activity has not yet been implemented.
E.5	1.A.3.a Domestic aviation – liquid fuels – CO ₂ (E.17, 2016) (E.17, 2015) Transparency	Provide a description of the methodology used to determine the fuel consumption of domestic and international aviation in the NIR.	Resolved. Croatia provided in the NIR a description of the methodology used to determine the fuel consumption of domestic and international aviation (pp.76, 91 and 92), which is aligned with the International Energy Agency and the definitions in the 2006 IPCC Guidelines.
E.6	1.A.3.b Road transportation – gaseous fuels – CO ₂ (E.10, 2016) (E.10,	Provide sufficient explanations in the NIR on the methodology used for estimating emissions from gaseous fuels.	Resolved. In its NIR (pp.92–94) Croatia provided a detailed description of the methodology used for estimating emissions from gaseous fuels.

<i>ID#</i>	<i>Issue and/or problem classification^{a, b}</i>	<i>Recommendation made in previous review report</i>	<i>ERT assessment and rationale</i>
	2015) (32, 2014) Transparency		
E.7	1.A.5.b Mobile – liquid fuels – CO ₂ , CH ₄ and N ₂ O (E.11, 2016) (E.11, 2015) (35, 2014) (34, 2013) (61, 2012) Transparency	Indicate in the NIR the category under which military fuel use has been included.	Resolved. Croatia provided details in the NIR (chapter 3.2.8.1, p.101).
E.8	1.B.1.a Coal mining and handling – solid fuels – CH ₄ (E.12, 2016) (E.12, 2015) (33, 2014) (31, 2013) (57, 2012) Accuracy	Use actual coal production figures for estimating emissions from coal mining and handling.	Resolved. Croatia indicated in the NIR (section 3.3.1, pp.102 and 103 and annex 3, table A3-18) that actual raw production figures were used to estimate emissions from coal mining and handling. The NIR also indicates that coal mining has not occurred in Croatia after 1999.
E.9	International bunkers and multilateral operations – liquid fuels – CO ₂ (E.6, 2016) (E.6, 2015) (26, 2014) (27, 2013) Transparency	Provide a detailed explanation of the factors contributing to decreases in bunker fuel consumption and associated CO ₂ emissions.	Resolved. Croatia provided explanations in the NIR (chapter 3.2.2, pp.75 and 76) and also during the review of the factors contributing to decreases in bunker fuel consumption and associated CO ₂ emissions. The ERT checked the related energy balance data with the expert responsible for the energy balance and was satisfied with the explanations.
IPPU			
I.1	2. General (IPPU) (I.6, 2016) (I.6, 2015) Adherence to the UNFCCC Annex I inventory reporting guidelines	Ensure that the key categories summary table title and contents are aligned.	Resolved. The title and contents of the key categories summary table for the IPPU sector (table 4.1-1 of the NIR, p.114) are consistent and aligned.
I.2	2.A.4 Other process uses of carbonates – CO ₂ (I.7, 2016) (I.7, 2015) Comparability	Provide information in the NIR on the activities related to the consumption and emissions of carbonates that are reported under the category other process uses of carbonates (2.A.4) and report CO ₂ emissions from the consumption of carbonates under the category in which the carbonates are consumed, in accordance with the 2006 IPCC Guidelines.	Resolved. The correct description of activities under category 2.A.4 is provided in chapter 4.2.4 of the NIR. Emissions are reported for ceramics (2.A.4.a), other uses of soda ash (2.A.4.b) and other (2.A.4.d). Emissions from the use of carbonates for glass production and iron and steel production are not reported under category 2.A.4, but are reported under the correct categories, 2.A.3 glass production and 2.C.1 iron and steel production. Descriptions of the activities and allocation of emissions are in line with the 2006 IPCC Guidelines.
I.3	2.B.2 Nitric acid production – N ₂ O (I.8, 2016) (I.8, 2015) Transparency	Include a summary of the abatement technology, the monitoring system and methodologies used in the emission measurements in nitric acid production plants.	Resolved. Relevant information is provided in the NIR (chapter 4.3.2.2) on the abatement technology (catalytic decomposition) as well as the monitoring system and methodologies used for N ₂ O emission measurements (see ID# I.25 in table 5).

<i>ID#</i>	<i>Issue and/or problem classification^{a, b}</i>	<i>Recommendation made in previous review report</i>	<i>ERT assessment and rationale</i>
I.4	2.B.8 Petrochemical and carbon black production – CO ₂ (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.	Not resolved. The tier 1 method was applied for estimating CO ₂ emissions from 2.B.8 petrochemical and carbon black production in the 2018 annual submission. As stated in its NIR (chapter 4.3.7.6 and chapter 10.4, table 10.4-3), Croatia plans to use a higher-tier method in future annual submissions.
I.5	2.C.2 Ferroalloys production – CO ₂ (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 the years 1994–1996 and 1999–2001.	Not resolved. According to table 10.4-3 of the NIR on sector-specific planned improvements, Croatia has no plans to increase the transparency and accuracy of the estimates for this category by obtaining AD for ferroalloys production to replace the interpolated data for the years 1994–1996 and 1999–2001. In addition, the NIR (chapter 4.4.2.2) indicated that it is not possible to collect actual AD because the production of ferroalloys was halted in 2003. The ERT considers that the interpolation method and other techniques from the 2006 IPCC Guidelines could be applied for estimating the missing AD, and that details on how the Party applied such methods to estimate emissions from ferroalloys production be included in the NIR.
I.6	2.C.2 Ferroalloys production – CO ₂ (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. CO ₂ emissions from category 2.C.2 ferroalloys production were estimated using the tier 1 method and default EFs as stated in the NIR (chapter 4.4.2.2) (see ID#I.5 above).
I.7	2.F.1 Refrigeration and air conditioning – HFCs and PFCs (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.	Addressing. According to the NIR (chapter 4.7.1.1, p.168), the Ministry of Environment and Energy did not complete the ongoing collection of information on the disposal of equipment containing HFCs from all centres providing services of recovery, recycling and reclamation of HFC refrigerants and other equipment, but the surveys will be continued in the future. Croatia reported in the NIR that, so far, no cases of disposal of equipment containing HFCs have been identified (see ID# I.42 in table 5).
I.8	2.F.2 Foam blowing agents – HFCs (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, chapter 7.4.2), and report such emissions under the appropriate subcategory.	Not resolved. HFC-152a emissions from category 2.F.2 foam blowing agents were reported in the CRF tables and the NIR under foam blowing agents with open cells for 2006, 2007, 2009 and 2010, but are reported as “NO” for other years in the period 1995–2016. In addition, the types of foam produced in Croatia have still not been analysed or classified for the purpose of emission estimation. The ERT noted that Croatia plans to analyse the types of foam produced in the country and implement the recommendation in its 2019 annual submission, according to the NIR, table 10.4-3 “Indication

ID#	Issue and/or problem classification ^{a, b}	Recommendation made in previous review report	ERT assessment and rationale
on timeline of implementation” (see ID# I.44 in table 5).			
Agriculture			
A.1	3.A.1 Cattle – CH ₄ (A.8, 2016) Accuracy	Use the correct values for Y _m and DE when estimating the CH ₄ EF from the enteric fermentation of mature dairy cattle.	Resolved. The Y _m and DE values used for estimating the CH ₄ EF for mature dairy cattle were corrected. In 2014, Y _m and DE for mature dairy cattle amounted to 6.31 and 69 per cent, respectively.
A.2	3.A.1 Cattle – CH ₄ (A.9, 2016) Accuracy	Use the correct values for the Y _m and DE when estimating the CH ₄ EF from the enteric fermentation of other mature cattle.	Resolved. The Y _m and DE values used for estimating the CH ₄ EF for other mature cattle were corrected. In 2014, Y _m and DE for other mature cattle amounted to 6.90 and 57 per cent, respectively.
A.3	3.B Manure management – N ₂ O (A.3, 2016) (A.3, 2015) (48, 2014) (46, 2013) (89, 2012) Accuracy	Implement country-specific EFs to estimate N ₂ O emissions from manure management.	Resolved. Croatia addressed the original recommendation by deriving the country-specific Nex values for cattle and MMS usage data (for the entire time series) for its estimates of N ₂ O emissions from manure management, in accordance with the 2006 IPCC Guidelines. The ERT recognizes that the development of country-specific N ₂ O EFs for manure management is a resource-intensive task and could be considered not to be a priority for implementation in the foreseeable future.
A.4	3.D Direct and indirect N ₂ O emissions from agricultural soils – N ₂ O (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 continues to use 11.0 per cent as data on N content in dry matter of sewage sludge for 2005–2008. Moreover, no category-specific QA/QC procedures were implemented (only general QC procedures).
A.5	3.D.a.2 Organic N fertilizers – N ₂ O (A.11, 2016) (A.9, 2015) Transparency	Include in the NIR the source of the data for sewage sludge applied to soils, and the additional information provided to the ERT during the review; namely, the source of the average N content of sewage sludge applied to soils, the type of information contained therein and a reference to the applicable regulation.	Resolved. The source of the data for sewage sludge applied to soils and additional information was included in the NIR (p.204) (see ID# A.4 above).
A.6	3.D.a.4 Crop residues – N ₂ O (A.12, 2016) (A.10, 2015) Transparency	Include in the NIR the rationale for using the dry matter fraction of harvested crops from the NIRs of Slovenia, Portugal and Hungary.	Resolved. Justification for the use of the dry matter fraction in crop residues from the NIRs of other countries was provided in table 5.5-5 of the NIR (p.210). The NIRs of Slovenia, Portugal and Hungary (from the 2013 annual submissions) were used as a data source on dry matter content in garlic, onions, cabbages and other brassicas, and watermelons.
LULUCF			
L.1	4. General (LULUCF) (L.1, 2016) (L.1,	Explain the recalculations conducted in the LULUCF sector.	Resolved. Croatia provided in the NIR (chapter 6) explanations of the recalculations of the AD (areas) in each of the different land categories.

ID#	Issue and/or problem classification ^{a, b}	Recommendation made in previous review report	ERT assessment and rationale
	2015) (61, 2014) Transparency		It also provided explanations on recalculations of the soil organic carbon pool estimates to address issues raised in the previous review report. Information on the differences in the estimates by land category between the 2017 and 2018 annual submissions is included in table 10-1-2 of the NIR (chapter 10).
L.2	4. General (LULUCF) – CO ₂ (L.11, 2016) (L.11, 2015) Accuracy	Report separately carbon stock changes in the litter and organic soils pools in the land-use change categories, and report on the progress made in the project currently under way.	Resolved. Carbon stock changes in soil organic carbon and litter are reported separately in the relevant CRF tables. During the review, Croatia informed the ERT that new information on soil organic carbon had been obtained as a result of the scientific research project “Carbon stock changes in the soils and the trends of total nitrogen and carbon in soil and the ratio of C:N”, finished in 2017. The report of this study is in Croatian only; however, the ERT identified an earlier published paper showing progress made by Croatia in the estimation of soil carbon and soil carbon stock changes (Pilas et al., 2013). The ERT noted that the NIR did not include information on the progress of the already concluded project indicated above, but given the circumstances regarding the improved reporting, the ERT did not find it necessary to report on this in the NIR. Nevertheless, the ERT considers that Croatia may include a summary of the results of the project in its next annual submission.
L.3	4. General (LULUCF) (L.12, 2016) (L.12, 2015) Adherence to the UNFCCC Annex I inventory reporting guidelines	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.	Not resolved. The analysis of significance of carbon pools and subcategories has not been performed and no information is reported in the NIR.
L.4	4. General (LULUCF) (L.13, 2016) (L.13, 2015) Adherence to the UNFCCC Annex I inventory reporting guidelines	Correct all the inconsistencies identified within the NIR and between the NIR and the CRF tables, and further improve the QA/QC system 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.	Addressing. There are still inconsistencies and errors in the NIR and between the NIR and the CRF tables that indicate an insufficient implementation of QC procedures for the LULUCF sector. In particular, the ERT noted that, of the issues identified in the previous review report, the Party has not resolved the following: ensuring consistency of the key category analysis reported in the LULUCF chapter of the NIR and the key category chapter in annex 1 to the NIR, ensuring consistency of information in tables 6.4-1 and 6.1-2 of the NIR and the corresponding CRF tables, and ensuring consistency of HWP data between table 6.10-2 of the NIR and the database of the Food and Agriculture Organization of the United Nations.
L.5	Land representation (L.14, 2016) (L.14,	Correct the land-use matrices for the different land use and land-use change categories.	Resolved. The errors in CRF tables 4.1 were corrected.

<i>ID#</i>	<i>Issue and/or problem classification^{a, b}</i>	<i>Recommendation made in previous review report</i>	<i>ERT assessment and rationale</i>
	2015) Accuracy		
L.6	Land representation (L.14, 2016) (L.14, 2015) Accuracy	Pay special attention to the consistency of the land area reporting across the time series, ensuring that the total country area reported is constant for the entire inventory period both in CRF table 4.1 and in CRF tables 4.A–4.F.	Resolved. The total area of the country as reported in CRF tables 4.1 is constant across the time series, and the areas of the land-use categories reported in CRF tables 4.1 are consistent with those reported in CRF tables 4.A–4.F, including the total country area.
L.7	Land representation (L.14, 2016) (L.14, 2015) Transparency	Provide in the NIR information on the 20-year land use and land-use change area by including a set of 20-year land-use matrices from 1990 to the latest inventory year.	Resolved. The land-use matrices from 1990 to the latest inventory year are included in CRF tables 4.1 and the ERT finds that there is no need to repeat the information in the NIR.
L.8	4.A Forest land – CO ₂ (L.2, 2016) (L.2, 2015) (66, 2014) (70, 2013) (105, 2012) Completeness	Make significant efforts to use the results of CRONFI to improve the LULUCF sector inventory.	Resolved. The ERT noted that Croatia is not able to directly use the results of its first CRONFI because they refer to forest areas according to the national definition of forests, which differs from the forest definition and thresholds set by Croatia for reporting under the Convention. CRONFI collected data on the above-ground biomass and deadwood pools, and did not collect data on the below-ground biomass, litter and soil organic carbon pools. The source Croatia used to estimate the biomass pool was a survey conducted under the national LULUCF 1 project mentioned in the NIR (p.257), including some parameters taken from the 2006 IPCC Guidelines (average annual increment, root to shoot ratio). In the case of the litter pool estimation, Croatia applied the results of the survey conducted as part of the project “Carbon stock changes in the soils and the trends of total nitrogen and carbon in soil and the ratio of C:N”. The ERT considers that it is not feasible to use the results of the current CRONFI (see ID# L.25 in table 5).
L.9	4.A.1 Forest land remaining forest land – CO ₂ (L.15, 2016) (L.15, 2015) Completeness	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.	Not resolved. Croatia continued to report “NO” for carbon stock losses from the living biomass pool in ‘out of yield’ forest land remaining forest land. Croatia did not collect the data necessary for estimating and reporting carbon stock losses from the living biomass pool in ‘out of yield’ forest.
L.10	4.A.2 Land converted to forest land – CO ₂ (L.16, 2016) (L.16, 2015) Completeness	Estimate and report emissions and removals associated with carbon stock changes in the deadwood pool, 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 litter pools.	Not resolved. Croatia continues to report “NO” for the deadwood pool in land converted to forest land in CRF table 4.A. Croatia indicated during the review that CRONFI did not collect data on litter and that it does not include data on the deadwood pool in lands that are afforested in the first age class. However, this information was not included in the NIR. The ERT noted that the Party estimated litter and reported it in CRF table 4.A, but did not report information on litter in the NIR (table 4-4-5). During the

ID#	Issue and/or problem classification ^{a, b}	Recommendation made in previous review report	ERT assessment and rationale
			review, Croatia provided a new table containing the estimate of litter (see ID# L.8 above).
L.11	4.B.1 Cropland remaining cropland – CO ₂ (L.5, 2016) (L.5, 2015) (69, 2014) (72, 2013) Accuracy	Implement the tier 2 approach to perennial cropland remaining perennial cropland as soon as possible.	Not resolved. Croatia has not provided tier 2 estimates of carbon stock changes in biomass in perennial cropland remaining perennial cropland.
L.12	4.B.2 Land converted to cropland – CO ₂ (L.6, 2016) (L.6, 2015) (70, 2014) 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.	Not resolved. Croatia has not improved the estimates of the carbon stock changes in cropland biomass, in particular cropland with perennial woody vegetation, such as vineyards, olive groves and fruit orchards, in order to move to a tier 2 method for reporting estimates of this key category.
L.13	4.B.2 Land converted to cropland – CO ₂ (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.	Not resolved. Croatia has not reported carbon stock changes in the deadwood pool in forest land converted to cropland. During the review, Croatia explained that it was not possible to use national data to estimate the deadwood pool and that the information of neighbouring countries is not applicable to the national circumstances of Croatia (see ID# L.14 below).
L.14	4.B.2 Land converted to cropland – CO ₂ (L.17, 2016) (L.17, 2015) Transparency	Provide detailed information in the NIR on the progress made in using the DOM pool data from CRONFI in the GHG inventory.	Resolved. Croatia reported in the NIR (p.270) that it could not yet make progress in using this source of data to estimate carbon stock changes in DOM because the information on the deadwood pool included in CRONFI is not compatible with Croatia's forest definition and land representation system under the Convention (see ID# L.8 above). A separate project has been initiated to adjust and use available CRONFI deadwood pool data for the purpose of reporting under the Convention in case of deforestation activities and corresponding types of land conversion.
L.15	4.C.2 Land converted to grassland – CO ₂ (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.	Not resolved. Croatia continues to use a tier 1 method to estimate carbon stock changes in above-ground and below-ground biomass in cropland converted to grassland (see ID# L.12 above).
L.16	4.E.2.1 Forest land converted to settlements – CO ₂ (L.9, 2016) (L.9, 2015) (64, 2014) (65, 2013) (98, 2012) Transparency	Improve the transparency of the NIR and the CRF tables by reporting DOM separately from living biomass for forest land converted to settlements and by separating the litter pool from the soils pool.	Resolved. In CRF table 4.E, Croatia reported stock changes in DOM separately from living biomass and from net soil carbon for the subcategory forest land converted to settlements. Croatia reported in the NIR (p.259) that carbon stocks in soil and litter were estimated separately.
L.17	4.E.2.2 Cropland converted to settlements – CO ₂	Improve the cropland biomass estimates to enable implementation of a tier 2 approach for estimating	Not resolved. During the review, Croatia explained to the ERT that it had not been possible to develop country-specific estimates

<i>ID#</i>	<i>Issue and/or problem classification^{a, b}</i>	<i>Recommendation made in previous review report</i>	<i>ERT assessment and rationale</i>
	(L.10, 2016) (L.10, 2015) (73, 2014) Accuracy	cropland biomass estimates under the cropland converted to settlements category as soon as possible.	(e.g. average net annual increment for specific vegetation types, BEF, wood densities, ratio of below-ground biomass to above-ground biomass) for biomass in this key category and, therefore, it could not move to a tier 2 method (see ID# L.12 above).
L.18	4(IV) Indirect N ₂ O emissions from managed soils – N ₂ O (L.18, 2016) (L.18, 2015) Completeness	Estimate indirect N ₂ O 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.	Not resolved. Indirect N ₂ O emissions associated with the loss of soil organic matter resulting from a change in land use or management of mineral soils were not reported in CRF table 4(IV). Indirect N ₂ O emissions associated with atmospheric deposition and N leaching and run-off were reported as “IE” and indicated as reported in CRF table 3.D under the agriculture sector.
L.19	4(V) Biomass burning – CO ₂ (L.19, 2016) (L.19, 2015) Completeness	Estimate and report CO ₂ emissions from biomass burned and combusted in forest land, following the guidance provided in the 2006 IPCC Guidelines, in order to avoid the underestimation of emissions from biomass burning.	Resolved. CO ₂ emissions from wildfires on forest land were reported in CRF table 4(V). Croatia used the tier 1 method from the 2006 IPCC Guidelines for CO ₂ emission estimates from biomass burning in forest land, because this category is not key.
Waste			
W.1	5.A Solid waste disposal on land – CH ₄ (W.1, 2016) (W.1, 2015) (77, 2014) (76, 2013) Transparency	Provide information on the type of waste disposed to SWDS and ensure that all types of solid waste, including industrial waste, sludge and construction and demolition waste, disposed to SWDS, are included in the emission estimates.	Not resolved. Croatia has not provided information on the annual quantities of MSW, industrial biodegradable solid waste and sludge from wastewater treatment generated and disposed of at different types of SWDS in the period 1990–2016. Table 7.2-2 of the NIR (p.306) does not include data on sludge deposited at SWDS. The ERT noted that Croatia did not clearly provide information in the NIR (p.306) on the type of industrial waste, quantities of construction and demolition waste and sludge generated and disposed of at SWDS. It is also not clear if all emissions relating to all types of solid waste are included in the emission estimates (see ID#s W.8 and W.9 in table 5).
W.2	5.A Solid waste disposal on land – CH ₄ (W.2, 2016) (W.2, 2015) (78, 2014) Transparency	Increase the transparency of the explanation of the trend in CH ₄ recovery and flaring or revise the estimates in order to ensure the consistency of the time series.	Resolved. Croatia reported in the NIR (p.315) that the fluctuating trend for flared CH ₄ during the period 2004–2016 was due to remediation of landfills and that the significant reduction in recovered CH ₄ in 2015 and 2016 was due to the use of CH ₄ for electricity generation at the two largest landfills.
W.3	5.A Solid waste disposal on land (W.8, 2016) (W.8, 2015) Transparency	Include information in the NIR on national regulations governing the treatment of management and handling of solid waste disposal from construction and demolition sites.	Resolved. Croatia indicated in the NIR (chapter 7.1, p.304) that Article 53 of the Sustainable Waste Management Act is the national regulation governing the treatment of management and handling of solid waste disposal from construction and demolition sites.
W.4	5.A Solid waste disposal on land – CH ₄	Include information on the fractions of MSW collected by type along with information on national regulations	Resolved. Croatia provided information on the fractions of MSW collected by type, along with information on national regulations guiding the

<i>ID#</i>	<i>Issue and/or problem classification^{a, b}</i>	<i>Recommendation made in previous review report</i>	<i>ERT assessment and rationale</i>
	(W.9, 2016) (W.9, 2015) Transparency	guiding the reporting of data from landfill operators.	reporting of data from landfill operators in its NIR (chapter 7.2.1, p.307).
W.5	5.A Solid waste disposal on land – CH ₄ (W.10, 2016) Transparency	Include information on technical standards and remediation at landfills.	Resolved. Croatia provided information on technical standards and remediation at landfills in its NIR (chapter 7.2.1, pp.307–308).
W.6	5.A Solid waste disposal on land – CH ₄ (W.11, 2016) (W.10, 2015) Transparency	Include an explanation for the trend of AD on MSW disposal in the NIR.	Resolved. Croatia provided an explanation of the trend in AD on MSW disposal in its NIR (chapter 7.2.2, p.306), stating that there was a significant increasing trend until 2009, after which a decline was registered, primarily caused by the economic crisis and the effects of measures undertaken to avoid, reduce and recycle waste.
W.7	5.C.1 Waste incineration – CO ₂ (W.6, 2016) (W.6, 2015) (table 3 and 82, 2014) Completeness	Extrapolate back in order to estimate CO ₂ emissions from incineration of plastic waste between 1990 and 2006 to improve the consistency of the time series and transparency.	Not resolved. Croatia has not yet estimated CO ₂ emissions (or CH ₄ and N ₂ O emissions) from the incineration of plastic waste between 1990 and 2006. Croatia provided some information in the NIR (chapter 7.4.1, p.321) indicating that there are no separate data on plastic waste, because plastic waste and hazardous waste were collected together for the period 1990–2008. This makes it challenging to extrapolate back to existing AD on plastic waste. In response to a question raised by the ERT, Croatia indicated that plastic packaging waste has been collected separately under a scheme managed by the Environmental Protection and Energy Efficiency Fund and sent to waste treatment facilities for recycling since 2008. The Party further indicated that, in the past, plastic waste was incinerated, but for the period before 2008 (i.e. prior to the introduction of the electronic Environmental Pollution Register) CAEN has no data registered on incineration. Incineration of plastic waste has not occurred in Croatia since 2008 (see ID# W.11 in table 5).

 KP-LULUCF activities

KL.1	General (KP-LULUCF) (KL.9, 2015) Yes. Adherence to the reporting guidelines under Article 7, paragraph 1, of the Kyoto Protocol	Provide detailed information on the methodology applied and the data used to develop the background level and the margin for AR under Article 3, paragraph 3, and FM under Article 3, paragraph 4, of the Kyoto Protocol, and on how it avoids the expectation of net credits or net debits during the commitment period. Provide information on any progress made with regard to the ongoing project on data collection. Include information demonstrating methodological consistency between the FMRL and reporting for FM, in accordance with decision 2/CMP.7, annex, paragraph	Resolved. In the NIR Croatia reported detailed information on the methodology applied and the data used to develop the background level and the margin for afforestation under Article 3, paragraph 3, and FM under Article 3, paragraph 4, of the Kyoto Protocol, and on how it avoids the expectation of net credits or net debits during the second commitment period. Croatia also provided information on the progress made with regard to data collection as part of the project performed in 2014–2015. In addition, Croatia provided detailed information demonstrating methodological consistency between the FMRL and reporting for FM.
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<i>ID#</i>	<i>Issue and/or problem classification^{a, b}</i>	<i>Recommendation made in previous review report</i>	<i>ERT assessment and rationale</i>
		14, and decision 2/CMP.8, annex II, paragraph 5(e).	
KL.2	General (KP-LULUCF) (KL.5, 2016) (KL.5, 2015) Transparency	Correct the minimum land area value for defining forest under the Kyoto Protocol in CRF table NIR-1 to 0.1 ha.	Resolved. The value of minimum land area was corrected to 0.1 ha in CRF table NIR-1.
KL.3	General (KP-LULUCF) (KL.5, 2016) (KL.5, 2015) Transparency	Report the correct EFs used for estimating emissions for the different gases as a result of wildfires in AR and FM activities, which can be found in table 2.5 of the 2006 IPCC Guidelines.	Resolved. In the NIR Croatia reported the correct EFs used for estimating emissions from wildfires in AR and FM activities taken from the 2006 IPCC Guidelines (vol. 4, p.2.47, table 2.5). Based on an estimate of 19.8 t dry matter burned per ha, reported in the NIR (p.301), the IEF corresponds to the values in table 2.5 for extratropical forest.
KL.4	General (KP-LULUCF) (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.	Not resolved. The deadwood pool occurs in AR activities in Croatia, but Croatia continued to use the notation key “NO” in CRF table NIR-1 (instead of “NR”) and the notation key “NO” in CRF tables 4(KP-I)A.1 and 4(KP-I)B.1 (instead of “NE”).
KL.5	AR – CO ₂ (KL.1, 2016) (KL.1, 2015) (93, 2014) Comparability	Report the below-ground biomass pool separately from the above-ground biomass estimates.	Resolved. Below-ground biomass and above-ground biomass pools for AR activities are reported separately in CRF table (KP-I)A.1.
KL.6	Deforestation – CO ₂ (KL.2, 2016) (KL.2, 2015) (95, 2014) Comparability	Report the below-ground biomass pool separately from the above-ground biomass estimates.	Resolved. Below-ground biomass and above-ground biomass pools for deforestation are reported separately in CRF table (KP-I)A.2.
KL.7	Deforestation – CO ₂ (KL.9, 2016) (KL.10, 2015) Completeness	Estimate carbon stock changes in the deadwood pool in all lands subject to deforestation by using national data (as a preference) or by using data from neighbouring countries with a similar ecology and climate and similar management practices, and report the results.	Resolved. Croatia estimated carbon stock changes in the deadwood pool from deforestation using national data and included these estimates in the estimation of the total harvested stock in all lands subject to deforestation. In CRF table (KP-I)A.2 carbon stock changes in the deadwood pool are reported as “IE”.
KL.8	FM – CO ₂ (KL.4, 2016) (KL.4, 2015) (98, 2014) Comparability	Report the below-ground biomass pool separately from the above-ground biomass estimates.	Resolved. Croatia reported the below-ground biomass and above-ground biomass pools for FM activities separately in CRF table (KP-I)B.1.
KL.9	FM – CO ₂ (KL.6, 2016) (KL.6, 2015) Completeness	Collect data in order to estimate and report carbon stock losses from the living biomass pool in ‘out of yield’ forests under FM activity.	Not resolved. The ERT noted that Croatia used the notation key “NO” for reporting carbon stock losses from the living biomass pool in CRF table 4(KP-I)B.1. During the review, Croatia informed the ERT that it had just initiated analysing the possibility of using data on forest fires to estimate carbon stock losses

<i>ID#</i>	<i>Issue and/or problem classification^{a, b}</i>	<i>Recommendation made in previous review report</i>	<i>ERT assessment and rationale</i>
			from the living biomass pool in 'out of yield' forests under FM. (see ID# KL.16 in table 5).
KL.10	Biomass burning – CO ₂ (KL.7, 2016) (KL.7, 2015) Completeness	Estimate and report CO ₂ emissions from biomass burned and combusted in land under FM, following the guidance provided in the 2006 IPCC Guidelines, in order to avoid the underestimation of emissions from biomass burning.	Resolved. Croatia estimated and reported CO ₂ emissions from biomass burning (wildfires) in lands under FM in CRF table 4(KP-II)4 using information from the 2006 IPCC Guidelines and replaced the notation key "IE" used in the previous submission.
KL.11	HWP – CO ₂ (KL.8, 2016) (KL.8, 2015) Transparency	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. Emissions from HWP originating from deforestation have been excluded from the reporting on the basis of instantaneous oxidation. 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 provisions of decision 2/CMP.7, annex, paragraph 16.

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

^b The review of the 2017 annual submission of Croatia did not take place during 2017 and, as such, the 2017 ARR was not available at the time of this review. Therefore, the recommendations reflected in table 3 are taken from the 2016 annual review report. For the same reason, the year 2017 is excluded from the list of years in which the issue has been identified.

IV. Issues identified in three 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 included in table 4 have been identified in three successive reviews, including the review of the 2018 annual submission of Croatia, and have not been addressed by the Party.

Table 4

Issues identified in three successive reviews and not addressed by Croatia

<i>ID#</i>	<i>Previous recommendation for the issue identified</i>	<i>Number of successive reviews issue not addressed^a</i>
General	No issues identified	
Energy		
E.3	Take steps to ensure the consistency of the AD for fuel use in manufacturing industries and construction	3 (2014–2018)
IPPU		
I.5	Provide more details on the plans to increase the transparency and accuracy of the estimates by obtaining AD for ferroalloys	4 (2013–2018)

<i>ID#</i>	<i>Previous recommendation for the issue identified</i>	<i>Number of successive reviews issue not addressed^a</i>
	production to replace the interpolated data for the years 1994–1996 and 1999–2001	
I.7	Continue to conduct surveys on the status of disposal of refrigeration and air-conditioning equipment and include the results in the NIR	4 (2013–2018)
Agriculture		
A.4	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	3 (2014–2018)
LULUCF		
L.11	Implement the tier 2 approach to perennial cropland remaining perennial cropland as soon as possible	4 (2013–2018)
L.12	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 (2014–2018)
L.15	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	3 (2014–2018)
L.17	Improve the cropland biomass estimates to enable implementation of a tier 2 approach for estimating cropland biomass estimates under the cropland converted to settlements category as soon as possible	3 (2014–2018)
Waste		
W.1	Provide information on the type of waste disposed to SWDS and ensure that all types of solid waste, including industrial waste, sludge and construction and demolition waste, disposed to SWDS are included in the emission estimates	4 (2013–2018)
W.7	Extrapolate back in order to estimate CO ₂ emissions from incineration of plastic waste between 1990 and 2008 to improve the consistency of the time series and transparency	3 (2014–2018)
KP-LULUCF activities		
	No issues identified	

^a The review of the 2017 annual submission of Croatia did not take place during 2017. Therefore, the year 2017 is not taken into account when counting the number of successive years in table 4. In addition, as the reviews of the 2015 and 2016 annual submissions were held in conjunction with each other, they are not considered “successive” years and 2015/2016 is considered as one year.

V. Additional findings made during the individual review of the 2018 annual submission

10. Table 5 contains findings made by the ERT during the individual review of the 2018 annual submission of Croatia that are additional to those identified in table 3.

Table 5

Additional findings made during the individual review of the 2018 annual submission of Croatia

<i>ID#</i>	<i>Finding classification</i>	<i>Description of the finding with recommendation or encouragement</i>	<i>Is finding an issue and/or a problem?^a If yes, classify by type</i>
General			
G.1	QA/QC	<p>Croatia reported in the NIR (chapter 1.2.3, pp.42–44) on its QA/QC plan and QA/QC activities undertaken, indicating that as its QA procedure Croatia applies an annual audit to selected categories and conducts some verification activities. For sectoral QA, only a few cases of QA activities were reported in the NIR, but no documentation on the results of these sectoral QA activities was provided.</p> <p>The ERT recommends that Croatia compile complete documentation on its QA activities undertaken and the results thereof, in particular on sectoral QA activities, and report on these activities in its annual submissions.</p>	Adherence to the UNFCCC Annex I inventory reporting guidelines
G.2	QA/QC	<p>Croatia reported in the NIR on QA/QC activities (chapter 1.2.3, pp.42–44) and on data collection, processing and storage (chapter 1.3, pp.46–47). The ERT noted that the data input is well documented in the annual Data Collection Plan, organized by sector. The data output is documented in inventory data record sheets by subcategory and by year. However, the NIR does not provide documentation on the process and data management/calculations regarding how the input data result in AD and emission estimates in the CRF tables. Also, although the NIR reported the ‘standard’ activities for QC for each category, there is no documentation on the specific QC activities that were conducted and their outcomes.</p> <p>The ERT recommends that Croatia 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.</p>	Adherence to the UNFCCC Annex I inventory reporting guidelines
G.3	Uncertainty analysis	<p>Croatia reported in the NIR (annex 2) that it applies approach 2 (Monte Carlo analysis) for the uncertainty analysis. However, the NIR does not provide information on or references to underlying assumptions, documentation and/or reports that were used for the uncertainty analysis. During the review, for example, the Party explained that the uncertainty estimates for the LULUCF sector were based on the results of a workshop in 2013 that was not documented and that these estimates were not updated in line with improvements to the methods for estimating emissions and removals for the LULUCF sector. For the IPPU and waste sectors the experts responsible for emission calculations estimated the uncertainty of the AD and related emission estimates. The NIR does not provide documentation or information on how these estimates were conducted.</p> <p>The ERT recommends that Croatia 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 its next annual submission. The ERT further recommends that the Party provide in the NIR information on underlying assumptions and methods, including documentation on the experts’ uncertainty estimates in the IPPU and waste sectors.</p>	Adherence to the UNFCCC Annex I inventory reporting guidelines
G.4	National system	The ERT noted that for a number of key categories Croatia continued to use tier 1 methods for its emission estimates (see ID#s I.4, I.6 and L.15 in table 3), although its annual improvement plans for at least the last two years contain	Adherence to the reporting guidelines

ID#	Finding classification	Description of the finding with recommendation or encouragement	Is finding an issue and/or a problem? ^a If yes, classify by type
		<p>projects to implement the use of higher-tier methods. The ERT also noted with concern that the majority of these planned projects had not yet started, even though they were noted as priorities. During the review, Croatia indicated that it faced difficulties in implementing these projects, mainly owing to a lack of allocation of funds and policy prioritization.</p> <p>The ERT recommends that Croatia 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.</p>	under Article 7, paragraph 1, of the Kyoto Protocol
G.5	National system	<p>The ERT noted that, for a number of key categories, Croatia has not obtained all the necessary AD and EFs to enable it to implement higher-tier methods (see ID#s E.2, E.3 and I.5 in table 3, and E.11, I.42, I.43, L.22 and W.9 below), although the annual improvement plans for at least the last two years contain projects to obtain such data. The ERT also noted with concern that the majority of these planned projects had not yet started, even though they were noted as priorities. During the review, Croatia indicated that it faced difficulties in implementing these projects, mainly owing to a lack of allocation of funds and policy prioritization.</p> <p>The ERT recommends that Croatia 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.</p>	Adherence to the reporting guidelines under Article 7, paragraph 1, of the Kyoto Protocol
G.6	NIR	<p>The ERT noted that, for several subcategories, the documentation on methodologies and assumptions in the NIR is missing, not complete or not to the necessary level of detail (e.g. PFCs from aluminium production, carbon stock changes from forest land, cropland (mineral soils), land converted to cropland and grassland, CH₄ from solid waste disposal, and carbon stock changes from afforestation and deforestation). During the review, Croatia informed the ERT that there is no additional documentation apart from the NIR.</p> <p>The ERT recommends that Croatia 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. PFCs from aluminium production, carbon stock changes from forest land, cropland (mineral soils), land converted to cropland and grassland, CH₄ from solid waste disposal, and carbon stock changes from afforestation and deforestation), prioritizing key categories.</p>	Transparency
G.7	NIR	<p>The ERT noted that chapter 12 of the NIR, titled “References”, included bibliographic information on relevant reports organized by category. The ERT also noted that in the NIR chapters on the agriculture (e.g. see ID# A.12 below), LULUCF and waste sectors no references are given to the relevant reports or documents that are indicated in chapter 12 of the NIR.</p>	Transparency

ID#	Finding classification	Description of the finding with recommendation or encouragement	Is finding an issue and/or a problem? ^a If yes, classify by type
To improve the transparency of the NIR, the ERT recommends that Croatia 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.			
Energy			
E.10	1.A Fuel combustion – sectoral approach – gaseous, liquid and solid fuels – CO ₂	<p>The ERT noted that Croatia has an improvement plan for its GHG inventory, aimed particularly at improving the accuracy and quality of the emission estimates. Most of the projects in this plan have not been implemented for the last three years, mainly owing to a lack of allocation of funds and policy prioritization. In the current improvement plan, there are 20 projects in total and 7 are for the energy sector. However, only one improvement project is currently in progress out of these seven projects: a project to develop country-specific EFs for subcategory 1.A.1.a public electricity and heat production and synchronize them with EU ETS data (see ID# E.2 in table 3). The other six improvement projects also have high priority and refer to the time-series consistency of AD (1.A.2), the consistency of the national energy balance and EU ETS data (1.A.1 and 1.A.2), the accuracy of country-specific CO₂ EFs (1.A.1 and 1.A.2), an analysis of the energy balance for industry in the period 1990–2000 (1.A.2), the accuracy of country-specific CO₂ EFs (1.A.3.b) and the accuracy of AD from coal mining and handling (1.B.1.a).</p> <p>The ERT recommends that Croatia implement as a priority the improvement projects for the energy sector addressing the methodological approach used for emission estimates for key categories in accordance with the 2006 IPCC Guidelines. If Croatia 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 table 3, the ERT recommends that Croatia document in the NIR the progress made in implementing the project, including any delays.</p>	Yes. Accuracy
E.11	1.A Fuel combustion – sectoral approach – gaseous fuels – CO ₂	<p>Croatia used a value of 56.10 t CO₂/TJ as the CO₂ EF for natural gas combustion (NIR, p.65, table 3.1-3 and CRF table 1.A(a)), which is the same as the IPCC EF default value. However, in table 4.3-1 of the NIR (chapter 4.3.1.2, pp.135–136) on the consumption and composition of natural gas in ammonia production, Croatia reported a value of 15.143 kg C/GJ as the carbon content equivalent to 55.52 t CO₂/TJ for 2016, which is lower than the IPCC EF default value used by Croatia. During the review, Croatia informed the ERT that natural gas used for ammonia production is domestically produced, but Croatia also imports considerable amounts of natural gas for other uses, although the CO₂ EF for this natural gas has not been estimated.</p> <p>The ERT recommends that Croatia check the CO₂ 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 CO₂ from natural gas consumption. The ERT also encourages Croatia to improve the interaction between energy and IPPU sectoral experts on such issues when compiling the GHG inventory.</p>	Yes. Accuracy
E.12	1.A.2.a Iron and steel – gaseous fuels – CO ₂	The ERT noted that Croatia reported CO ₂ , CH ₄ and N ₂ O emissions from natural gas consumption for steel production in the energy sector under subcategory 1.A.2.a iron and steel. The ERT also noted that according to table 4.4-2 of the NIR natural gas is used as feedstock for steel production (0.9–8.5 million m ³ /year in the period 1990–2016) and that CO ₂ emissions from this amount of natural gas were reported under subcategory 2.C.1 iron and steel	Yes. Accuracy

ID#	Finding classification	Description of the finding with recommendation or encouragement	Is finding an issue and/or a problem? ^a If yes, classify by type
		<p>production. During the review, Croatia confirmed that all natural gas consumed in the country for steel production was reported in the energy and IPPU sectors and therefore emissions from this natural gas consumption were double counted under the energy and IPPU sectors in the period 1990–2016 (see ID# I.31 below).</p> <p>The ERT recommends that Croatia in its next annual submission 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 CO₂ 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.</p>	
E.13	1.A.2.g Other (manufacturing industries and construction) – gaseous, liquid, solid, other fossil fuels and biomass – CO ₂ , CH ₄ and N ₂ O	<p>The ERT noted that Croatia reported emissions from construction under subcategory 1.A.2.g.v. During the review, the Party acknowledged that these are in fact emissions from cement production and should therefore be reported under subcategory 1.A.2.f (non-metallic minerals).</p> <p>The ERT recommends that Croatia report emissions from cement production under subcategory 1.A.2.f in its subsequent annual submissions.</p>	Yes. Comparability
E.14	1.A.3.b Road transportation – gaseous and liquid fuels – CO ₂ and N ₂ O	<p>Croatia used the COPERT model for estimating CO₂, CH₄ and N₂O emissions from road transportation. The ERT noted that CO₂ emissions and the IEFs for N₂O from road transportation have high inter-annual variability over the entire time series, particularly in the period 2003–2016. For example, for CO₂ emissions from gasoline use the significant inter-annual changes identified were –4.7 per cent (2003–2004); –5.8 per cent (2009–2010); –7.0 per cent (2011–2012) and –7.7 per cent (2013–2014). For diesel oil use these were 18.6 per cent (2002–2003); 9.5 per cent (2003–2004); 7.6 per cent (2004–2005); 9.7 per cent (2005–2006); 10.0 per cent (2006–2007); 8.7 per cent (2014–2015) and 5.1 per cent (2015–2016). Regarding N₂O IEFs for gasoline cars these were 130.5 per cent (2003–2004) and –56.3 per cent (2004–2005). For gasoline light-duty trucks these were 238.9 per cent (2003–2004), –69.9 per cent (2004–2005) and –36.8 per cent (2015–2016). For diesel oil light-duty trucks these were 43.5 per cent (2002–2003) and for diesel oil heavy-duty trucks and buses these were 34.1 per cent (2015–2016). Croatia explained during the review that part of this variability could be due to rent-a-car services being introduced in Croatia in recent years (which are seasonal in use); the rising share of diesel cars; the number of hybrid and electric vehicles, which more than doubled over the period 2014–2016; a decrease by 9 per cent in the number of old (all vehicles up to EURO 4) passenger cars and light-duty vehicles; an increase by 24 per cent in new (EURO 4, EURO 5 and EURO 6) passenger cars and light-duty vehicles during 2014–2016; and an increase in imports of used cars. The ERT also noted that CO₂ estimates are best estimated from fuel consumption as per the 2006 IPCC Guidelines and any results of CO₂ estimates from models (e.g. COPERT) should be consistent with the fuel consumption statistics approach.</p> <p>The ERT recommends that Croatia 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 CO₂ emissions and the IEFs for N₂O. The ERT also</p>	Yes. Transparency

ID#	Finding classification	Description of the finding with recommendation or encouragement	Is finding an issue and/or a problem? ^a If yes, classify by type
E.15	1.A.4.b Residential – gaseous, liquid, solid fuels and biomass – CO ₂	<p>recommends that Croatia ensure that CO₂ emissions estimated using the COPERT model are fully consistent with CO₂ emissions calculated using fuel consumption from statistics and explain any differences in the NIR.</p> <p>The ERT noted that Croatia conducted the last household survey on energy consumption almost four years ago (since this review of the GHG inventory took place). The survey mainly reported the use of natural gas and solid biomass by households. The ERT also noted that the AD for biomass consumption in households have not been updated since 2014 and, according to the information provided by Croatia during the review, extrapolation techniques are used for estimating emissions from subcategory 1.A.4.b residential for the last three years reported in the 2018 annual submission. The ERT further noted that, for example, biomass consumption in subcategory 1.A.4.b residential decreased by 11.9 per cent (2013–2014) before increasing by 14.7 per cent (2014–2015) and then decreasing again by 2.9 per cent (2015–2016), which does not seem to be the result of an extrapolation of previous values. In the case of gaseous fuels, consumption decreased between 2010 and 2014, but later increased by 2.9 per cent (2014–2015) and 4.4 per cent (2015–2016), which also does not appear to be the result of an extrapolation of previous values. Therefore, the ERT noted that possibly there may be some related data inconsistencies in the time series of inventory estimates from this subcategory.</p> <p>The ERT recommends that Croatia 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. The ERT encourages Croatia to conduct a new survey on household energy consumption and use it as the basis for estimating emissions from subcategory 1.A.4.b residential in future annual submissions.</p>	Yes. Consistency
E.16	1.B.2.b Natural gas – gaseous fuels – CO ₂	<p>The ERT noted that natural gas produced in the Croatian Molve and Kalinovac gas fields contains a large amount of CO₂ (more than 15 per cent), which has to be cleaned (scrubbed) before natural gas is transported through commercial pipelines. This is because the maximum permitted content of CO₂ in commercial natural gas is 3 per cent (by volume). For this reason scrubbing units exist at the largest Croatian gas fields. The ERT also noted that Croatia estimated emissions from natural gas processing using a tier 1 approach on the basis of the total amount of natural gas produced and default EFs from the 2006 IPCC Guidelines (vol. 2, p.4.48, table 4.2.4). Croatia also included in its reporting under category 1.B.2.b natural gas data on CO₂ emissions provided by the scrubbing plant operator and, therefore, the ERT considers that Croatia double counted these CO₂ emissions. During the review, Croatia agreed that double counting occurred and resulted in an overestimation of emissions from natural gas processing and agreed to correct this error in its next annual submission.</p> <p>Considering that CO₂ emissions from 1.B.2.b natural gas is a key category, the ERT recommends that Croatia strive to develop a country-specific CO₂ EF for 1.B.2.b.3 natural gas – processing, taking into account data on CO₂ scrubbing provided by gas field and plant operators and, if this is not possible, use the IPCC CO₂ 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 CO₂ emissions from 1.B.2.b.3 natural gas – processing.</p>	Yes. Accuracy

ID#	Finding classification	Description of the finding with recommendation or encouragement	Is finding an issue and/or a problem? ^a If yes, classify by type
IPPU			
I.9	2. General (IPPU) – CO ₂ and N ₂ O	<p>The ERT noted that Croatia used emission data for 2012 onward from EU ETS reports to report emissions for several categories of the IPPU sector (e.g. 2.A.1, 2.A.2, 2.A.3, 2.A.4, 2.B.1, 2.B.2 and 2.C.1). However, the ERT noted that the use of emission data from EU ETS reports was not transparently described in the NIR. Specifically, it is not clear how the emission data taken from EU ETS reports were allocated to IPCC categories. In addition, the AD, EF, methods and assumptions used for the preparation of EU ETS reports were not described in the NIR. It is also not clear whether the methods used for preparing EU ETS reports are consistent with the 2006 IPCC Guidelines. The ERT concluded that the NIR does not transparently present the approach used for inventory compilation in the IPPU sector based on the use of emission data from EU ETS reports.</p> <p>The ERT recommends that Croatia 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 and their related responsibilities, as well as data flows between them. The ERT also recommends that Croatia include in the NIR a brief description of the AD, EF, 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. The ERT further recommends that Croatia 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.</p>	Yes. Transparency
I.10	2. General (IPPU) – SF ₆	<p>The ERT noted that, in the NIR (table ES.3.2-6), SF₆ emissions are reported as 0.0 kt CO₂ eq for the whole inventory period. However, the ERT also noted that SF₆ emissions occur in Croatia and are reported in CRF table summary 2 (e.g. 6.39 kt CO₂ eq in 2016). During the review, Croatia clarified that in the NIR (table ES.3.2-6) emissions of SF₆ were reported as 0.0 kt CO₂ eq by mistake, and the Party provided the correct SF₆ emissions in tables ES.2-3 and ES.2-4 of the NIR, as well as in the IPPU sectoral chapter and tables. The ERT concluded that data on SF₆ emissions in Croatia were not reported consistently between the CRF tables and the NIR.</p> <p>The ERT recommends that Croatia correct the error in NIR table ES. 3.2-6, ensuring that emissions reported in this table are consistent with the SF₆ emissions reported in CRF table summary 2 and sectoral CRF tables and within the NIR.</p>	Yes. Adherence to the UNFCCC Annex I inventory reporting guidelines
I.11	2. General (IPPU) – CO ₂ and N ₂ O	<p>The ERT noted that the NIR (annex 5-6) contains a comparison of emission data reported in the CRF tables with emission data from the EU ETS reports for each category, and noted that CO₂ emissions from glass production reported in the NIR are significantly lower than the emissions reported under the EU ETS for 2013–2014, with emissions remaining the same since 2015. The ERT also noted that the verified emissions in the EU ETS reports for 2.B.1 ammonia production in 2016 (510.22 kt CO₂ eq) are lower than the emissions reported in CRF table 2(I).A-H (547.86 kt CO₂ eq). During the review, Croatia explained that inconsistencies between emissions reported in the CRF tables and the EU ETS reports have arisen because of different classifications of emission categories. During</p>	Yes. Transparency

ID#	Finding classification	Description of the finding with recommendation or encouragement	Is finding an issue and/or a problem? ^a If yes, classify by type
		<p>the review, the ERT checked the EU ETS reports for some categories (e.g. 2.A.1 and 2.B.1) and concluded that the data reported in the CRF tables and the NIR are correct but not transparent.</p> <p>The ERT recommends that Croatia provide in its 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.</p>	
I.12	2.A.1 Cement production – CO ₂	<p>The ERT noted that Croatia provided some inaccurate and irrelevant information in the description of category 2.A.1 cement production in the NIR. Specifically, the ERT noted inaccurate information in table 4.2-1 of the NIR, which contains data of actual clinker production (t) that corresponds to the clinker production data corrected using the CKD factor. The same table also contains the EFs (t CO₂/t clinker) for Portland cement and aluminate cement, which actually correspond to the IEFs for 2012 onward. The ERT also noted that potentially irrelevant information had been reported in table 4.2-2 of the NIR, namely data on quantities of clinker imported/exported (1990–2016) that were not used in the estimations of the inventory. The ERT concluded that the description of category 2.A.1 cement production provided in the NIR is not accurate and transparent.</p> <p>The ERT recommends that Croatia provide in the NIR relevant information on the EFs applied and AD of clinker production that have not been corrected using the CKD factor. The ERT encourages Croatia to exclude irrelevant information, that is information not used in the calculations or for QA activities, from the NIR (e.g. import/export of clinker, if strictly necessary).</p>	Yes. Transparency
I.13	2.A.1 Cement production – CO ₂	<p>The ERT noted that in the NIR (chapter 4.2.1) Croatia did not include in the description of category 2.A.1 cement production the information recommended by the 2006 IPCC Guidelines on carbonate sources of CaO and non-carbonate sources of CaO used in cement plants. During the review, Croatia explained that the main source of CaO is limestone. By analysing EU ETS reports the ERT identified that non-carbonate sources of CaO are used in the cement plants in Croatia (e.g. slag is used in a plant operated by Holcim) and that the emissions from these non-carbonate sources of CaO were included in the reported emissions. The ERT concluded that the description in the NIR of the methods used for estimating CO₂ emissions for category 2.A.1 cement production related to carbonate and non-carbonate sources of CaO is not transparent.</p> <p>The ERT recommends that Croatia 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.</p>	Yes. Transparency
I.14	2.A.1 Cement production – CO ₂	<p>The ERT noted that the fraction of Portland clinker used for Portland cement production increased from 0.736 in 2011 to 0.866–0.923 in the period 2012–2016 (the fraction was estimated by the ERT based on the data provided in tables 4.2-1, 4.2-2 and 4.2-3 of the NIR). During the review, Croatia could not explain why the fraction of clinker used for cement production had increased. The review by the ERT of questionnaires provided by the cement plants to Croatia's inventory compilers confirmed that the average fraction of clinker used for cement production is about 0.7 t Portland clinker/t Portland cement. The ERT concluded that the information on clinker production and</p>	Yes. Transparency

ID#	Finding classification	Description of the finding with recommendation or encouragement	Is finding an issue and/or a problem? ^a If yes, classify by type
		export/import (tables 4.2-1 and 4.2-2 of the NIR) and cement production (table 4.2-3 of the NIR) in the period 2012–2016 could be either incomplete or not accurate, because the fraction of Portland clinker used for Portland cement production (0.866–0.923 t Portland clinker/t Portland cement in the period 2012–2016) is higher than the expected value (about 0.7 t Portland clinker/t Portland cement).	
		The ERT recommends that Croatia 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 the period 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. The ERT also recommends that the Party revise the estimates of CO ₂ emissions from cement production in accordance with corrected AD, if necessary.	
I.15	2.A.1 Cement production – CO ₂	The ERT noted that CO ₂ emissions from cement production were estimated for 1990–2011 taking into account the default value of CKD (1.02) and an uncertainty value of 2 per cent estimated by Croatia. However, the ERT also noted that the uncertainty of the default CKD value in the 2006 IPCC Guidelines is in the range of 25–35 per cent. During the review, Croatia could not justify its choice of uncertainty value for CKD. The ERT concluded that the assessment of uncertainty for category 2.A.1 could be incorrect.	Yes. Adherence to the UNFCCC Annex I inventory reporting guidelines
		The ERT recommends that Croatia justify its 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 by the 2006 IPCC Guidelines (25–35 per cent), including a suitable justification.	
I.16	2.A.2 Lime production – CO ₂	The ERT noted that, according to the NIR (chapter 4.2.2.2), Croatia used the tier 2 method for estimating CO ₂ emissions from lime production for 1990–2011 and that, since 2012, the CO ₂ emission data on lime production have been taken from the EU ETS reports. The ERT also noted that Croatia did not use in its estimates for 1990–2011 the correction factor for LKD or the correction factor for hydrated lime production, as recommended by the 2006 IPCC Guidelines for the tier 2 method. During the review, Croatia confirmed that hydrated lime is produced in the country and long rotary kilns generating significant amounts of LKD are used. The ERT concluded that the methodology applied for estimating CO ₂ emissions from category 2.A.2 lime production for 1990–2011 is not in line with the requirements of the 2006 IPCC Guidelines.	Yes. Accuracy
		The ERT recommends that Croatia estimate emissions from 2.A.2 lime production in accordance with the tier 2 method of the 2006 IPCC Guidelines, taking into account the LKD correction factor and hydrated lime production for 1990–2011.	
I.17	2.A.2 Lime production – CO ₂	The ERT noted that the average content of CaO in quick lime and dolomitic lime and the corresponding EFs for quick lime and dolomitic lime in Croatia (tables 4.2-5 to 4.2-8 of the NIR) were estimated incorrectly for 1990–2011, because non-functioning plants were taken into account in the estimation, whereas the production of lime in some existing plants was not considered. During the review, Croatia acknowledged that the average content of CaO and EFs for lime production were not correctly estimated. The ERT concluded that emissions from 2.A.2 lime	Yes. Accuracy

ID#	Finding classification	Description of the finding with recommendation or encouragement	Is finding an issue and/or a problem? ^a If yes, classify by type
		<p>production were not accurately estimated for 1990–2011 because EFs were estimated incorrectly, leading to emission underestimates in some years and overestimates in other years of this period.</p> <p>The ERT recommends that Croatia 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 CO₂ estimates from 2.A.2 lime production for 1990–2011 using the correct EFs.</p>	
I.18	2.A.2 Lime production – CO ₂	<p>The ERT noted that according to figure 4.2-2 of the NIR, CO₂ emissions from category 2.A.2 lime production in 2016 were about 60 kt. However, according to CRF table 2(I), CO₂ emissions from category 2.A.2 lime production in 2016 were 93.33 kt. During the review, Croatia clarified that the data shown in figure 4.2-2 of the NIR are not correct for 2016 and the correct data on CO₂ emissions from lime production were included in CRF table 2(I).s1. The ERT concluded that information on CO₂ emissions from 2.A.2 lime production is not consistently reported in the NIR and the CRF tables.</p> <p>The ERT recommends that Croatia provide consistent information on CO₂ emission data for 2.A.2 lime production in figure 4.2-2 in the NIR and CRF table 2(I).</p>	Yes. Adherence to the UNFCCC Annex I inventory reporting guidelines
I.19	2.A.3 Glass production – CO ₂	<p>The ERT noted that the NIR (chapter 4.2.3.2) does not include information on AD and EFs applied by Croatia to estimate CO₂ emissions from 2.A.3 glass production. During the review, Croatia clarified that the main sources of carbonates used for glass production in Croatia are limestone, dolomite and soda ash, and that the EFs applied are taken from the 2006 IPCC Guidelines. The ERT took note of the provided explanations and concluded that the description of the methods, AD and EFs in the NIR is not transparent, while the emission estimates are accurate.</p> <p>The ERT recommends that Croatia improve the description of the methods applied for estimating CO₂ emissions from 2.A.3 glass production by including in the NIR information on the AD of carbonate sources for glass production and the EFs applied.</p>	Yes. Transparency
I.20	2.A.4 Other process uses of carbonates – CO ₂	<p>The ERT noted that Croatia was not able to collect AD for soda ash consumption in 2016 from companies/plants where soda ash is used, as explained in the NIR (chapter 4.2.4.2). Therefore, the data on soda ash use for 2016 were estimated by Croatia using the extrapolation approach. Croatia explained during the review that actual data on soda ash consumption will be available from the companies/plants for the next annual submission. The ERT concluded that the approach implemented by Croatia is consistent with the UNFCCC Annex I inventory reporting guidelines; however, it noted that using extrapolated data instead of actual AD could lead to inaccurate estimations of emissions from 2.A.4 other process uses of carbonates.</p> <p>The ERT recommends that Croatia collect and revise the AD on soda ash consumption for 2016 using available plant-level data in its 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 CO₂ emissions from 2.A.4 other process uses of carbonates, using actual data instead of extrapolated data.</p>	Yes. Accuracy

ID#	Finding classification	Description of the finding with recommendation or encouragement	Is finding an issue and/or a problem? ^a If yes, classify by type
I.21	2.A.4 Other process uses of carbonates – CO ₂	<p>The ERT noted that CRF table 2(I).A-H does not contain a description of AD for the subcategory 2.A.4.d other process uses of carbonates – other. During the review, Croatia explained that values for carbonate consumption (limestone and dolomite) are included in the CRF tables but a description of the AD was not provided by mistake. The ERT concluded that the information on AD used for the estimation of emissions from the subcategory 2.A.4.d other is not transparently reported in the CRF tables.</p> <p>The ERT recommends that Croatia include in CRF table 2(I).A-H a description of the AD used for estimating CO₂ emissions from 2.A.4.d other process uses of carbonates – other.</p>	Yes. Transparency
I.22	2.A.4 Other process uses of carbonates – CO ₂	<p>The ERT noted that the NIR (chapter 4.2.4.2) does not include information on the estimation of CO₂ emissions from the calcination of carbonates contained in clay used for ceramics production. During the review, Croatia clarified that emissions from the calcination of carbonates contained in clay were not estimated for 1990–2011 and were only estimated for 2012–2015 because clay has been included as an emissions source in the EU ETS reports since 2012. The ERT concluded that the reported CO₂ emissions from ceramics production were incomplete for 1990–2011 because CO₂ emissions from the calcination of carbonates contained in clay were not taken into consideration.</p> <p>The ERT recommends that Croatia estimate CO₂ 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.</p>	Yes. Completeness
I.23	2.B.2 Nitric acid production – N ₂ O	<p>The ERT noted that according to the NIR (chapter 4.3.2.2) a tier 2 method was applied for the estimation of N₂O emissions from nitric acid production. However, the ERT also noted that the description of the method applied by Croatia corresponds to the tier 3 method of the 2006 IPCC Guidelines. During the review, Croatia acknowledged that the tier was identified incorrectly in the NIR. The ERT concluded that the NIR contains incorrect information on the tier method applied by Croatia for estimating N₂O emissions from 2.B.2 nitric acid production.</p> <p>The ERT recommends that Croatia correctly identify in the NIR the tier 3 method applied for estimating N₂O emissions from 2.B.2 nitric acid production.</p>	Yes. Transparency
I.24	2.B.2 Nitric acid production – N ₂ O	<p>The ERT noted that the inter-annual changes of the N₂O IEFs for 2012–2013 (–64.3 per cent) and 2015–2016 (–58.7 per cent) are significant. The ERT also noted that the N₂O IEF value for 2016 (0.001 t/t) is below the range of IPCC default EF values (2006 IPCC Guidelines, vol. 3, chapter 3, table 3.3) for different types of production processes, including plants with abatement technologies (0.002–0.009 t/t). During the review, Croatia clarified that there are two production plants of nitric acid in the country. One of them has two production lines. Abatement technologies (SCR) were installed at the first plant in January 2013 for one production line and in July 2013 for the other production line. Abatement technologies (SCR) for the second plant were installed in November 2012. The causes of the fluctuation in emissions and corresponding changes of IEFs were technical problems associated with the work of the installed SCR system (e.g. loss of catalyser and system reconstruction, as well as an increase in the number of shutdowns/start-ups of the plants). The ERT agreed with the Party's explanation of the values and observed inter-</p>	Yes. Transparency

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		<p>annual changes of the N₂O IEFs. However, the ERT concluded that the information on the N₂O emissions trends is not transparently described in the NIR.</p> <p>The ERT recommends that Croatia include in the NIR technical explanations of the emission trends and declines and fluctuations in the N₂O IEFs observed since 2013 for 2.B.2 nitric acid production.</p>	
I.25	2.B.2 Nitric acid production – N ₂ O	<p>The ERT noted that according to the NIR (chapter 4.3.2.2) a continuous emission measurement system was applied by operators of nitric acid plants for monitoring N₂O emissions. However, according to chapter 4.3.2.6 of the NIR, the continuous emission measurement system is not installed in nitric acid plants. Croatia could not clarify during the review which measurement system is installed in nitric acid production plants. Therefore, the ERT concluded that the information on the measurement system used in nitric acid production plants is not transparent.</p> <p>The ERT recommends that Croatia identify the measurement systems used for N₂O emission monitoring at nitric acid production plants and describe the systems clearly in the NIR.</p>	Yes. Transparency
I.26	2.B.2 Nitric acid production – N ₂ O	<p>The ERT noted that table 4.3-4 of the NIR contains data on nitric acid production in Croatia for 1990–2016. However, it is not clear whether the provided data refer to 100 per cent nitric acid, as required by the 2006 IPCC Guidelines. Croatia could not clarify during the review the concentration of nitric acid production reported in the NIR. The ERT concluded that information on AD for nitric acid production is not transparently reported in the NIR and that it was unable to determine the accuracy of the reported emissions.</p> <p>The ERT recommends that Croatia 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.</p>	Yes. Accuracy
I.27	2.B.8 Petrochemical and carbon black production – CO ₂	<p>The ERT noted that the NIR (chapter 4.3.7.1) does not contain a sufficient description of category 2.B.8 petrochemical and carbon black production because no information on the main sources of CO₂ emissions was included, and there is no information on the types of product produced or technologies applied. Croatia acknowledged during the review that the description in the NIR of category 2.B.8 petrochemical and carbon black production is not complete and informed the ERT that currently methanol production is the only activity occurring in the country under this category. The ERT concluded that the description of category 2.B.8 petrochemical and carbon black production in the NIR is not transparent.</p> <p>The ERT recommends that Croatia provide in the NIR a detailed description of category 2.B.8 petrochemical and carbon black production, including information on the main sources of CO₂ emissions from petrochemical and carbon black production in Croatia, types of product produced, technologies applied and other relevant information.</p>	Yes. Transparency
I.28	2.C.1 Iron and steel production – CO ₂	<p>The ERT noted that emissions from pig iron production during 1990–1993 were not reported under category 2.C.1 iron and steel production, as required by the 2006 IPCC Guidelines. During the review, Croatia confirmed that CO₂ emissions from pig iron production were reported in the energy sector, and provided to the ERT the AD used in the emission estimates for pig iron production, including coke and coal consumption. The ERT concluded that</p>	Yes. Comparability

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		<p>allocating CO₂ emissions from pig iron production for 1990–1993 to the energy sector is not in accordance with the 2006 IPCC Guidelines, and that Croatia is able to estimate CO₂ emissions from pig iron production using the tier 2 method based on coke and coal consumption data and therefore able to report these emissions separately under category 2.C.1.</p> <p>The ERT recommends that Croatia estimate CO₂ emissions from pig iron production for 1990–1993 using the tier 2 method of the 2006 IPCC Guidelines, based on available data on coke and coal consumption for pig iron production, and report these emissions under category 2.C.1 iron and steel production in the IPPU sector. The ERT also recommends that Croatia ensure that CO₂ emissions are not double counted under the energy and IPPU sectors (see ID#s E.12 in table 3 and I.31 below).</p>	
I.29	2.C.1 Iron and steel production – CO ₂	<p>The ERT noted that, according to table 4.4-1 of the NIR, the production of steel exceeds the consumption of ferrous charge materials (e.g. 20,503 t combined iron scrap and steel scrap were used for production of 23,620 t steel in Croatia in 2016). During the review, Croatia could not clarify whether the information on charge materials for steel production was complete and accurate. The ERT concluded that information on steel production and raw materials used for steel production was not transparently reported in the NIR and that it was unable to determine the accuracy of the reported emissions.</p> <p>The ERT recommends that Croatia specify all sources of ferrous materials for steel production used in the country and provide this information in the NIR. The ERT also recommends that Croatia revise its CO₂ emission estimates from steel production if the ferrous charge materials were not accurately taken into account in the calculations.</p>	Yes. Accuracy
I.30	2.C.1 Iron and steel production – CO ₂	<p>The ERT noted that according to the NIR (chapter 4.4.1.2) only EAFs are currently used in Croatia to produce steel. The ERT also noted that according to table 4.4-1 of the NIR, the consumption of electrodes for steel production in EAFs amounted to 0 t in 2016 and 5 t in 2012. This amount of electrodes does not correspond to the amount of steel produced (23,620 t in 2016 and 5,896 t in 2012) because EAFs cannot be operated without carbon electrodes. During the review, Croatia clarified that EAFs are not the only furnaces used for steel production, as electric ovens are also used (medium-frequency induction furnaces) and these do not require electrodes for steel smelting. Croatia confirmed that all carbon inputs were considered in the calculations. The ERT concluded that the information on steel production technologies applied in Croatia and the corresponding steel production and carbon materials consumption data are not transparent.</p> <p>The ERT recommends that Croatia 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.</p>	Yes. Transparency
I.31	2.C.1 Iron and steel production – CO ₂	<p>The ERT noted that according to table 4.4-2 of the NIR natural gas is used as feedstock for steel production in Croatia (0.9–8.5 million m³/year in the period 1990–2016). CO₂ emissions from this amount of natural gas used for steel production were reported under 2.C.1 iron and steel production. The ERT also noted that it is not clear in the NIR whether emissions from natural gas consumption were not double counted under the IPPU and energy sectors.</p>	Yes. Accuracy

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		<p>During the review, Croatia clarified that all natural gas consumed in the country for steel production was also reported under the energy sector. The ERT concluded that emissions from natural gas consumption were double counted under the IPPU and energy sectors in the period 1990–2016.</p> <p>The ERT recommends that Croatia correctly allocate the estimates of CO₂ emissions from natural gas consumption for steel production emissions only to the IPPU sector in accordance with the 2006 IPCC Guidelines, and improve the coordination among the IPPU and energy experts preparing the inventory (see ID# E.12 above).</p>	
I.32	2.C.1 Iron and steel production – CO ₂	<p>The ERT noted that, according to table 4.4-4 of the NIR, Croatia used an NCV for natural gas of 34.00 TJ/Gg for estimating CO₂ emissions from EAFs. The ERT also noted that this value is significantly lower than the range of IPCC default values for NCVs of natural gas (46.5–50.4 TJ/Gg). During the review, Croatia explained that an incorrect unit for the NCV of natural gas was provided in the NIR, and that the NCV value used in calculations was 34.00 TJ/10⁶ m³, which the ERT considers appropriate. The ERT concluded that the information on the NCV for natural gas applied for estimating CO₂ emissions from EAFs is not transparently reported in the NIR.</p> <p>The ERT recommends that Croatia include in the NIR correct data, including units, for the NCV of natural gas used in the emission calculations for steel production.</p>	Yes. Transparency
I.33	2.C.1 Iron and steel production – CO ₂	<p>The ERT noted that not all steel produced in Croatia in 1990–1991 was included in the estimation of CO₂ emissions from 2.C.1.a steel. According to the statistics provided to the ERT during the review 214 kt steel was produced in 1991, but only 120 kt steel was included in the estimations, according to table 4.4-5 of the NIR. During the review, the Party did not provide further information on this issue. The ERT concluded that the CO₂ emission estimates for steel production in Croatia in 1990–1991 could be incomplete.</p> <p>The ERT recommends that Croatia investigate which technology was used for steel production in the country from 1990 to 1991 other than EAFs (e.g. open-hearth furnaces), include relevant descriptions in the NIR, estimate CO₂ emissions from all steel produced in the country, as necessary, and include those emissions in the annual submissions.</p>	Yes. Accuracy
I.34	2.C.3 Aluminium production – PFCs	<p>The ERT noted that Croatia reported PFC emissions from aluminium production for 1990–1991 only. The ERT also noted that, according to the NIR (chapter 4.4.3.2), the EFs used for estimating PFC emissions from 2.C.3 aluminium production were 1.7 kg/t aluminium produced for CF₄ and 0.17 kg/t aluminium produced for C₂F₆ for side-worked prebaked anodes. However, the ERT also noted that the reported IEFs in CRF tables (1.6 kg/t aluminium produced for CF₄ and 0.4 kg/t aluminium produced for C₂F₆) are different from the EFs provided in the NIR. During the review, Croatia explained that there is an error in the NIR (chapter 4.4.3.2, p.156) and the correct EFs correspond to IEFs of 1.6 kg/t aluminium produced for CF₄ and 0.4 kg/t aluminium produced for C₂F₆, in accordance with the default values from the 2006 IPCC Guidelines (vol. 3, table 4.15). The ERT agreed with the explanation provided and concluded that the information on EFs applied was incorrect in the NIR.</p>	Yes. Transparency

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I.35	2.C.3 Aluminium production – PFCs	<p>The ERT recommends that Croatia provide in the NIR correct information on the EFs used for estimating PFC emissions from 2.C.3 aluminium production with a relevant reference to the 2006 IPCC Guidelines.</p> <p>The ERT noted that according to the NIR (chapter 4.4.3.3) the uncertainty of default EFs used for estimating PFC emissions was assessed as 25 per cent. The ERT also noted that the uncertainty of the default PFC EFs stated in the 2006 IPCC Guidelines ranges from –40 to +150 per cent. During the review, Croatia could not justify its choice of uncertainty value and stated that the uncertainties for the EFs for CF₄ and C₂F₆ will be corrected in accordance with the values in the 2006 IPCC Guidelines and included in the next annual submission.</p> <p>The ERT recommends that Croatia justify and document in the NIR its choice of uncertainty value for the EFs used for estimating PFC emissions from aluminium production, including when taking default uncertainty values from the 2006 IPCC Guidelines for the corresponding default EFs.</p>	Yes. Adherence to the UNFCCC Annex I inventory reporting guidelines
I.36	2.D.1 Lubricant use – CO ₂	<p>The ERT noted that the inter-annual changes of AD (consumption of lubricants) for 1998–1999 (–68.3 per cent) and 2003–2004 (35.9 per cent) are significant. Croatia clarified during the review that the annual consumption of lubricants was extracted from the national energy balance. However, the ERT noted that data for lubricant use are available in the energy balance for the period 1999–2016 only. For the period 1990–1998, data for lubricant use were reported in the energy balance as a total together with other unspecified products from fuels. Croatia explained that data on lubricant use in 1990–1998 were estimated based on expert judgment. However, the Party did not clarify the method used for estimating AD for lubricant use. During the review, Croatia agreed that the time series of lubricant use is not consistent and stated that AD for 1990–1998 are to be revised. The ERT further noted that the significant change in AD between 2003 and 2004 was not clarified during the review. The ERT concluded that the AD and corresponding CO₂ emissions from lubricant use are inconsistent between the periods 1990–1998 and 1999–2016 as well as between 2003 and 2004.</p> <p>The ERT recommends that Croatia revise the AD of lubricant use in the country for 1990–1998 using the splicing techniques provided in the 2006 IPCC Guidelines (vol. 1, chapter 5) and ensure the consistency of the AD time series and corresponding CO₂ emissions. The ERT also recommends that the Party explain transparently in the NIR the reasons for the significant change in AD in 2003–2004 and, if appropriate, in other years.</p>	Yes. Consistency
I.37	2.D Non-energy products from fuels and solvent use – CO ₂	<p>The ERT noted that category 2.D non-energy products from fuels and solvent use was identified as a key category according to annex 5-6 to the NIR and CRF table 7. The ERT also noted that the tier 1 method was used for estimating CO₂ emissions from 2.D.1 lubricant use and 2.D.2 paraffin wax use, as stated in the NIR (chapters 4.5.1.2 and 4.5.2.1, respectively). The ERT concluded that a higher-tier method was not applied for estimating CO₂ emissions from subcategories 2.D.1 and 2.D.2; however, it recognized that the decision trees for methodological choice of the 2006 IPCC Guidelines for these subcategories (vol. 3, p.5.8, figure 5.2, and vol. 3, p.5.12, figure 5.3) state that a tier 2 method is to be used when a subcategory is significant (i.e. those subcategories that contribute together more than 60 per cent of the key category). In this regard, the ERT further noted that the subcategory 2.D.3</p>	Not an issue/problem

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		<p>other – solvent use contributed 66.9 per cent of category 2.D non-energy products from fuels and solvent use in 2016.</p> <p>The ERT encourages Croatia to implement a higher-tier method for estimating CO₂ emissions from the subcategories 2.D.1 lubricant use and 2.D.2 paraffin wax use under the key category 2.D non-energy products from fuels and solvent use.</p>	
I.38	2.D.1 Lubricant use – CO ₂	<p>The ERT noted that the NIR (chapters 4.5.1.2 and 4.5.2.2) did not contain information on the value of the NCV used to convert data for lubricants and paraffin waxes from mass units (kt) in tables 4.5-1 and 4.5-3 of the NIR to energy units (TJ) for estimating CO₂ emissions. During the review, Croatia clarified that a country-specific value of 33.5 TJ/Gg was used for the NCV for lubricants and paraffin waxes. The ERT noted that the value of 33.5 TJ/Gg for paraffin waxes does not correspond to the default NCV (40.2 TJ/Gg) and is outside the range of NCVs (33.7–48.2 TJ/Gg) in the 2006 IPCC Guidelines for paraffin waxes, and that 33.5 TJ/Gg for lubricants corresponds to the lowest NCV of the range provided in the 2006 IPCC Guidelines (33.5–42.3 TJ/Gg) for lubricants. During the review, Croatia could not justify its chosen NCV for lubricants and paraffin waxes (33.5 TJ/Gg) by providing an original data source. The ERT concluded that the information on the NCV chosen for lubricants and paraffin waxes is not transparent and that future ERTs should consider this issue further to ensure that there is not an underestimation of emissions from this category.</p> <p>The ERT recommends that Croatia include in the NIR information on NCVs and data sources for the NCVs used for estimating CO₂ emissions from lubricants and paraffin waxes. The ERT also recommends that Croatia justify its 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, the ERT recommends that Croatia apply the default NCVs from table 1.2 of volume 2, chapter 1 of the 2006 IPCC Guidelines, and revise the emission estimates accordingly.</p>	Yes. Accuracy
I.39	2.D.1 Lubricant use – CO ₂	<p>The ERT noted that the NIR (chapter 4.5.1) did not contain any explanation of how the consumption of lubricants for two-stroke engines was taken into account in the preparation of the inventory. The ERT noted that, according to the 2006 IPCC Guidelines, the emissions from lubricant use for two-stroke engines are to be estimated and reported as part of the combustion emissions in the energy sector. Croatia clarified during the review that all lubricants used in the country were reported under the IPPU sector. The ERT concluded that CO₂ emissions from lubricant use for two-stroke engines were not correctly allocated between the energy and IPPU sectors.</p> <p>The ERT recommends that Croatia 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.</p>	Yes. Comparability
I.40	2.D.1 Lubricant use – CO ₂	<p>The ERT noted that the Party used a value of 0.2 for the ‘oxidation during use’ factor for lubricants for estimating CO₂ emissions, as stated in the NIR (chapter 4.5.1.2). During the review, Croatia provided to the ERT the balance of lubricants in the country from a report on special categories of waste for 2016. The lubricants balance shows that 50 per cent of lubricants is lost during the first lubricant use and an additional 30 per cent is lost after the first</p>	Yes. Completeness

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		<p>application and not collected in special services (section 3.1.1 of the above-mentioned report). The ERT concluded that it is possible that Croatia did not estimate all emissions from lubricant use in the country because only 20 per cent (corresponding to an ‘oxidation during use’ factor of 0.2) was estimated under the IPPU sector and the remaining 80 per cent of lubricants was assumed to be lost during the second use.</p> <p>The ERT recommends that Croatia confirm the balance of lubricants used in Croatia, as shown to the ERT during the review (50 per 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.</p>	
I.41	2.D.3 Other (non-energy products from fuels and solvent use) – CO ₂	<p>The ERT noted that Croatia decided not to report indirect CO₂ emissions from the atmospheric oxidation of CH₄, carbon monoxide and non-methane volatile organic compounds in the national inventory as stated in chapter 9 of the NIR (“Description of sources of indirect emissions in GHG inventory”). The indirect CO₂ emissions are reported as “NO” and “NA” in CRF tables summary 1.A, summary 2, table 6, table 8 and table 10. However, the ERT also noted that Croatia reported in CRF table 2(I).A-H under 2.D.3 other indirect CO₂ emissions from solvent use, road paving with asphalt and asphalt roofing for 1990–2016 (e.g. 139.3 kt CO₂ in 1990 and 60.6 kt CO₂ in 2016). The ERT concluded that Croatia did not transparently report indirect CO₂ emissions using CRF table 6 and did not adhere to the requirements of paragraph 29 of the UNFCCC Annex I inventory reporting guidelines regarding reporting national totals with and without indirect CO₂ emissions.</p> <p>The ERT encourages Croatia to continue estimating indirect CO₂ 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, and recommends that Croatia 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 CO₂ emissions in the national totals in CRF tables summary 2 and table 10. The ERT also recommends that Croatia include in the corresponding section of the NIR (e.g. in chapter 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.</p>	Yes. Adherence to the UNFCCC Annex I inventory reporting guidelines
I.42	2.F.1 Refrigeration and air conditioning – HFCs	<p>The ERT noted that Croatia reported AD on HFCs as “NO” in the columns “Filled into new manufactured products” and “Remaining in products at decommissioning” of CRF table 2(II).B-H. During the review, the ERT analysed with Croatian experts the statistics provided by CAEN on HFCs sold, used and recovered in the country and a 2016 research study on HFC use in Croatia. As a result, the ERT identified potential activities not taken into account in the inventory calculations that may lead to HFC emissions in Croatia, such as (1) manufacturing of equipment containing HFCs (e.g. at companies such as MD Frigo, Frigo Plus and Dolmacija Klima), (2) disposal of equipment containing HFCs (e.g. at special service centres responsible for the collection, recovery and destruction of HFCs) and (3) HFCs imported annually in containers. The ERT concluded that the information on AD and HFC emissions from category 2.F.1 refrigeration and air conditioning is not transparent and the emission estimates may be</p>	Yes. Completeness

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		<p>incomplete. The ERT believes that future ERTs should consider this issue further to ensure that there is not an underestimation of emissions from this category.</p> <p>The ERT recommends that Croatia 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 Dolmacija Klima), (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 2.F.1 refrigeration and air conditioning for the whole time series.</p>	
I.43	2.F.1 Refrigeration and air conditioning – HFCs and PFCs	<p>The ERT noted that the latest and most accurate information on HFCs used in Croatia is available in the above-mentioned 2016 study, which was not taken into consideration for the emission estimates. According to CRF table 2(II).B-H of the submission of 24 May 2018, in 2014 the total amount of HFCs in operating systems (annual average stock) was 1,428.03 t. However, according to the study indicated above (p.15), in 2014 the total mass of HFCs contained in operating refrigeration and air-conditioning units and heat pumps in Croatia was 1,672 t. The ERT also noted that AD used by Croatia for its HFC emission estimates from stocks in category 2.F.1 refrigeration and air conditioning in 2014 were based on statistical sources with corrections based on expert judgment. During the review, the ERT analysed with Croatian experts and scientists the AD used for the HFC emission estimates. Croatian experts agreed with the ERT that accurate data on HFC consumption for 2.F.1 refrigeration and air conditioning are reported in the study indicated above. The ERT made a preliminary estimate of HFC emissions from the operation phase of equipment for category 2.F.1 using the data from the study and came to the conclusion that emissions in 2014 were likely underestimated by about 47 kt CO₂ eq or 0.2 per cent of the national total (which exceeds the significance threshold of 0.05 per cent of the national total without LULUCF). The ERT concluded that HFC emissions from category 2.A.1 refrigeration and air conditioning were underestimated in 2014 and probably also underestimated in 2013 and 2015–2016.</p> <p>The ERT included this issue in the list of potential problems and further questions raised by the ERT and recommended that Croatia collect accurate and reliable AD on HFCs used in Croatia for 2013–2016 for each use/application under 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). AD could be collected as follows: AD for 2014 could be gathered from the study indicated above for each application under category 2.F.1 for the refrigerants R-134a, R-143a, R-152a, R-422D, R-417A, R-407C, R-410A, R-507A and R-404A containing HFCs; AD for 2013 and 2015–2016 could be estimated using the splicing techniques provided in the 2006 IPCC Guidelines (vol. 1, chapter 5), for example, using the overlap or surrogate data approach. The ERT also recommended that Croatia revise its HFC emission estimates for category 2.F.1 refrigeration and air conditioning for 2013–2016 and, following the principle of consistency, for the entire time series using the collected AD and by applying the tier 2a method (EF approach) of the 2006 IPCC Guidelines (vol. 3, chapter 7), and report the revised HFC emission estimates in the corresponding CRF tables for 2013–2016 and, following the principle of consistency, for the entire time series.</p>	Yes. Accuracy

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		<p>In response to the list of potential problems and further questions raised by the ERT, Croatia resubmitted a set of revised CRF tables for 2013–2016 with revised HFC emission estimates for category 2.F.1 refrigeration and air conditioning following the recommendations of the ERT. The ERT agreed with the revised emission estimates of HFCs from 2.F.1 refrigeration and air conditioning for 2013–2016. As a result of the revision, the HFC emissions from 2.F.1 refrigeration and air conditioning increased by 60.27 kt CO₂ eq in 2013 (0.25 per cent of the national total or 2.31 per cent of the IPPU sector); increased by 60.87 kt CO₂ eq in 2014 (0.26 per cent of the national total or 2.20 per cent of the IPPU sector); increased by 62.60 kt CO₂ eq in 2015 (0.26 per cent of the national total or 2.26 per cent of the IPPU sector); and increased by 63.86 kt CO₂ eq in 2016 (0.26 per cent of the national total or 2.60 per cent of the IPPU sector).</p> <p>The ERT noted also that Croatia revised emissions of PFCs from 2.F.1 refrigeration and air conditioning in 2013–2015 based on up-to-date information from the 2016 study indicated above and reported PFCs as “NO”. Previously, emissions of PFCs had been reported as 0.06 kt CO₂ eq in 2013 and 2014, 0.03 kt CO₂ eq in 2015 and “NO” in 2016. The ERT noted the changes made in the emission reporting and agreed with the revised estimates of PFCs.</p> <p>The ERT recommends that Croatia 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/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, the ERT recommends that Croatia 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. The ERT also recommends that Croatia 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 it ensured the consistency of the time series, as well as document up-to-date information indicating that PFC emissions are not occurring in Croatia under category 2.F.1 refrigeration and air conditioning. If the latter is not possible, the ERT recommends that Croatia continue reporting PFC emissions under category 2.F.1 refrigeration and air conditioning in accordance with paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines.</p>	
I.44	2.F.2 Foam blowing agents – HFCs	<p>The ERT noted that HFC emissions from closed-cell foams were reported as “NO” in CRF table 2(II).B-H for the entire time series. The ERT noted also that the NIR explains that closed-cell foams are not produced in Croatia. However, the NIR does not clarify whether closed-cell foams are imported and used in the country. According to the 2006 IPCC Guidelines, HFC emissions from closed-cell foams may occur during use and decommissioning. During the review, Croatia could not confirm whether closed-cell foams are imported and used in the country. The ERT concluded that information on the use of closed-cell foams in Croatia is not transparently reported in the NIR and that HFC emissions may occur from the use and commissioning of imported closed-cell foams. The ERT believes that future ERTs should consider this issue further to ensure that there is not an underestimation of emissions from this category.</p>	Yes. Completeness

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I.45	2.F.3 Fire protection – HFCs	<p>The ERT recommends that Croatia investigate whether closed-cell foams are imported and used in the country, noting that a list of sub-applications for consideration is provided in the 2006 IPCC Guidelines (vol. 3, chapter 7, table 7.4). If closed-cells foams are used, the ERT recommends that Croatia 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.</p> <p>The ERT noted that HFC-236fa emissions from subcategory 2.F.3 fire protection were reported for 2006–2008 and 2011–2016; however, for 2009 and 2010 and before 2006 they were reported as “NO”. The ERT also noted that, according to CRF table 2(II).B-H, the HFC-236fa product life factor for subcategory 2.F.3 is 4.0 per cent, which corresponds to the life factor for portable extinguishers. This product life factor was also applied to HFC-125 and HFC-227ea. During the review, Croatia explained that only potential emissions of HFC-236fa were estimated under subcategory 2.F.3 for the years 2006–2008 and 2011–2016 when HFCs were filled into fire protection systems, and also explained that HFC emissions were not estimated for 2009–2010 because additional volumes of HFCs were not used for fire protection in this period. Croatia also clarified that the EF for portable extinguishers (4.0 per cent) was not correctly applied to the calculations for stationary fire protection systems (to which a value of 2 per cent applies). The ERT further noted that the tier 2a method was not correctly applied to HFC-236fa emission estimates and the chosen EF (for portable extinguishers) does not correspond to the EF for stationary extinguisher systems estimated and reported under subcategory 2.F.3. The ERT concluded that the HFC emissions from subcategory 2.F.3 fire protection were not estimated accurately because the incorrect method and EF were used for estimating HFC-236fa emissions, and possibly HFC-125 and HFC-227ea emissions. The ERT believes that future ERTs should consider this issue further to ensure that there is not an underestimation of emissions for this subcategory.</p> <p>The ERT recommends that Croatia estimate emissions in accordance with the chosen tier 2a method of the 2006 IPCC Guidelines for all HFCs used in subcategory 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.</p>	Yes. Accuracy
I.46	2.F.3 Fire protection – HFCs	<p>The ERT noted that Croatia reported under subcategory 2.F.3 fire protection HFC emissions from stationary installations for fire protection, and that emissions from portable extinguishers were not estimated. During the review, Croatia clarified that there is one producer of portable extinguishers in the country, which uses HFC-236fa to fill portable extinguishers. The ERT concluded that HFC emissions may occur in Croatia during the production, use and decommissioning of portable extinguishers using HFC-236fa. The ERT believes that future ERTs should consider this issue further to ensure that there is not an underestimation of emissions from this category.</p> <p>The ERT recommends that Croatia 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 subcategory 2.F.3 fire protection and provide relevant information in the NIR.</p>	Yes. Completeness
I.47	2.F.4 Aerosols – HFCs	<p>The ERT noted that according to the NIR (chapter 4.7.2.2) HFC emissions from subcategory 2.F.4 aerosols were estimated using the tier 2 method. However, the ERT also noted that the NIR does not contain any information on how the quantity of HFCs contained in aerosol products was estimated and which assumptions were used for the estimations. During the review, Croatia explained that the AD on HFCs for the emission calculation under 2.F.4</p>	Yes. Transparency

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I.48	2.G.1 Electrical equipment – SF ₆	<p>aerosols were estimated only on the basis of import data because aerosols are not produced in Croatia. Estimates of emissions were based on the average annual stocks of HFC-134a for 2.F.4 aerosols – metered dose inhalers. Croatia also explained that the default EF (100 per cent) from the 2006 IPCC Guidelines was used for the emission estimation (vol. 3, chapter 7.3.2.2, p.7.29). The ERT concluded that the AD, EFs, methods and assumptions used for estimating HFC emissions from 2.F.4 aerosols were not transparently described in the NIR.</p> <p>The ERT recommends that Croatia include information in the NIR on the AD, EFs, methods and assumptions used for estimating HFC emissions from 2.F.4 aerosols in accordance with paragraph 50(a) of the UNFCCC Annex I inventory reporting guidelines.</p> <p>The ERT noted that SF₆ emissions from electrical equipment decreased significantly from 11.98 kt CO₂ eq in 2008 to 8.03 kt CO₂ eq in 2009 (by 33.0 per cent) and further to 6.39 kt CO₂ eq in 2016 (by 20.4 per cent). The ERT also noted that explanations of trends in SF₆ emissions in the category 2.G.1 electrical equipment were not provided in the NIR. During the review, Croatia provided the original data used for estimating SF₆ emissions, which were available from questionnaires of companies that use electrical equipment in Croatia. The ERT further noted, as was confirmed by Croatia during the review, that inconsistent EFs (losses from installed equipment) for different periods of the inventory were used in the estimations. The ERT concluded that SF₆ emissions from category 2.G.1 electrical equipment are inconsistent across the time series because of the inconsistency of EFs used in the estimations. The ERT performed preliminary estimates of SF₆ emissions using the AD provided by Croatia during the review and default EFs from the 2006 IPCC Guidelines, and concluded that reported emissions were underestimated for 2013–2016 (emissions in 2013 would increase by 4.45 kt CO₂ eq or 0.018 per cent of the national total; in 2014 would increase by 5.38 kt CO₂ eq or 0.022 per cent of the national total; in 2015 would increase by 3.89 kt CO₂ eq or 0.016 per cent of the national total; and in 2016 would increase by 3.13 kt CO₂ eq or 0.013 per cent of the national total); however, the likely level of underestimation of emissions does not exceed the significance threshold of 0.05 per cent of the national total or 500 kt CO₂ eq.</p> <p>The ERT recommends that Croatia use consistent EFs for estimating SF₆ emissions from 2.G.1 electrical equipment, using available information from questionnaires of companies that use electrical equipment filled with SF₆, revise its estimates of SF₆ emissions and report a consistent time series of SF₆ emissions.</p>	Yes. Consistency
I.49	2.G.3 N ₂ O from product uses – N ₂ O	<p>The ERT noted that N₂O emissions from category 2.G.3 N₂O from product uses were reported as a constant value for each year of the period 1990–2009 (0.11 kt N₂O). During the review, Croatia agreed that data for N₂O use in anaesthesia and aerosol cans should be analysed and reviewed for the entire reporting period. The ERT also noted that, according to the NIR (chapter 4.8.3.6), Croatia included in its annual data improvement plan (short-term goal) a project on gathering accurate and consistent data for the entire reporting period on N₂O product uses.</p> <p>The ERT recommends that Croatia implement the planned improvement regarding gathering accurate and consistent data on N₂O product uses to ensure the accuracy of AD and N₂O emission estimates from N₂O used in anaesthesia and aerosol cans under category 2.G.3 N₂O from product uses, report a consistent time series of emissions in the CRF tables and provide relevant information in the NIR.</p>	Yes. Accuracy

<i>ID#</i>	<i>Finding classification</i>	<i>Description of the finding with recommendation or encouragement</i>	<i>Is finding an issue and/or a problem?^a If yes, classify by type</i>
Agriculture			
A.7	3. General (agriculture) – CH ₄ and N ₂ O	<p>The ERT noted that Croatia performed recalculations for 1990–2015 in the categories 3.A enteric fermentation (CH₄), 3.B manure management (CH₄ and N₂O) and 3.D agricultural soils (N₂O). The ERT also noted that Croatia did not provide descriptions in the NIR of the impact of the recalculations on the trend in emissions at the category and sector level.</p> <p>The ERT encourages Croatia to include in the NIR descriptions of the impact of any recalculations on the trend in emissions at the category and sector level, as appropriate.</p>	Not an issue/problem
A.8	3. General (agriculture) – CH ₄ and N ₂ O	<p>In table 5.2-3 of the NIR (p.186) Croatia reported populations of mature non-dairy cattle and young cattle disaggregated into subcategories as used in the GHG inventory estimations. The ERT noted that these values are inconsistent across the time series because of changes in national statistics (e.g. one “young cattle” subcategory for 1990–1999, three subcategories for 2000–2006 and two subcategories for 2007–2016). During the review, Croatia explained that the population of all cattle subcategories up to two years old is aggregated into young cattle and the population of all cattle subcategories over two years old is aggregated into mature non-dairy cattle. Additionally, Croatia provided the ERT with statistical data on cattle populations per sex/age subcategories for 1990–2016. The ERT noted that statistics on the cattle population are available for eight cattle subcategories for 1990–1999 and for 11 subcategories from 2000 onward.</p> <p>The ERT recommends that Croatia 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 CH₄ and N₂O emissions.</p>	Yes. Transparency
A.9	3. General (agriculture) – CH ₄ and N ₂ O	<p>In CRF table 3.A the Party used the notation key “NO” to report CH₄ emissions from enteric fermentation for the subcategory 3.A.4 other livestock – poultry. In addition, in CRF table 3 the notation key “NA” is used for reporting CH₄ emissions from 3.D agricultural soils. However, the ERT noted that poultry and agricultural soils can both be a source of CH₄ emissions despite the fact that the 2006 IPCC Guidelines do not provide a relevant methodology, as indicated in the note under CRF table 3 for agricultural soils or in the indication of insufficient data for the calculation of EFs for poultry in table 10.10 of the 2006 IPCC Guidelines (vol. 4, chapter 10, p.10.28).</p> <p>The ERT recommends that Croatia justify in the NIR the use of the notation key “NO” or otherwise use the notation key “NE” for reporting CH₄ emissions from enteric fermentation of poultry under category 3.A.4 other livestock (see ID# A.10 below), and justify in the NIR the use of the notation key “NA” or otherwise use the notation key “NE” for reporting CH₄ emissions from 3.D agricultural soils.</p>	Yes. Comparability
A.10	3. General (agriculture) – CH ₄ and N ₂ O	<p>During the review, Croatia informed the ERT about an ongoing project to estimate country-specific CH₄ and N₂O EFs from enteric fermentation and manure management of cattle, sheep, goats, swine, poultry and horses. This project will include the collection of livestock productivity data and data on MMS use from farms as well as feed and manure sampling in three agro-ecological zones of Croatia with a subsequent sampling analysis in the laboratory</p>	Not an issue/problem

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		<p>using standardized methods (following the international standards HRN ISO 6498:2001, HRN ISO 6496:2001, HRN ISO 5984:2004, etc.). Samples will undergo physical analysis (dry matter, ash), chemical analysis (crude protein, crude fibre, etc.), enzymatic analysis (starch, sugar) and digestibility analysis in vitro.</p> <p>The ERT commends the Party for the planned improvements and encourages Croatia to ensure that country-specific CH₄ and N₂O EFs derived using an empirical approach are representative and in line with the 2006 IPCC Guidelines, and also encourages Croatia to perform QA/QC procedures and an uncertainty analysis of the results, as appropriate, and report the results in its annual submissions.</p>	
A.11	3. General (agriculture) – CH ₄ and N ₂ O	<p>The ERT noted that category-specific QC procedures were not implemented by the Party as encouraged in the UNFCCC Annex I inventory reporting guidelines.</p> <p>The ERT encourages Croatia to implement category-specific QC procedures for key categories and for those categories in which significant methodological changes or data revisions occurred and report in the NIR on these activities.</p>	Not an issue/problem
A.12	3. General (agriculture) – CO ₂ , CH ₄ and N ₂ O	<p>The ERT noted that Croatia reported 13 literature sources in chapter 12 of the NIR (“References”). However, no relevant citations for these sources are provided in the agriculture chapter (chapter 5) of the NIR. The ERT also noted that some sources are outdated and not relevant to the estimation of emissions (e.g. <i>Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories</i>) or are generic and do not provide precise information on the specific year and data used for the inventory calculations (e.g. Central Bureau of Statistics, Statistical Yearbooks (1990–2016)).</p> <p>As the sources of information are relevant when assessing and understanding the estimation of emissions for the agriculture sector, the ERT recommends that Croatia 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.</p>	Yes. Transparency
A.13	3.A Enteric fermentation – CH ₄	<p>Croatia reported two different weight values (typical animal mass) for sheep in CRF tables 3.A (additional information) and 3.B(a) for each year of the time series (e.g. for 2016, 39.00 kg and 48.50 kg, respectively). During the review the Party informed the ERT that the appropriate weight value used to estimate emissions is 48.50 kg from the 2006 IPCC Guidelines (vol. 4, chapter 10, p.10.82, table 10.A.9, data for developed countries). The ERT noted that the reporting of an incorrect typical animal mass of sheep in CRF table 3.A (additional information) did not impact the accuracy of the emission estimates because Croatia used the correct typical animal mass value and a tier 1 method to estimate CH₄ emissions from the enteric fermentation of sheep. Moreover, the ERT noted that CRF table 3.A (additional information), which should only provide information for those livestock types for which a tier 2 method was used, in addition to sheep, contains data (weight, DE and GE) for swine, goats, horses, mules and asses, while a tier 1 method was used to estimate CH₄ emissions from these animals.</p>	Not an issue/problem

ID#	Finding classification	Description of the finding with recommendation or encouragement	Is finding an issue and/or a problem? ^a If yes, classify by type
		The ERT encourages Croatia to report consistent weight values (typical animal mass) for relevant livestock categories in CRF tables 3.A (additional information) and 3.B(a) for each year of the time series and report information in CRF table 3.A only for those livestock categories for which a tier 2 method was used.	
A.14	3.A Enteric fermentation – CH ₄	<p>The ERT noted that for 1990 Croatia used default EFs for developing countries for sheep and swine from table 10.10 of the 2006 IPCC Guidelines (5.00 and 1.00 kg/head/year, respectively). However, for 2016 a default EF for developed countries was used for sheep (8.00 kg/head/year) and an incorrect EF for developed countries was used for swine (1.40 kg/head/year instead of 1.50 kg/head/year). An interpolation approach was applied to derive EFs for 1991–2015. During the review, Croatian experts established that, if the correct default EF for swine (1.5 kg/head/year) was used, emissions in 2016 would increase by 3.5 kt CO₂ eq (0.015 per cent of national total emissions without LULUCF, which does not exceed the significance threshold of 0.05 per cent of the national total). The ERT agreed with this assessment.</p> <p>The ERT recommends that Croatia 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.</p>	Yes. Accuracy
A.15	3.A.1 Cattle – CH ₄	<p>In table 5.2-4 of the NIR (p.189) Croatia reported maintenance coefficients (C_f) values of 0.429, 0.365 and 0.365 for mature dairy, mature non-dairy and young cattle, respectively. The ERT noted that these values do not correspond to relevant default data from table 10.4 of the 2006 IPCC Guidelines (vol. 4, chapter 10). During the review, Croatia explained that the data provided in table 5.2-4 of the NIR are not correct, but accurate values from table 10.4 of the 2006 IPCC Guidelines (0.386, 0.322 and 0.322 for mature dairy, mature non-dairy and young cattle, respectively) were used for its estimation of CH₄ emissions.</p> <p>The ERT recommends that Croatia report in the NIR the correct maintenance coefficients from the 2006 IPCC Guidelines (vol. 4, chapter 10, table 10.4) that were used to estimate CH₄ emissions from enteric fermentation of cattle.</p>	Yes. Transparency
A.16	3.A.1 Cattle – CH ₄	Croatia used the notation key “NO” for reporting milk yield and the percentage of pregnant females for other mature cattle in CRF table 3.A. However, according to the NIR (p.187), “Non-dairy cattle (mature) is cattle whose milk is used exclusively for the calf (cows in the cow-calf system), bulls and female bovine animals older than 24 months (mostly pregnant heifers)”. During the review, the ERT concluded that Croatia applied a tier 2 method to mature non-dairy cattle and growing cattle categories without disaggregating into males and females. The ERT is of the view that the enhanced characterization of cattle used by Croatia is not in line with the 2006 IPCC Guidelines, which state that it is good practice to classify livestock populations into subcategories for each species according to age, type of production and sex. During the review, Croatian experts used the default data from table 10A.2 of the 2006 IPCC Guidelines (vol. 4, chapter 10, pp.10.73 and 10.74) and concluded that, as result of disaggregating other mature cattle into males and females, CH ₄ emissions from enteric fermentation would increase in 1990–2016 by	Yes. Accuracy

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		<p>1.4–7.9 kt CO₂ eq per year (0.005–0.033 per cent of national total emissions without LULUCF, which does not exceed the significance threshold of 0.05 per cent of the national total). The ERT agreed with this assessment.</p> <p>As basic data are available for estimating CH₄ emissions disaggregated per non-dairy cattle sex and age subcategories (e.g. statistics on population (see ID# A.8 above) and amount of pregnant heifers, weight gain, etc. from the yearly cattle reports of the country), the ERT recommends that Croatia estimate CH₄ 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, chapter 10, p.10.11) and report the results in its annual submission. The ERT noted that 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 based on the structure of the herd in 2000–2017 and it can be assumed that other cows mostly comprise beef cows).</p>	
A.17	3.A.1 Cattle – CH ₄	<p>For 2016, Croatia reported in CRF table 3.A (additional information) under the “feeding situation” values of activity coefficients (i.e. 0.00816 and 0.097104 for dairy and other mature cattle, respectively), but did not report in the NIR any information on how these values were derived. The ERT noted that, according to table 10.5 of the 2006 IPCC Guidelines (vol. 4, chapter 10, p.10.17), the feeding situation is defined as stall, pasture and grazing large areas. In response to a question raised by the ERT, Croatia explained that the activity coefficients it used were taken from table 10.5 of the 2006 IPCC Guidelines based on expert judgment on the allocation of cattle per stall and pasture feeding system in five-year steps (e.g. 1990–1995), while for the years within these five-year periods, activity coefficients were interpolated. The ERT agreed with the approach taken by Croatia.</p> <p>The ERT recommends that Croatia report the feeding situation for cattle in CRF table 3.A (e.g. stall, pasture) instead of reporting activity 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, chapter 10, p.10.16), for mature dairy and non-dairy cattle.</p>	Yes. Transparency
A.18	3.B Manure management – CH ₄	<p>In CRF table 3.B(a) (sheet1), for allocation by climate region for sheep, goats, market swine and poultry, Croatia reported the notation key “NO” in the cells for temperate and warm climate, while the cell for cool climate was left blank. During the review, the Party confirmed that the correct allocation for these species is “cool climate”.</p> <p>As the appropriate climate region for Croatia is cool, the ERT recommends that Croatia 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.</p>	Yes. Transparency
A.19	3.B Manure management – CH ₄ and N ₂ O	<p>Croatia reported in table 5.3-2 of the NIR country-specific and default Nex values per livestock category without providing a clear reference to the source for these values. During the review, Croatia provided the ERT with the report that was used as a source of data on country-specific Nex values for cattle. According to the report, Nex values for cattle are derived based on the N intake and N retention using equations 10.31–10.33 from the 2006 IPCC Guidelines (vol. 4, chapter 10, pp.10.58 and 10.60) and country-specific data on cattle productivity. The ERT noted that, given that N intake data are based on different GE values for other mature cattle and growing cattle (e.g. 141.4</p>	Yes. Transparency

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		<p>and 172.9 MJ/head/day, respectively, for 2016) calculated Nex values should be different as well. However, the ERT noted that the Nex values for other mature cattle and growing cattle reported in CRF table 3.B(b) have the same value each year of the entire time series (e.g. 54.75 and 49.94 kg N/head/year for 1990 and 2016, respectively). In response to a question raised by the ERT during the review, Croatia explained that Nex values for other mature and growing cattle were aggregated for reporting purposes (i.e. used for non-dairy cattle). Given that in CRF table 3.B(b) reporting Option B was selected by Croatia for cattle, which envisages that data on other mature cattle and growing cattle will be reported separately, the ERT considers that the reporting of aggregated Nex data for non-dairy cattle can be applied for reporting Option A but not for Option B. In addition, the ERT noted that, for other livestock categories, Nex values are derived using default Nex data from table 10.19 of the 2006 IPCC Guidelines (vol. 4, chapter 10, p.10.59) and expert assumptions (e.g. average between Eastern and Western Europe).</p> <p>The ERT recommends that Croatia 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. The ERT also recommends that Croatia report Nex values 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 value for both above-mentioned animal subcategories.</p>	
A.20	3.B Manure management – CH ₄ and N ₂ O	<p>The ERT noted that Croatia did not report AD and CH₄ and N₂O emissions from manure management for rabbits under subcategory 3.B.4 other livestock. During the review Croatia provided the ERT with statistics confirming that at least, data do exist on the population of rabbits in Croatia (although the data are only for females and for selected years), which could be used for estimating CH₄ and N₂O emissions from manure management under subcategory 3.B.4 other livestock. The ERT also noted that there is a default CH₄ EF in tables 10.16 and 10.A.9 (vol. 4, chapter 10, pp.10.41 and 10.83, respectively) and a Nex value in table 10.19 (vol. 4, chapter 10, p.10.59) of the 2006 IPCC Guidelines for estimating emissions from manure management for rabbits. The ERT believes that future ERTs should consider this issue further to ensure that there is not an underestimation of emissions from this subcategory.</p> <p>The ERT recommends that Croatia estimate CH₄ and N₂O emissions from manure management of rabbits under subcategory 3.B.4 other livestock, using default EF and parameters from tables 10.16 and 10.A.9 (vol. 4, chapter 10, pp.10.41 and 10.83, respectively) and Nex value from table 10.19 (vol. 4, chapter 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.</p>	Yes. Completeness
A.21	3.B.1 Cattle – CH ₄	<p>The ERT noted that CH₄ emissions from manure management is a key category, and emissions from cattle accounted for 50.5 per cent of this category in 2016. However, in CRF table 3.B(a) Croatia reported default VS values from table 10.A-4 of the 2006 IPCC Guidelines (4.50 and 2.70 kg dm/head/day for dairy cows and other cattle in Eastern Europe, respectively). In response to a question raised by the ERT, Croatia explained that the derivation of country-specific VS values for cattle is part of an ongoing project to improve emission estimates in the agriculture sector (see ID# A.10 above). The ERT noted that basic data are currently available (e.g. GE and DE were</p>	Yes. Accuracy

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		<p>used to estimate emissions from cattle enteric fermentation) and can be used for estimating country-specific VS values using equation 10.24 of the 2006 IPCC Guidelines (vol. 4, chapter 10, p.10.42).</p> <p>The ERT recommends that Croatia follow the guidance in the decision tree in the 2006 IPCC Guidelines (vol. 4, chapter 10, p.10.36, figure 10.3) for estimating CH₄ emissions from the manure management of cattle, including the use of currently available data on GE and DE for estimating country-specific VS values, and report the results in its next annual submission. The ERT also recommends that Croatia 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 resulting from the project to improve the emission estimates in the agriculture sector.</p>	
A.22	3.B.2 Sheep – CH ₄	<p>Croatia did not provide in the NIR (table 5.3-1, p.196) a reference to the source of VS and B_o values (0.34 kg dm/head/year and 0.14 m³/kg VS for 2016, respectively) used for estimating CH₄ emissions from sheep manure management. In response to a question raised by the ERT, Croatia explained that the VS and B_o values used in its estimation of CH₄ emissions from sheep for the entire time series are not correct and default values from table 10.A.9 of the 2006 IPCC Guidelines should be used instead. During the review Croatian experts assessed that, using VS and B_o default values, in 1990–2016 emissions would increase by 0.85–1.6 kt CO₂ eq per year (0.0034–0.006 per cent of national total emissions without LULUCF, which does not exceed the significance threshold of 0.05 per cent of the national total). The ERT agreed with this assessment.</p> <p>The ERT recommends that in the next annual submission Croatia revise its CH₄ 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 m³/kg VS, respectively).</p>	Yes. Accuracy
A.23	3.B.5 Indirect N ₂ O emissions – N ₂ O	<p>For 2016, in CRF table 3.B(b), Croatia did not report a value or a notation key for the cells on reporting N lost through leaching and run-off and indirect N₂O emissions from N leaching and run-off. For 1990–2015, in CRF table 3.B(b), the notation key “NE” was used to report N lost through leaching and run-off and indirect N₂O emissions from N leaching and run-off. In response to a question raised by the ERT, Croatia clarified that N₂O emissions from this category were not estimated owing to the lack of country-specific data on the Frac_{leachMS}. The ERT recognizes that the 2006 IPCC Guidelines do not explicitly provide default data for Frac_{leachMS} (this fraction is highly uncertain and the estimation of N losses from leaching and run-off should be considered part of the tier 2 method).</p> <p>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), the ERT recommends that Croatia make efforts to obtain country-specific data on Frac_{leachMS}. If this is not possible for the next annual submission, the ERT recommends that the Party 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 N₂O emissions from N leaching and run-off in CRF table 3.B(b).</p>	Yes. Completeness
A.24	3.D.a Direct N ₂ O emissions from	<p>In the uncertainty assessment performed using approach 2 (Monte Carlo analysis), Croatia reported the use of an uncertainty value for the default EF₁ (which refers to N₂O emitted from synthetic and organic N applications to</p>	Yes. Adherence to the UNFCCC Annex

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	managed soils – N ₂ O	<p>soils) of ±30 per cent for mineral fertilizers, N-fixing crops and crop residues and ±50 per cent for animal manure. The ERT noted that these values are not in line with the uncertainty ranges for default values of EF₁ (0.003–0.03 kg N₂O-N/kg N) from table 11.1 of the 2006 IPCC Guidelines (vol. 4, chapter 11, p.11.11).</p> <p>The ERT recommends that Croatia justify in the NIR the assumptions used to derive the uncertainty value of ±30 per cent for the EF₁ 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 EF₁ from table 11.1 of the 2006 IPCC Guidelines (0.003–0.03 kg N₂O-N/kg N) in its Monte Carlo uncertainty analysis.</p>	I inventory reporting guidelines
A.25	3.D.a Direct N ₂ O emissions from managed soils – N ₂ O	<p>For estimating direct N₂O emissions from managed soils, Croatia used data on the consumption of inorganic N fertilizers for 1992–2016 that were obtained from companies/producers of N fertilizers (urea, calcium ammonium nitrate, N, phosphorus and potassium fertilizer, ammonium nitrate and urea ammonium nitrate). A comparison analysis between data from producers and statistical data (available only from 2000 onward) made by the ERT on the consumption of inorganic N fertilizers for 2000–2016 showed that data on the amount of N fertilizers applied during 2000–2005 are almost identical. However, for the periods 2006–2008 and 2010–2011 statistical data are higher than the data obtained from producers by 4.6–40.5 per cent and for 2009 and 2012–2016 statistical data are lower by 0.4–20.8 per cent.</p> <p>The ERT recommends that Croatia 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 its next annual submission. The ERT further recommends that Croatia ensure that the data it uses on the amount of synthetic N fertilizers consumed in the country are consistent with the data used in the calculations of direct N₂O emissions from N inputs to managed soils for the LULUCF sector.</p>	Yes. Accuracy
A.26	3.D.a.2.b Sewage sludge applied to soils – N ₂ O	<p>Croatia reported sewage sludge applied to soils since 2005 (data for earlier years are not available). The amount of sludge applied for 2005–2008 (ranging from 3 to 16 t) differs significantly from corresponding data for the period 2009–2016 (ranging from 434 to 1,567 t) (NIR table 5.5-2, p.204). The NIR (p.204) indicates that the AD are limited to data provided by privately owned companies and that for the period 1990–2004 no data were provided or could be estimated. During the review, Croatia informed the ERT that the number of companies that report the application of sludge has increased since 2009, which explains the observed increase. The ERT concluded that data on sludge applied to soils for 2005–2008 are not fully reliable and would be incomplete.</p> <p>Considering the increasing trend in the amount of sludge applied during the period 2005–2016, the ERT recommends that Croatia make all the necessary efforts to obtain reliable data on sludge applied during the period 1990–2008. If this is not possible, the ERT recommends that Croatia extrapolate the values for 2009–2016 or use another, more appropriate splicing technique recommended by the 2006 IPCC Guidelines to derive the amount of</p>	Yes. Completeness

ID#	Finding classification	Description of the finding with recommendation or encouragement	Is finding an issue and/or a problem? ^a If yes, classify by type
A.27	3.D.a.5 Mineralization/immobilization associated with loss/gain of soil organic matter – N ₂ O	<p>sludge applied to soils for 2005–2008 and report the resulting N₂O emissions from subcategory 3.D.a.2.b sewage sludge applied to soils. The ERT also recommends that Croatia 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 N₂O emissions from the 3.D.a.2.b subcategory for the complete time series.</p> <p>In its NIR Croatia reported a sharp increase in N₂O emissions (18.7 per cent) due to the loss of soil organic matter in 2016, compared with those in 2015 after a decreasing trend was observed in 1999–2015 (NIR figure 5.5-5, p.211), but an explanation for this was not provided. During the review, the Party informed the ERT that emission estimates for the entire time series are incorrect because of errors in data on the average annual loss of carbon and the C/N ratio. The Party also explained that 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”, initiated by CAEN, was finalized in 2017. The results of this project will form the basis for recalculations of N₂O emissions due to loss/gain of soil organic matter in the next annual submission. During the review, Croatian experts established that emissions in 1990–2016 would decrease by 0.07–0.15 kt CO₂ eq per year (0.0003–0.0006 per cent of national total emissions without LULUCF) when using correct data on the average annual loss of carbon and C/N ratio. The ERT agreed with this assessment.</p> <p>The ERT recommends that Croatia revise, in its next annual submission, its estimates of N₂O 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 in the LULUCF sector.</p>	Yes. Accuracy
A.28	3.H Urea application – CO ₂	<p>In the uncertainty assessment of the EF used in emission estimates from urea application performed using approach 2 (Monte Carlo analysis), Croatia used a value of ±50 per cent. However, the ERT noted that only a default value of –50 per cent uncertainty can be applied to the default EF from urea fertilization because “uncertainties cannot exceed the default EF because this value represents the absolute maximum emissions associated with urea fertilization” (2006 IPCC Guidelines, vol. 4, chapter 11, note on p.11.32).</p> <p>The ERT recommends that Croatia 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.</p>	Yes. Adherence to the UNFCCC Annex I inventory reporting guidelines
LULUCF			
L.20	4. General (LULUCF) – CO ₂ , CH ₄ and N ₂ O	<p>The ERT noted that in a number of cases the NIR did not include a clear, documented and complete description of the methodologies used, including the identification of equations, references and sources of information used in the specific IPCC methodologies, or a clear indication of which parameters used are default or country-specific. For example, this is an issue in the categories forest land, cropland (mineral soils), land converted to cropland and carbon stock changes in grassland.</p> <p>The ERT recommends that Croatia provide in the NIR a clear, documented and complete description of the methodologies used, in particular for forest land, cropland (mineral soils), land converted to cropland and grassland,</p>	Yes. Transparency

ID#	Finding classification	Description of the finding with recommendation or encouragement	Is finding an issue and/or a problem? ^a If yes, classify by type
		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.	
L.21	4. General (LULUCF) – CO ₂	<p>The ERT noted that Croatia used the notation key “NO” for reporting cases where, for a specific carbon pool, an IPCC default method was applied that assumes that no net carbon stock changes occur (e.g. deadwood, litter and soil organic carbon in CRF table 4.A). The ERT considers that the correct notation key to be used is “NA”, accompanied by an explanation in the information box of the corresponding CRF table stating that “NA” indicates a tier 1 estimate.</p> <p>The ERT recommends that Croatia 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.</p>	Yes. Adherence to the UNFCCC Annex I inventory reporting guidelines
L.22	4. General (LULUCF) – CO ₂ , CH ₄ and N ₂ O	<p>The ERT noted several errors in the NIR; for example, in table 6.4-5 the column with data on the annual carbon stock in litter has been omitted; carbon stock changes in soil organic carbon in mineral soils are reported as annual carbon stock changes on page 258; total carbon stocks in above-ground biomass in perennial croplands are reported as annual stock changes on page 267; and existing carbon pools are mentioned as “NO” in section 6.8. These errors indicate that QC activities have not been fully implemented or need to be improved.</p> <p>The ERT recommends that Croatia include in table 6.4-5 the column with data on the annual carbon stock in litter; report carbon stock changes in soil organic carbon in mineral soils instead of annual carbon stock changes (p.258 of the NIR); report total carbon stocks in above-ground biomass in perennial croplands instead of annual stock changes (p.267 of the NIR); correct the indication that existing carbon pools are not occurring (section 6.8 of the NIR); and improve and fully implement the QC activities in the LULUCF sector to avoid such type of error in the NIR.</p>	Yes. Adherence to the UNFCCC Annex I inventory reporting guidelines
L.23	Land representation – CO ₂ , CH ₄ and N ₂ O	<p>The ERT noted that Croatia reported land uses/land-use changes using a combination of approaches 1, 2 and 3. In the forest land category Croatia used approach 3, which works well for tracking forest land remaining forest land and land-use changes to and from forest land. However, the ERT identified that the tracking of other land uses, such as grasslands and, in particular, land-use changes to and from cropland, shows a high level of uncertainty. In table 6.4.6 of the NIR (pp.260–262) the uncertainties in AD are reported as being estimated using expert judgment, but the description in the NIR of how this method was implemented is brief and not transparent. The ERT noted that the uncertainty of CO₂ eq emissions/removals, using the tier 2 method (Monte Carlo), ranges between –53.4 per cent and +194.63 per cent for forest land remaining forest land, which is a key category. For land converted to forest land the uncertainty levels of CO₂ eq emissions/removals are also high, ranging from –225.2 per cent to +182.21 per cent.</p> <p>The ERT recommends that Croatia review the uncertainty estimations in forest land remaining forest land, land converted to forest land, grasslands 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</p>	Yes. Accuracy

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		<p>and 3 for land representation, and the ones 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 the ERT recommends that Croatia focus its efforts on improving quality of the approach used for tracking land-use changes to and from grasslands and land-use changes to and from cropland and the related parameters used in the estimates. The ERT also recommends that Croatia 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.</p>	
L.24	4.A Forest land – CO ₂	<p>The ERT noted that Croatia has produced a first CRONFI, which is based on land classification and representation systems that are not coherent with the forest definition and thresholds adopted by Croatia for reporting under the Convention. In this regard, during the review, the Party explained that above-ground biomass and deadwood are the pools for which CRONFI collected data, but this information cannot be used directly for reporting in the GHG inventory of the LULUCF sector because the land classification system used in CRONFI is not consistent with the forest definition used for reporting under the Convention. In addition, during the review, Croatia clarified that information on deadwood for land-use changes to forest land is not gathered in the first age cycle of the trees (see ID#s L.8, L.9 and L.10 in table 3).</p> <p>In order to improve the quality of the LULUCF sector inventory, in particular the completeness of the reporting, the ERT encourages Croatia to implement measures to ensure that the next CRONFI is designed in such a way that the data collected can be used to estimate and report carbon stock changes under the Convention, in all carbon pools of the category 4.A forest land. In the meantime, if this action is not going to be undertaken in the short term, the ERT recommends that Croatia develop alternative methods to collect data that can be used to estimate and report carbon stock changes in all carbon pools of the category 4.A forest land (in particular the (above-ground) living biomass and deadwood pools), as the LULUCF 1 project did in the past. The ERT also recommends that Croatia 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.</p>	Yes. Completeness
L.25	4.A Forest land – CO ₂	<p>Croatia used a combination of tier 1 and tier 2 parameters to estimate carbon stock changes in living biomass in the key category forest land. The ERT noted that annual average biomass growth and wood densities used in calculations are country-specific, but the BEFs and ratios of below-ground biomass to above-ground biomass are default values taken from the 2006 IPCC Guidelines.</p> <p>The ERT recommends that Croatia 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 its next annual submission.</p>	Yes. Accuracy
L.26	4(V) Biomass burning – CO ₂	<p>The ERT noted that for estimating emissions from biomass burning Croatia used the default EFs included in table 2.5 of the 2006 IPCC Guidelines (vol. 4, chapter 2, p.2.47). However, the AD used in the calculations of CO₂ emissions included only 60 per cent of the area effectively burned, resulting in an underestimation of CO₂ emissions</p>	Yes. Completeness

ID#	Finding classification	Description of the finding with recommendation or encouragement	Is finding an issue and/or a problem? ^a If yes, classify by type
		<p>for the whole time series. During the review Croatia clarified that 100 per cent of that area burned was used for its estimation of emissions of CH₄ and N₂O for the whole time series.</p> <p>The ERT recommends that Croatia use 100 per cent of the area effectively burned to estimate CO₂ emissions and make the necessary recalculations for the whole time series.</p>	
Waste			
W.8	5.A Solid waste disposal – CH ₄	<p>The ERT noted that there are various types of SWDS and management practices for waste in Croatia, but the Party has not provided in the NIR clear information on the classification and use of the different SWDS, or the amounts and composition of waste deposited in different SWDS. No detailed information is included in the NIR on (1) the total number of active landfills by the end of 2016 and, specifically, of MSW landfills (including unofficial ones), (2) landfills that are closed with/without waste, and closed landfills with industrial waste, (3) landfills classified by management practice and (4) the amounts of waste and waste composition deposited at different SWDS. During the review, Croatia provided information to the ERT on the categorization and number of active and closed MSW landfills and industrial waste landfills. The Party further explained that “unofficial landfills”, as used in its categorization of SWDS, correspond to illegal dumpsites. CAEN does not monitor quantities of waste at unofficial landfills, but it is in the plan for 2019 to establish a database on illegal landfills, which will be registered by municipality officials and reported to a central database operated by CAEN.</p> <p>The ERT recommends that Croatia provide comprehensive information on solid waste management practices in its NIR, if possible in a 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.</p>	Yes. Transparency
W.9	5.A Solid waste disposal – CH ₄	<p>The ERT noted that, in the reported estimates for category 5.A solid waste disposal, Croatia has not included CH₄ emissions from sludge and industrial solid waste disposed of at SWDS for the complete time series. The ERT also noted that in the NIR the Party indicated the availability of data on sludge from wastewater treatment and biodegradable industrial waste for 2010–2016; however, in response to questions raised by the ERT, Croatia indicated that it did not estimate CH₄ emissions from sludge disposed of at SWDS on the assumption that no CH₄ was emitted because all wastewater treatment systems in the country are aerobic and do not produce CH₄, and also explained that CH₄ emissions from industrial waste were not estimated owing to a lack of data. During the review, the ERT requested the Party to provide AD for the entire time series (1990–2016) on sludge disposed of at different types of SWDS. In its response to this request, Croatia indicated that the historical development of types of treatment and the disposal of sludge should be investigated and comprehensive research is needed to improve the AD on sludge disposed of at different SWDS as part of the inventory improvement plan. However, Croatia was able to provide the ERT with AD on sludge going to SWDS for 2010–2016, informed the ERT that AD on the amount of sludge going into SWDS until 2009 were not available, and confirmed that CH₄ emissions for these years and the remaining years of the time series were not estimated. The ERT further noted that the sources of sludge in Croatia are industrial and municipal wastewater treatment plants and that generated sludge is used for various applications</p>	Yes. Accuracy

ID#	Finding classification	Description of the finding with recommendation or encouragement	Is finding an issue and/or a problem? ^a If yes, classify by type
		<p>(e.g. energy recovery and use as a fertilizer on agricultural lands), as well as that sludge is sent to SWDS (NIR, chapters 7.1 and 7.2). In addition, during the review, Croatia provided the ERT with AD for 2010–2016 on industrial solid waste disposed of at SWDS.</p> <p>During the review, the Party performed a preliminary revised calculation of CH₄ emissions including sludge and industrial solid waste with the support of the ERT, using the FOD method (IPCC FOD model), methane correction factor and degradable organic carbon default values recommended by the 2006 IPCC Guidelines and country-specific parameters previously used in calculations. Data on the quantity of sludge and industrial solid waste were calculated by extrapolating available 2010–2016 data to the 1955–2009 period using techniques given in the 2006 IPCC Guidelines (vol. 1, chapter 5). The ERT established that the difference (about 445.10 kt CO₂ eq or 1.8 per cent of the national total in 2016) between the originally reported and the revised CH₄ emissions from 5.A solid waste disposal (including the sludge and industrial solid waste) was above the significance level threshold indicated in the UNFCCC Annex I reporting guidelines (para. 37(b)). Therefore, the ERT concluded that the CH₄ emission estimates from category 5.A solid waste disposal originally reported by Croatia were underestimated for the entire time series and that these estimates were not in line with the 2006 IPCC Guidelines, in particular for 2013–2016. The ERT included this issue in the list of potential problems and further questions raised by the ERT and recommended that the Party obtain accurate country-specific historical AD and parameters (and document these comprehensively) for estimating CH₄ emissions from category 5.A solid waste disposal for the entire time series. Alternatively, if this is not possible, the ERT recommended that the Party obtain AD (and document these AD comprehensively) using extrapolation or other splicing techniques provided in the 2006 IPCC Guidelines based on available 2010–2016 AD on sludge and industrial solid waste disposed of at SWDS for the period 1955–2009 and, subsequently, regardless of which of these two approaches is taken, use the obtained AD and the relevant parameters to estimate CH₄ emissions from 5.A solid waste disposal, using the FOD method (IPCC FOD model) for the entire time series, in particular for 2013–2016, following the requirements of the 2006 IPCC Guidelines.</p> <p>In response to the list of potential problems and further questions raised by the ERT, Croatia provided a complete set of CRF tables for the full time series with revised CH₄ emissions for 5.A solid waste disposal following the recommendations of the ERT, using AD obtained by extrapolation and other splicing techniques provided in the 2006 IPCC Guidelines, default and country-specific parameters and simplified assumptions about the annual increase of population, waste generation per capita and percentage of waste disposed of at SWDS for 1955–1990. The ERT agreed with the revised emission estimates of CH₄ from category 5.A solid waste disposal. As a result of the revision, the CH₄ emissions from solid waste disposal increased by 402.12 kt CO₂ eq in 2013 (1.64 per cent of the national total or 23.68 per cent of the waste sector); increased by 429.61 kt CO₂ eq in 2014 (1.81 per cent of the national total or 24.77 per cent of the waste sector); increased by 415.33 kt CO₂ eq in 2015 (1.72 per cent of the national total or 22.87 per cent of the waste sector); and increased by 437.08 kt CO₂ eq in 2016 (1.80 per cent of the national total or 23.77 per cent of the waste sector).</p> <p>The ERT recommends that Croatia continue its 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</p>	

ID#	Finding classification	Description of the finding with recommendation or encouragement	Is finding an issue and/or a problem? ^a If yes, classify by type
		SWDS for different periods of time from 1955 to 1990, with the aim of estimating CH ₄ emissions for the entire time series from 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 increase of population, waste generation per capita and the percentage of waste disposed of at SWDS for different periods of time from 1955 to 1990.	
W.10	5.B.1 Composting – CH ₄ and N ₂ O	<p>In table 7.3-1 of the NIR (p.318) Croatia reported AD on different types of waste (dry weight) treated by composting for the period from 2007 for MSW and from 2013 for the other types of waste. Also, Croatia reported in its NIR (pp.318–319) emissions of CH₄ and N₂O from composting for the period 2007–2016 and for earlier years used the notation key “NE”. However, the ERT noted that the Party did not provide information justifying why no estimates had been made. In response to a question raised by the ERT during the review, Croatia indicated that the official source of AD for composting and anaerobic digestion is CAEN, which collects data from emission point sources in the Environmental Pollution Register database, and stated that these activities only started in Croatia in 2007.</p> <p>The ERT recommends that Croatia provide in its 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.</p>	Yes. Transparency
W.11	5.C.1 Waste incineration – CO ₂ , CH ₄ and N ₂ O	<p>The ERT noted that Croatia did not provide information in the NIR on the handling practices of plastic waste, AD for plastic waste that is not collected and recycled and total AD for plastic waste that is generated in the country. During the review, in response to a question raised by the ERT on the management of plastic waste, Croatia indicated that it had established a national collection scheme for packaging waste, which has been operated by the Environmental Protection and Energy Efficiency Fund since 2008, and that about 41 per cent of plastic packaging is separately collected and recycled, while the remaining plastic waste is sent to SWDS.</p> <p>The ERT recommends that Croatia 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.</p>	Yes. Transparency
W.12	5.D.1 Domestic wastewater – CH ₄	<p>Croatia reported in its NIR (p.326) that aerobic biological process is mostly used in wastewater treatment and that the disposal of domestic wastewater, particularly in rural areas where systems such as septic tanks are used, is partly anaerobic without flaring, which results in CH₄ emissions. However, Croatia also reported in its NIR (p.328) that it is estimated that, at the national level, 13 per cent of the total population is connected to devices with preliminary purification and primary level of wastewater treatment, and approximately 21 per cent of the total population is connected to devices with secondary and tertiary level of wastewater treatment and that Croatian Waters, the responsible authority, does not have the full information on the procedures and technologies that are applied to devices for domestic wastewater treatment by the remaining 66 per cent of the population with individual treatment systems. During the review, Croatia explained that both aerobic and anaerobic wastewater treatments occur in the country for individual wastewater treatment systems, which are mainly septic tanks and anaerobic systems, and that these should result in emissions, but these were not taken into account in the estimation of CH₄ from domestic</p>	Yes. Completeness

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		<p>wastewater. The ERT believes that future ERTs should consider this issue further to ensure that there is not an underestimation of emissions from this category.</p> <p>The ERT recommends that Croatia collect more detailed and complete information on domestic wastewater treated in various systems occurring in the country, in particular individual wastewater treatment systems, and use this information to estimate and improve the accuracy of the CH₄ emissions from domestic wastewater.</p>	
W.13	5.D.1 Domestic wastewater – CH ₄	<p>The ERT noted that Croatia used the notation key “NO” in CRF table 5.D for sludge removed; however, it also noted that sludge removal exists and sludge is used in other applications (e.g. see ID#s A.4, A.5 and W.1 in table 3 and W.9 above); and for example, Croatia provided data on sludge for the period 2013–2016 in its NIR (p.318, table 7.3-1). Taking into account that only sludge treated anaerobically in centralized aerobic plants is a source of emissions, the ERT further noted that emissions from sludge could be double counted because in the emission estimates degradable carbon from sludge removed was not excluded from the total organically degradable carbon in wastewater.</p> <p>The ERT recommends that Croatia provide transparent descriptions and accurate data in the NIR 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. The ERT also recommends that Croatia 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 CH₄ 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 further recommends that the Party report correctly in CRF table 5.D the amount of the degradable organic component of sludge removed.</p>	Yes. Accuracy
W.14	5.D.2 Industrial wastewater – CH ₄ and N ₂ O	<p>The Party reported in the NIR that anaerobic processes are applied in some industrial wastewater treatment plants and that data are submitted by wastewater treatment plants to the Environmental Pollution Register. However, the ERT noted that actual data provided by water treatment plants were not provided in the NIR and were not used for estimations of CH₄ and N₂O. The ERT also noted that Croatia did not provide in its NIR a transparent description of the industrial wastewater treatment systems used in the country and the amounts of industrial wastewater treated aerobically and anaerobically and discharged into waterways and the seas (p.328 of NIR). During the review, the Party acknowledged the need for a more transparent description of industrial (and domestic) wastewater treatment systems existing in the country and stated that it plans to provide this information in its next annual submission.</p> <p>The ERT recommends that Croatia 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.</p>	Yes. Transparency

KP-LULUCF activities

ID#	Finding classification	Description of the finding with recommendation or encouragement	Is finding an issue and/or a problem? ^a If yes, classify by type
KL.12	General (KP-LULUCF) – CO ₂ , CH ₄ and N ₂ O	<p>The ERT noted that in a number of cases the NIR did not include a clear, documented and complete description of the methodologies used, including the identification of equations, references and sources of information used in the specific IPCC methodologies, including a clear indication of which data used are default or country-specific. For example, the equations from the 2006 IPCC Guidelines that were used to estimate carbon stock changes in biomass in afforestation and deforestation are not explicitly mentioned.</p> <p>The ERT recommends that Croatia 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 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.</p>	Yes. Transparency
KL.13	General (KP-LULUCF) – CO ₂	<p>Croatia assessed uncertainties for KP-LULUCF activities using approach 2 (Monte Carlo analysis) and reported a very high overall value of uncertainty ranging from ±247 to ±681 per cent for AR and deforestation together (which should probably be –247 to +681). The ERT noted that the AD used for the estimates seem to be robust and, considering that the methods used for calculating the estimates were tier 1/tier 2, it is unclear why the resulting uncertainties are so high, which raises some doubts on the quality of the estimates. The ERT also noted that Croatia reported an uncertainty ranging from ±65 to ±66 per cent for FM in the NIR (which should probably be –65 to +66).</p> <p>The ERT recommends that Croatia 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 the ERT recommends that Croatia focus its efforts on improving the quality of the estimates for AR and deforestation and the related parameters used in the estimates. The ERT also recommends that Croatia 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.</p>	Yes. Adherence to the reporting guidelines under Article 7, paragraph 1, of the Kyoto Protocol
KL.14	AR – CO ₂	<p>The ERT noted inconsistencies in the information provided in the NIR (chapter 11.2.1.2, p.402) and in CRF table 4(KP-I)A.1. The NIR indicates that the notation key “NO” is used for reporting carbon stock losses, but in CRF table 4(KP-I)A.1 numerical values are provided for carbon stock losses in the above-ground and below-ground biomass pools.</p> <p>The ERT recommends that Croatia 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 its next annual submission.</p>	Yes. Adherence to the UNFCCC Annex I inventory reporting guidelines
KL.15	Article 3.3 activities – CO ₂	<p>The ERT noted that Croatia did not estimate emissions/removals from the deadwood pool in AR areas and used the notation key “NO” in CRF table 4(KP-I)A.1. Croatia reported in the NIR (p.400) that this pool is not a source of emissions for AR and deforestation activities. Croatia justified in the NIR that in grasslands and in croplands with</p>	Yes. Completeness

ID#	Finding classification	Description of the finding with recommendation or encouragement	Is finding an issue and/or a problem? ^a If yes, classify by type
		<p>annual vegetation deadwood is expected to increase when the land is afforested, so this pool cannot be expected to be a net source and could be omitted. The ERT considers that the assumptions are reasonable, but that Croatia did not provide verifiable information that demonstrates that the unaccounted pool was not a net source. In addition, the ERT noted that in CRF table 4.A Croatia reports 213 ha perennial croplands converted to forest land, and in this conversion deadwood should have been a net source.</p> <p>The ERT recommends that Croatia 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 Croatia does not report this carbon pool, the ERT also recommends that Croatia use the correct notation key “NE” in CRF table 4(KP-I)A.1 (instead of “NO”).</p>	
KL.16	Deforestation – CO ₂	<p>The ERT noted that Croatia reported in CRF table 4(KP-I)A.2 that 2.61 kha of ‘out of yield’ forests were deforested in 2016. The ERT also noted that Croatia provided aggregated estimates of emissions from deforestation in the NIR (p.422), but reported “NO” for carbon stock losses in above-ground biomass and –0.001 kt for carbon stock losses in below-ground biomass in CRF table 4(KP-I)A.2 for ‘out of yield’ forests in 2016. The ERT considered that this information could be unrealistic and shows that estimates could be incomplete and need to be checked.</p> <p>The ERT recommends that Croatia 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.</p>	Yes. Completeness
KL.17	FM – CO ₂	<p>The ERT noted that for FM activities in CRF table 4(KP-I)B.1 Croatia reported carbon stock changes in deadwood and litter as “NO” for all types of forest (coniferous, deciduous and ‘out of yield’). Croatia reported in the NIR (pp.404–409) that deadwood and litter pools are not a net source of emissions for FM activities. However, the ERT considers that Croatia did not provide verifiable information that demonstrates that the unaccounted pools were not a net source of emissions.</p> <p>The ERT recommends that Croatia 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”).</p>	Yes. Completeness
KL.18	FM – CO ₂	<p>The ERT noted that Croatia reported 8,770.10 kt CO₂ eq as the FM cap in the CRF table on accounting for KP-LULUCF activities. The ERT also noted that this value is incorrect as it should be 8,737.30 kt CO₂ eq, which is fixed for the second commitment period of the Kyoto Protocol in accordance with paragraph 12 of decision 6/CMP.9 and equivalent to 3.5 per cent of the total base-year GHG emissions, excluding LULUCF, defined in the review report of the initial report to facilitate the calculation of the assigned amount for the second commitment period of the Kyoto Protocol of Croatia.</p>	Yes. Transparency

ID#	Finding classification	Description of the finding with recommendation or encouragement	Is finding an issue and/or a problem? ^a If yes, classify by type
		The ERT recommends that Croatia, in its future annual submissions, 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.	

^a Recommendations made by the ERT during the review are related to issues as defined in paragraph 81 of the UNFCCC review guidelines, or problems as defined in paragraph 69 of the Article 8 review guidelines. Encouragements are made to the Party to address all findings not related to such issues or problems.

VI. Application of adjustments

11. The ERT did not identify the need to apply any adjustments to the 2018 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 has elected commitment period accounting and therefore the issuance and cancellation of units for KP-LULUCF activities is not applicable to the 2018 review.

VIII. Questions of implementation

13. No questions of implementation were identified by the ERT during the individual review of the Party's 2018 annual submission.

Annex I

Overview of greenhouse gas emissions and removals for Croatia for submission year 2018 and data and information on activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, as submitted by Croatia in its 2018 annual submission

1. Tables 6–9 provide an overview of total GHG emissions and removals as submitted by Croatia.

Table 6
Total greenhouse gas emissions for Croatia, base year^a–2016
(kt CO₂ eq)

	<i>Total GHG emissions excluding indirect CO₂ emissions</i>		<i>Total GHG emissions including indirect CO₂ emissions^b</i>		<i>Land-use change (Article 3.7 bis as contained in the Doha Amendment)^c</i>	<i>KP-LULUCF activities (Article 3.3 of the Kyoto Protocol)^d</i>	<i>KP-LULUCF activities (Article 3.4 of the Kyoto Protocol)</i>	
	<i>Total including LULUCF</i>	<i>Total excluding LULUCF</i>	<i>Total including LULUCF</i>	<i>Total excluding LULUCF</i>			<i>CM, GM, RV, WDR</i>	<i>FM</i>
FMRL								–6 289.00
Base year	25 471.05	32 084.64	NA	NA	NA		NA	
1990	25 471.05	32 084.64	NA	NA				
1995	14 111.70	23 165.03	NA	NA				
2000	18 693.93	26 098.05	NA	NA				
2010	21 328.72	28 339.18	NA	NA				
2011	21 981.39	27 970.79	NA	NA				
2012	20 488.83	26 202.31	NA	NA				
2013	18 757.66	25 025.74	NA	NA		36.65	NA	–7 077.00
2014	17 895.78	24 188.31	NA	NA		12.61	NA	–6 970.12
2015	19 295.71	24 666.51	NA	NA		3.86	NA	–6 366.78
2016	19 382.93	24 805.10	NA	NA		–107.78	NA	–6 329.27

Note: Emissions/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 NF₃, for which the base year is 2000. Croatia has not elected any activities under Article 3, paragraph 4, of the Kyoto Protocol. For activities under Article 3, paragraph 3, of the Kyoto Protocol and FM under Article 3, paragraph 4, only the inventory years of the commitment period must be reported.

^b The Party did not report indirect CO₂ emissions in CRF table 6.

^c The value reported in this column refers to 1990.

^d Activities under Article 3, paragraph 3, of the Kyoto Protocol, namely AR and deforestation.

Table 7
Greenhouse gas emissions by gas for Croatia, excluding land use, land-use change and forestry, 1990–2016

(kt CO₂ eq)

	CO ₂ ^a	CH ₄	N ₂ O	HFCs	PFCs	Unspecified mix of HFCs and PFCs	SF ₆	NF ₃
1990	23 441.97	4 544.90	2 847.09	NO	1 240.24	NO	10.45	NO
1995	17 040.10	3 783.59	2 300.91	29.32	NO	NO	11.12	NO
2000	19 815.74	3 643.91	2 478.87	147.90	NO	NO	11.62	NO
2010	21 245.08	4 326.22	2 380.02	378.87	0.03	NO	8.95	NO
2011	20 801.67	4 322.87	2 440.67	396.20	0.02	NO	9.37	NO
2012	19 242.97	4 258.69	2 294.16	397.28	0.03	NO	9.18	NO
2013	18 588.18	4 190.63	1 771.69	469.19	NO	NO	6.05	NO
2014	17 850.67	4 167.92	1 688.19	474.76	NO	NO	6.77	NO
2015	17 996.57	4 364.52	1 817.71	482.50	NO	NO	5.22	NO
2016	18 220.60	4 388.00	1 706.58	483.53	NO	NO	6.39	NO
Per cent change 1990–2016	-22.3	-3.5	-40.1	NA	NA	NA	-38.8	NA

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

^a Croatia did not report indirect CO₂ emissions in CRF table 6.

Table 8
Greenhouse gas emissions by sector for Croatia, 1990–2016

(kt CO₂ eq)

	Energy	IPPU	Agriculture	LULUCF	Waste	Other
1990	21 831.84	4 680.65	4 398.33	-6 613.59	1 173.82	NO
1995	16 121.96	2 487.80	3 263.93	-9 053.34	1 291.36	NO
2000	18 350.77	3 154.12	3 131.40	-7 404.12	1 461.77	NO
2010	19 903.93	3 356.61	3 029.76	-7 010.47	2 048.89	NO
2011	19 634.83	3 125.93	3 120.82	-5 989.40	2 089.22	NO
2012	18 187.43	2 879.74	3 037.18	-5 713.48	2 097.94	NO
2013	17 415.67	2 661.50	2 848.39	-6 268.08	2 100.18	NO
2014	16 459.83	2 822.73	2 742.00	-6 292.53	2 163.76	NO

	<i>Energy</i>	<i>IPPU</i>	<i>Agriculture</i>	<i>LULUCF</i>	<i>Waste</i>	<i>Other</i>
2015	16 728.04	2 832.29	2 875.21	-5 370.80	2 230.98	NO
2016	17 074.45	2 524.05	2 930.94	-5 422.17	2 275.66	NO
Per cent change 1990–2016	-21.8	-46.1	-33.4	-18.0	93.9	NA

Notes: (1) Emissions/removals reported in the sector other (sector 6) are not included in the total GHG emissions. (2) Croatia did not report indirect CO₂ emissions in CRF table 6.

Table 9
Greenhouse gas emissions/removals from activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol by activity, base year^a–2016, for Croatia
(kt CO₂ eq)

	<i>Article 3.7 bis as contained in the Doha Amendment^b</i>		<i>FM and elected Article 3.4 activities of the Kyoto Protocol</i>					
	<i>Article 3.3 of the Kyoto Protocol</i>							
	<i>Land-use change</i>	<i>AR</i>	<i>Deforestation</i>	<i>FM</i>	<i>CM</i>	<i>GM</i>	<i>RV</i>	<i>WDR</i>
FMRL				-6 289.00				
Technical correction				904.83				
Base year	NA				NA	NA	NA	NA
2013		-85.87	122.52	-7 077.00	NA	NA	NA	NA
2014		-94.25	106.85	-6 970.12	NA	NA	NA	NA
2015		-132.74	136.60	-6 366.78	NA	NA	NA	NA
2016		-231.71	123.93	-6 329.27	NA	NA	NA	NA
Per cent change base year– 2016					NA	NA	NA	NA

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

^a Croatia has not elected any activities under Article 3, paragraph 4, of the Kyoto Protocol. For activities under Article 3, paragraph 3, of the Kyoto Protocol, and FM under Article 3, paragraph 4, only the inventory years of the commitment period must be reported.

^b The value reported in this column refers to 1990.

- Table 10 provides an overview of key relevant data for Croatia's reporting under Article 3, paragraphs 3 and 4, of the Kyoto Protocol.

Table 10

Key relevant data for Croatia under Article 3, paragraphs 3 and 4, of the Kyoto Protocol in the 2018 annual submission

<i>Key parameters</i>	<i>Values</i>
Periodicity of accounting	(a) AR: commitment period accounting (b) Deforestation: commitment period accounting (c) FM: commitment period accounting (d) CM: not elected (e) GM: not elected (f) RV: not elected (g) WDR: not elected
Election of activities under Article 3, paragraph 4	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) (see ID# KL.18 in table 5)
Cancellation of AAUs, ERUs, CERs and/or issuance of RMUs in the national registry for:	
1. AR in 2016	NA
2. Deforestation in 2016	NA
3. FM in 2016	NA
4. CM in 2016	NA
5. GM in 2016	NA
6. RV in 2016	NA
7. WDR in 2016	NA

Annex II

Information to be included in the compilation and accounting database

Tables 11–14 include the information to be included in the compilation and accounting database for Croatia. Data shown are from the original annual submission of the Party, including the latest revised estimates submitted, adjustments (if applicable) and the final data to be included in the compilation and accounting database.

Table 11

Information to be included in the compilation and accounting database for 2016, including on the commitment period reserve, for Croatia

(t CO₂ eq)

	<i>Original submission</i>	<i>Revised estimate</i>	<i>Adjustment</i>	<i>Final</i>
CPR	146 043 977			146 043 977
Annex A emissions for 2016				
CO ₂	18 220 602			18 220 602
CH ₄	3 950 919	4 387 997		4 387 997
N ₂ O	1 706 576			1 706 576
HFCs	419 672	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	24 304 160	24 805 100		24 805 100
Activities under Article 3, paragraph 3, of the Kyoto Protocol for 2016				
3.3 AR	–231 709			–231 709
3.3 Deforestation	123 928			123 928
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol for 2016				
3.4 FM	–6 329 265			–6 329 265

Table 12

Information to be included in the compilation and accounting database for 2015 for Croatia

(t CO₂ eq)

	<i>Original submission</i>	<i>Revised estimate</i>	<i>Adjustment</i>	<i>Final</i>
Annex A emissions for 2015				
CO ₂	17 996 568			17 996 568
CH ₄	3 949 197	4 364 525		4 364 525
N ₂ O	1 817 710			1 817 710
HFCs	419 898	482 496		482 496
PFCs	34	NO		NO
Unspecified mix of HFCs and PFCs	NO			NO
SF ₆	5 216			5 216
NF ₃	NO			NO
Total Annex A sources	24 188 623	24 666 514		24 666 514
Activities under Article 3, paragraph 3, of the Kyoto Protocol for 2015				

	<i>Original submission</i>	<i>Revised estimate</i>	<i>Adjustment</i>	<i>Final</i>
3.3 AR	-132 737			-132 737
3.3 Deforestation	136 599			136 599
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol for 2015				
3.4 FM	-6 366 783			-6 366 783

Table 13

Information to be included in the compilation and accounting database for 2014 for Croatia
(t CO₂ eq)

	<i>Original submission</i>	<i>Revised estimate</i>	<i>Adjustment</i>	<i>Final</i>
Annex A emissions for 2014				
CO ₂	17 850 672			17 850 672
CH ₄	3 738 310	4 167 924		4 167 924
N ₂ O	1 688 189			1 688 189
HFCs	413 897	474 765		474 765
PFCs	60	NO		NO
Unspecified mix of HFCs and PFCs	NO			NO
SF ₆	6 765			6 765
NF ₃	NO			NO
Total Annex A sources	23 697 893	24 188 315		24 188 315
Activities under Article 3, paragraph 3, of the Kyoto Protocol for 2014				
3.3 AR	-94 245			-94 245
3.3 Deforestation	106 853			106 853
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol for 2014				
3.4 FM	-6 970 120			-6 970 120

Table 14

Information to be included in the compilation and accounting database for 2013 for Croatia
(t CO₂ eq)

	<i>Original submission</i>	<i>Revised estimate</i>	<i>Adjustment</i>	<i>Final</i>
Annex A emissions for 2013				
CO ₂	18 588 178			18 588 178
CH ₄	3 788 514	4 190 633		4 190 633
N ₂ O	1 771 688			1 771 688
HFCs	408 914	469 186		469 186
PFCs	60	NO		NO
Unspecified mix of HFCs and PFCs	NO			NO
SF ₆	6 052			6 052
NF ₃	NO			NO
Total Annex A sources	24 563 406	25 025 737		25 025 737
Activities under Article 3, paragraph 3, of the Kyoto Protocol for 2013				
3.3 AR	-85 872			-85 872
3.3 Deforestation	122 521			122 521
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol for 2013				
3.4 FM	-7 076 999			-7 076 999

Annex III

Additional information to support findings in table 2

Missing categories that may affect completeness

The categories for which 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 reporting in the Party’s inventory are the following:

- (a) 2.A.4.a other process uses of carbonates – ceramics (1990–2011) (CO₂) (see ID# I.22 in table 5);
- (b) 2.D.1 lubricant use (CO₂) (see ID# I.40 in table 5);
- (c) 2.F.1 refrigeration and air conditioning – manufacturing and disposal (HFCs) (see ID# I.42 in table 5);
- (d) 2.F.2 foam blowing agents (HFCs) (see ID# I.44 in table 5);
- (e) 2.F.3 fire protection (HFCs) (see ID# I.46 in table 5);
- (f) 3.B.4 other livestock – rabbits (CH₄ and N₂O) (see ID# A.20 in table 5);
- (g) 3.B.5 indirect N₂O emissions – N leaching and run-off (N₂O) (see ID# A.23 in table 5);
- (h) 3.D.a.2.b sewage sludge applied to soils (N₂O) (see ID# A.26 in table 5);
- (i) 4.A forest land – above-ground biomass and deadwood (CO₂) (see ID# L.24 in table 5);
- (j) 4.A.1 forest land remaining forest land – living biomass (carbon stock losses) (CO₂) (see ID# L.9 in table 3);
- (k) 4.A.2 land converted to forest land – deadwood (CO₂) (see ID# L.10 in table 3);
- (l) 4.B.2.1 forest land converted to cropland – deadwood (CO₂) (see ID# L.13 in table 3);
- (m) 4(IV) indirect N₂O emissions from managed soils (N₂O) (see ID# L.18 in table 3);
- (n) 4(V) biomass burning (CO₂) (see ID# L.26 in table 5);
- (o) 5.C.1 waste incineration (CO₂, CH₄ and N₂O) (1990–2006) (see ID# W.7 in table 3);
- (p) 5.D.1 domestic wastewater (CH₄) (see ID# W.12 in table 5);
- (q) 4(KP-I)A.1 AR – deadwood (CO₂) (see ID# KL.15 in table 5);
- (r) 4(KP-I)A.1 deforestation – above-ground biomass and below-ground biomass (CO₂) (see ID# KL.16 in table 5);
- (s) 4(KP-I)B.1 FM – living biomass (carbon stock losses) (CO₂) (see ID# KL.9 in table 3);
- (t) 4(KP-I)B.1 FM – deadwood and litter (CO₂) (see ID# KL.17 in table 3).

Annex IV

Documents and information used during the review

A. Reference documents

Reports of the Intergovernmental Panel on Climate Change

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

IPCC. 2014. *2013 Revised Supplementary Methods and Good Practice Guidance Arising from the Kyoto Protocol*. T Hiraiishi, T Krug, K Tanabe, et al. (eds.). Hayama, Japan: Institute for Global Environmental Strategies. Available at <http://www.ipcc-nggip.iges.or.jp/public/kpsg>.

IPCC. 2014. *2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands*. T Hiraiishi, T Krug, K Tanabe, et al. (eds.). Geneva: IPCC. Available at <http://www.ipcc-nggip.iges.or.jp/public/wetlands/>.

Annual review reports

Reports on the individual reviews of the 2013, 2014, 2015 and 2016 annual submissions of Croatia, contained in documents FCCC/ARR/2013/HRV, FCCC/ARR/2014/HRV, FCCC/ARR/2015/HRV and FCCC/ARR/2016/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 <http://unfccc.int/resource/webdocs/agi/2018.pdf>.

Annual status report for Croatia for 2018. Available at https://unfccc.int/sites/default/files/resource/asr2018_HRV.pdf.

Pilas I, Kusan V, Medved I, 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*. 115(3): pp.339–347.

B. Additional information provided by the Party

Responses to questions during the review were received from Ms. Vlatka Palčić (Ministry of Environment and Energy), including additional material on the methodology and assumptions used. The following documents¹ were also provided by Croatia:

Doc.dr.sc. Goran Kis. 2015. *Unapredenje proracuna emisije NH₃, CH₄ i N₂O iz sektora gospodarenja stajskim gnojem i izrada nacionalnih faktora (Improvement of the NH₃, CH₄ and N₂O emissions estimation from solid manure management and development of the national emission factors)*. Zagreb: University of Zagreb, Faculty of Agriculture.

M. Grozdek. 2016. *Učinkovitost i održivost sustava za prikupljanje, obnavljanje i oporabu tvari koje oštećuju ozonski sloj i fluoriranih stakleničkih plinova te analiza utjecaja uredbe (EU) 517/2014 o fluoriranim stakleničkim plinovima na gospodarstvo u Republici Hrvatskoj (Effectiveness and viability of the system for collecting and recovering ozone layer depleting substances and fluorinated greenhouse gases and analysis of the impact of Regulation (EU) 517/2014 on fluorinated greenhouse gases in the economy in the Republic of Croatia)*. Zagreb: Hrvatska agencija za okoliš i prirodu.

Laila Gumhalter Malić, HAOP, 2018. *Izješće o posebnim kategorijama otpada za 2016. godinu (Report on special categories of waste for 2016 year)*. Zagreb.

¹ Reproduced as received from the Party.