United Nations

FCCC/ARR/2021/MCO

Framework Convention on Climate Change

Distr.: General
15 September 2022

English only

Report on the individual review of the annual submission of Monaco submitted in 2021*

Note by the expert review team

Summary

Each Party included in Annex I to the Convention must submit an annual inventory of emissions and removals of greenhouse gases for all years from the base year (or period) to two years before the inventory due date (decision 24/CP.19). Parties included in Annex I to the Convention that are Parties to the Kyoto Protocol are also required to report supplementary information under Article 7, paragraph 1, of the Kyoto Protocol with the inventory submission due under the Convention. This report presents the results of the individual review of the 2021 annual submission of Monaco, 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 27 September to 2 October 2021.

* In the symbol for this document, 2021 refers to the year in which the inventory was submitted, not to the year of publication.

Contents

Abbreviations and acronyms

2006 IPCC Guidelines	*2006 IPCC Guidelines for National Greenhouse Gas Inventories*
AAU	assigned amount unit
AD	activity data
Annex A source	source category included in Annex A to the Kyoto Protocol
AR	afforestation and reforestation
Article 8 review guidelines	"Guidelines for review under Article 8 of the Kyoto Protocol"
B_o	maximum methane-producing capacity
BOD	biochemical oxygen demand
C	carbon
CER	certified emission reduction
CH_4	methane
C_3F_8	perfluoropropane
Citepa	Interprofessional Technical Centre for Studies on Atmospheric Pollution
CM	cropland management
CO_2	carbon dioxide
CO_2 eq	carbon dioxide equivalent
COD	chemical oxygen demand
Convention reporting adherence	adherence to the "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual greenhouse gas inventories"
COPERT	software tool for calculating road transport emissions
CP	commitment period
CPR	commitment period reserve
CRF	common reporting format
DC	degradable organic component
EF	emission factor
ERT	expert review team
ERU	emission reduction unit
F-gas	fluorinated gas
FM	forest management
FMRL	forest management reference level
GHG	greenhouse gas
GIS	geographic information system
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 reporting adherence	adherence to the reporting guidelines under Article 7, paragraph 1, of the Kyoto Protocol
KP-LULUCF	activities under Article 3, paragraphs 3–4, of the Kyoto Protocol
LULUCF	land use, land-use change and forestry
N	nitrogen
N_2O	nitrous oxide
NA	not applicable
NCV	net calorific value

NE	not estimated
NF_3	nitrogen trifluoride
NIR	national inventory report
NO	not occurring
PFC	perfluorocarbon
QA/QC	quality assurance/quality control
RISQ	Referencing Information on Software Quality
RMU	removal unit
RV	revegetation
SEF	standard electronic format
SF_6	sulfur hexafluoride
SIAR	standard independent assessment report
SMEG	Monaco Electricity and Gas Company
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"
WDR	wetland drainage and rewetting
Wetlands Supplement	*2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands*

I. Introduction

1. This report covers the review of the 2021 annual submission of Monaco, organized by the secretariat in accordance with the Article 8 review guidelines (adopted by decision 22/CMP.1 and revised by decision 4/CMP.11). In accordance with the Article 8 review guidelines, this review process also encompasses the review under the Convention as described in the UNFCCC review guidelines, particularly in part III thereof, namely the "UNFCCC guidelines for the technical review of greenhouse gas inventories from Parties included in Annex I to the Convention" (annex to decision 13/CP.20). The review took place from 27 September to 2 October 2021 and was coordinated by Claudia do Valle and Javier Hanna (secretariat). Table 1 provides information on the composition of the ERT that conducted the review for Monaco.

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

Area of expertise	*Name*	*Party*
Generalist	Riccardo De Lauretis	Italy
	John Watterson	United Kingdom
Energy	Alexey Vladimirovich Cherednichenko	Kazakhstan
	Renata Patricia Soares Grisoli	Brazil
IPPU	Menouer Boughedaoui	Algeria
Agriculture	Braulio Pikman	Brazil
LULUCF and KP-LULUCF	Ana Blondel	Canada
Waste	Chart Chiemchaisri	Thailand
	Gustavo Barbosa Mozzer	Brazil
Lead reviewers	Menouer Boughedaoui	
	Riccardo De Lauretis	

2. The basis of the findings in this report is the assessment by the ERT of the Party's 2021 annual submission in accordance with the UNFCCC review guidelines and the Article 8 review guidelines.

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

4. A draft version of this report was communicated to the Government of Monaco, which provided comments that were considered and incorporated, as appropriate, into this final version of the report.

5. Annex I presents the annual GHG emissions of Monaco, including totals excluding and including LULUCF, indirect CO_2 emissions, and emissions by gas and by sector, and contains background data on emissions and removals from KP-LULUCF, if elected by the Party, by gas, sector and activity.

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

[1] Issues are defined in decision 13/CP.20, annex, para. 81.
[2] Problems are defined in decision 22/CMP.1, annex, paras. 68–69, as revised by decision 4/CMP.11.

II. Summary and general assessment of the Party's 2021 annual submission

7. In accordance with paragraph 76 of the UNFCCC review guidelines and paragraphs 47 and 65 of the Article 8 review guidelines, the ERT has prioritized the review of issues and problems identified in previous review reports or in the initial assessment, recalculations that have changed the estimated emissions or removals for a category by more than 2 per cent or national total emissions by more than 0.5 per cent for any of the recalculated years, and supplementary information reported under the Kyoto Protocol. Table 2 provides the assessment by the ERT of the Party's 2021 annual submission with respect to the tasks undertaken during the desk review. Further information on the issues identified, as well as additional findings, may be found in tables 3, 5 and 6.

Table 2
Summary of review results and general assessment of the 2021 annual submission of Monaco

Assessment		*Issue/problem ID#(s) in table 3, 5 or 6[a]*
Dates of submission	Original submission: NIR, 13 April 2021; CRF tables (version 1), 14 April 2021; SEF tables (SEF-2020-CP1), 7 April 2021; SEF tables (SEF-2020-CP2), 4 May 2021	
Review format	Desk review	
Application of the requirements of the UNFCCC Annex I inventory reporting guidelines and the Wetlands Supplement (if applicable)	Have any issues been identified in the following areas:	
	(a) Identification of key categories?	No
	(b) Selection and use of methodologies and assumptions?	Yes L.9, L.11
	(c) Development and selection of EFs?	Yes L.12
	(d) Collection and selection of AD?	Yes E.1, E.2, L.8, L.10
	(e) Reporting of recalculations?	Yes G.12
	(f) Reporting of a consistent time series?	No
	(g) Reporting of uncertainties, including methodologies?	No
	(h) QA/QC?	QA/QC procedures were assessed in the context of the national system (see supplementary information under the Kyoto Protocol below)
	(i) Missing categories, or completeness?[b]	Yes E.16
	(j) Application of corrections to the inventory?	No
Significance threshold	For categories reported as insignificant, has the Party provided sufficient information showing that the likely level of emissions meets the criteria in paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines?	Yes
Description of trends	Did the ERT conclude that the description in the NIR of the trends for the different gases and sectors is reasonable?	Yes
Supplementary information under the Kyoto Protocol	Have any issues been identified related to the following aspects of the national system:	
	(a) Overall organization of the national system, including the effectiveness and reliability of the institutional, procedural and legal arrangements?	Yes G.11
	(b) Performance of the national system functions?	Yes G.5, I.10
	Have any issues been identified related to the national registry:	
	(a) Overall functioning of the national registry?	No

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

[a] Further information on the issues identified, as well as additional findings, may be found in tables 3, 5 and 6.
[b] Missing categories for which methods are provided in the 2006 IPCC Guidelines may affect completeness and are listed in annex III.

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

8. Table 3 compiles the recommendations from previous review reports that were included in the most recent previous review report, published on 20 March 2020,[3] and had not been resolved by the time of publication of the report on the review of the Party's 2019 annual submission. The ERT has specified whether it believes the Party had resolved, was addressing or had not resolved each issue or problem by the time of publication of this review report and has provided the rationale for its determination, which takes into consideration the publication date of the most recent previous review report and national circumstances.

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

ID#	*Issue/problem classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
General			
G.1	CPR (G.2, 2019) (G.18, 2017) KP reporting adherence	Improve QA/QC procedures to review the calculation of the inputs for determining the CPR, including the assigned amount and the relevant modalities in accordance with the annex to decision 18/CP.7, the annex to decision 11/CMP.1 and decision 1/CMP.8, paragraph 18.	Not resolved. Monaco did not update the calculation of the inputs for determining the CPR, including the assigned amount (NIR section 12.5, p.312). Base-year emissions, the assigned amount and the CPR were incorrectly reported as 99,312, 619,707 and 557,736 t CO_2 eq, respectively, in the NIR. However, in the initial review report (FCCC/IRR/2017/MCO), base-year emissions, the assigned amount and the CPR were reported as 99,319, 619,751 and 557,777 t CO_2 eq, respectively, and these are the values that should be reported in the NIR. In addition, according to decision 11/CMP.1, annex, paragraph 6, Parties should compare emissions reported in their most recently reviewed inventory (i.e. Monaco's 2021 submission) with 90 per cent of their assigned amount and maintain in their registry whichever is lowest. In the NIR (p.313), Monaco continued to make this comparison using 2015 emission data from the 2017 GHG inventory submission. According to the 2021 submission, the 2019 emissions (without LULUCF) reported in the most recently reviewed inventory amount to 82.54 kt CO_2 eq. This amount multiplied by eight is 660,394 t CO_2 eq. The correct CPR of Monaco is therefore 557,777 t CO_2 eq (90 per cent of the assigned amount, which is the lower of the two values). During the review, the Party clarified that it will take into account this recommendation for the next NIR.
G.2	Inventory planning (G.3, 2019) (G.2, 2017) (G.2, 2015) (17, 2014) (12(a), 2013) Convention reporting adherence	Strengthen cooperation with national institutions and companies in order to increase the use of available country-specific data for the preparation of the inventory so as to develop more accurate estimates.	Resolved. Monaco reported in its NIR (section 1.3.1, p.39) that the legal status of the GHG inventory has been strengthened in Monaco by ministerial decree 2020-916 of 24 December 2020 concerning the establishment of national inventories of GHG and atmospheric pollutants, which requires the communication of data by private actors. During the review, the Party provided a weblink for the decree (https://journaldemonaco.gouv.mc/Journaux/2021/Journal-

[3] FCCC/ARR/2019/MCO. The ERT notes that the report on the individual inventory review of Monaco's 2020 annual submission has not been published yet owing to insufficient funding for the review process. As a result, the latest previously published annual review report reflects the findings of the review of the Party's 2019 annual submission.

ID#	Issue/problem classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
			8519/Arrete-Ministeriel-n-2020-916-du-24-decembre-2020-relatif-a-l-etablissement-des-inventaires-nationaux-de-gaz-a-effet-de-serre-et-de-polluants-atmospheriques, in French).
G.3	Inventory planning (G.4, 2019) (G.3, 2017) (G.3, 2015) (15, 2014) Convention reporting adherence	Amend the annex with information on the QA/QC and verification procedures implemented for each of the sectors.	Resolved. Monaco has not included annex 8 to the NIR since its 2015 submission. The Party has changed how it reports information on QA/QC. The NIR (section 1.2.4, pp.30–38) provides information on QA/QC and verification. Annex 5 to the NIR (section 21.2, p.388) includes a spreadsheet (figure 193 "Fiche Contrôle Qualité") for the source category QC checks. The NIR (p.392) also provides a summary of the QA/QC plan. The ERT finds that the level of detail in the NIR provides a satisfactory description of the QA/QC system used by Monaco.
G.4	Inventory planning (G.5, 2019) (G.4, 2017) (G.4, 2015) (18, 2014) Convention reporting adherence	Continue updating and improving the QA/QC plan with a view to improving the effectiveness of the QA/QC procedures.	Resolved. The ERT noted that over the last two years Monaco has made incremental improvements to its QA/QC plan. A description of the QA/QC procedures was given in the NIR (section 1.2.4). Monaco made improvements to all the areas listed in the recommendation including: on the main steps in the inventory preparation process, indicating actions and deadlines in preparing the inventory, and supplementary information as required by decision 19/CMP.1, annex, paragraph 10(d) (NIR p.29); a description of all QC checks, activities, tasks and procedures applied for the inventory, with an indication of the scheduled time frame for the annual QC checks and the responsible unit or person (NIR p.29); and information on the source category QC checks (e.g. an indication of the checklists (QC tier 1 template) used for the QC checks in accordance with annex 6A.1 to the 2006 IPCC Guidelines, vol. 1, p.6.27) and an explanation as to whether any issues were found (annex 5 to the NIR, section 21.2).
G.5	Inventory planning (G.6, 2019) (G.5, 2017) (G.5, 2015) (18, 2014) (12(c), 2013) (16, 2012) Convention reporting adherence	Provide information concerning the implementation of the QA/QC plan, in particular regarding the prioritization of inventory improvements on the basis of the key category analysis and uncertainty assessment.	Not resolved. Monaco reported in its NIR (section 1.2.4.2.2) that QC measures include the determination of key sources. Moreover, the NIR (section 1.4.1) states that the priority areas of development are based on key categories and on the development of specific methods to increase the level of confidence in the estimates of the categories that are the main contributors to overall emissions. During the review, the Party clarified that the RISQ tool is used to help compile the inventory, to enable key categories to be identified and to help manage improvements (see NIR section 1.2.4.2.4, p.37). The ERT considers that the recommendation has not yet been fully addressed because the ERT could not locate in the NIR a prioritized inventory development plan, which should prioritize improvement activities for the key categories and consider the magnitude of uncertainties associated with all the categories in the inventory. Key categories with significant levels of uncertainty should be the highest priority for improvement. The plan should list the activities to be carried out by Monaco to ensure that higher-tier methods are applied to key categories, including a timeline for implementation.
G.6	Inventory management (G.8, 2019) (G.21, 2017) KP reporting adherence	Improve the inventory management procedures to enable it to respond to all stages of the review process, in particular the initial assessment, in order to facilitate the timely technical review by the ERT of the annual submission.	Resolved. Monaco has improved its response to the review process and provided responses to all the initial assessment questions. The ERT notes that responses were sent promptly after the initial questions were raised, and that Monaco generally provided prompt answers to follow-up and new questions.

ID#	*Issue/problem classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
G.7	National system (G.11, 2019) (G.11, 2017) (G.8, 2015) (21, 2014) (12(b), 2013) KP reporting adherence	In order to improve the national system, ensure that adequate resources are allocated to the preparation of the inventory.	Resolved. Monaco reported in the NIR (section 1.2.5, p.38) that a new member joined the inventory team in April 2020. This new team member, who has increased the resources available to the Monaco team, is responsible for the national registry and the IPPU sector and assisted in the compilation of the 2021 inventory. Monaco improved the timeliness of the annual submission. During the review, the Party clarified that it believes that the GHG inventory team now has sufficient resources.
G.8	National system (G.15, 2019) Transparency	Provide in the NIR a national system diagram with a narrative of the overall institutional arrangements that support inventory planning, preparation and management.	Addressing. Monaco did not update the NIR to include a diagram of the national system with a narrative of the overall institutional arrangements. The ERT noted that the inventory preparation plan (NIR figure 1, p.29) contains some elements of the institutional arrangements used in the Party's national system (e.g. "companies", meaning private data owners or providers; "ministry", probably meaning a single national entity or the national focal point; and "collection of data", which is related to the unit responsible for management and coordination); however, the ERT considers that this figure would be more relevant to the tasks and deadlines associated with the inventory preparation process. The ERT considers that the recommendation has not yet been addressed because the Party has not yet provided a suitable diagram of its national system. The ERT suggests that Monaco refer to figure 1.0 and table 1.3 of the *2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories* (vol. 1, chap. 1.4.1.2, pp.1.12–1.13) for inspiration and to help generate suitable diagrams and a narrative of the overall institutional arrangements.
G.9	National system (G.16, 2019) Transparency	Include in the NIR more transparent information (e.g. in tabular format) on the listed steps taken to address the actions presented in the plan submitted to the Compliance Committee (see (a–f) in the 2019 annual review report), including the action proposed in the plan, a clear description of what was and was not implemented, along with time frames and accompanying explanations of the status of implementation. This should also include, as highlighted in (e–f) in the 2019 annual review report, a more detailed explanation of how the RISQ tool operates and a description of the ongoing external support provided, the tasks involved and the scope of the collaboration, including time frames and deadlines. In addition, report on the improvements and changes to methodologies made for the inventory	Resolved. Monaco did not include information in tabular format but explained in different parts of the NIR the improvements made to its national system in the seven areas raised by the previous ERT: (a) Reinforcement of the inventory team. A new IPPU sectoral expert was recruited to the Monaco GHG inventory team in April 2020. Monaco indicated that its team now has sufficient resources. Details were provided in the NIR (sections 1.2.5, p.38, and 21.1, p.386); (b) Expertise of the inventory team. Building on the training the team received in 2019 and 2020, the team received sectoral training in 2020 from Citepa (https://www.Citepa.org/fr/presentation/). The areas covered were solid waste, road transport, RISQ, wastewater and the national system. In response to a question raised by the ERT, Monaco indicated that the training covered the specific needs of Monaco experts in a relevant category and training sessions generally lasted one day; (c) Legal provision for data collection. Ministerial decree 2020-916 of 24 December 2020, a legal instrument relating to the establishment of national inventories of GHGs and atmospheric pollutants, requires the communication of data by private actors, as indicated in paragraph 1.2.2 of the decree "Legislative provisions" (2021 NIR, section 1.3.1, p.39); (d) Information technology shared storage space. The shared storage space was already functional at the time of the last review. Section 1.3.2.3 "Archivage" of the 2021 NIR provides a summary of the system in the section entitled "Sur base informatique";

ID#	Issue/problem classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
		that resulted from the plan (see (g) in the 2019 annual review report).	(e) Implementation of the RISQ tool. The new QA/QC plan was implemented in 2019, and additional information on the plan was provided in sections 1.2.4, 1.3.1 and 21.2 of the 2021 NIR. The RISQ tool is used to help generate the inventory, in particular by checking its overall consistency. It also allows identification of key categories (NIR section 1.2.4.2.4, p.37) and management of improvements; (f) External support. Monaco has an ongoing contract with Citepa, which provides specific ad hoc expertise and performs a general QA role. Section 1.2.4.4 "Entités extérieures" describes the Party's collaboration with Citepa. In response to a question raised by the ERT, Monaco indicated that periodically, Citepa conducts a QA review of the NIR, most recently in 2019, when it provided an analysis of the report's structure and the methodologies used and provided recommendations for improvements. Monaco indicated that, following the QA review, the NIR was improved in substance and form. The ERT notes that Monaco has not yet provided a more detailed description of the ongoing support provided by Citepa, the tasks involved and the scope of the collaboration, including time frames and deadlines; (g) Methodological improvements. Monaco has some planned improvements for the next submission, including for the wastewater sector and F-gases. In response to a question raised by the ERT on the status of these methodological improvements, Monaco indicated that the wastewater methodology was reviewed for the 2020 NIR. For category 2.F.1.f, as indicated in section 10.5 of the NIR, the mechanism for implementing the improvement is still under evaluation. Monaco noted that the inventory expert for this sector was replaced and the team is facing difficulties in obtaining the relevant data to reconstruct the time series and update the data for subsequent submissions. Monaco stated that it will provide more information in the next NIR.
G.10	Notation keys (G.18, 2019) Transparency	Update CRF table 9 to reflect the explanations for reporting "IE" and "NE" in the inventory.	Not resolved. Monaco did not update CRF table 9 with explanations for the reporting of "IE" and "NE". The Party did not provide, for example, an explanation related to the reporting of "IE" for CH_4 and N_2O emissions from biomass burning in CRF table 4(V) (category 4.E) or for losses in carbon stock in living biomass for tree crown cover in CRF table 4.E (category 4.E.1). Moreover, the Party did not update CRF table 9 to explain the reporting of "NE" for a number of categories: CO_2 emissions from biomass burning in CRF table 4(V); net carbon stock change in mineral soils and net carbon stock change in dead organic matter in CRF table 4.E (category 4.E.1); and indirect emissions under waste, energy and IPPU (CRF table 6).
G.11	QA/QC and verification (G.12, 2019) (G.14, 2017) Convention reporting adherence	Provide in the NIR explanations of changes made in response to recommendations from previous reviews, including UNFCCC technical expert reviews.	Addressing. Monaco included additional information regarding its responses to previous recommendations (NIR table 10.6, p.293). However, the numbering of the issues in the table does not refer to the year of the issue, and the Party response to the status of the implementation simply refers the reader to the section of the NIR where additional information can be found. No details about the improvements implemented or changes made to the methods, AD or EFs in response to the review process were provided (see ID# G.12 below). The ERT notes that Monaco could include the issue number and annual review report where the issue was identified for clarity. Monaco could also include a brief description of the work carried out to

ID#	Issue/problem classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
			respond to the issue raised, in addition to providing information on where information on the improvement can be found in the NIR.
G.12	Recalculations (G.13, 2019) (G.8, 2017) (G.11, 2015) (13, 2014) Convention reporting adherence	Report the recalculations under each category and include a clear explanation of the reasons for the recalculations made in the course of previous reviews, clearly distinguishing them from the recalculations made for the purpose of the current annual submission.	Addressing. Monaco reported the impact of the recalculations and provided some details of the methodological changes that led to those recalculations. At the end of NIR chapters 3–8, the Party reported a chart displaying the time series of the current and previous inventories when there were recalculations in the sector. The sectoral chapters include descriptions of the reasons for recalculations at the category level. The NIR (section 10.1) provides a summary of the methodological changes which have resulted in updated estimates of emissions, by sector. NIR section 10.2 contains a table which summarizes the magnitude of the change in emission estimates at category level. However, NIR sections 10.1–10.2 do not provide information for the recalculations made in response to previous review recommendations, and there is no information to enable the reader to distinguish them from the changes in the estimates resulting from the recalculations made for other reasons. The ERT considers that the recommendation has not yet been fully addressed because the Party has not yet clearly indicated the changes in emission estimates resulting from each methodological change implemented. To fully address this issue, the ERT suggests that Monaco extend the information provided in its NIR. Monaco should explain the magnitude of the changes from recalculations in NIR chapters 3–8, in the sections entitled "Recalcul du Secteur". The Party should clearly indicate the changes it has made to the method, EFs or AD, or a combination thereof. To increase the transparency of the reporting in NIR section 10.2, the ERT suggests that Monaco provide two tables. The first could have the following column headings: Emissions of individual GHGs according to the previous submission (CO_2 eq, kt); Emissions of individual GHGs according to the latest submission (CO_2 eq, kt); Difference between the emission estimates (CO_2 eq, kt); Difference (%); Explanation for recalculations. The final column should include a short explanation of the main factors responsible for the change in emission estimates. The second table should contain information about improvements to Monaco's GHG inventory submission in response to UNFCCC review findings, and could have the following column headings: CRF category/issue; Review recommendation; Review report/paragraph; Party response/status of implementation; Reference to chapter/section of the latest NIR. The column entitled "Review report/paragraph" could contain the issue ID#s and the years of the annual review report, for example, (G.13, 2019), (G.8, 2017), (G.11, 2015) and (G.13, 2014). The column entitled "Party response/status of implementation" should indicate whether the issue is currently "Resolved" or whether Monaco is "Addressing" the issue and should describe in a few sentences the actions that Monaco is taking or has already taken.
Energy			
E.1	Fuel combustion – reference approach – biomass – CO_2 (E.4, 2019) (E.12, 2017)	Correct the error in total biomass consumption reported for the reference approach.	Addressing. The total biomass consumption values reported in the reference approach (CRF table 1.A(b)) match the values reported under category 1.A (fuel combustion) in the sectoral approach (CRF table 1.A(a)s1) for 1990–2018. However, for 2019, the total biomass

ID#	Issue/problem classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
	Convention reporting adherence		consumption reported in the reference approach is 624.60 TJ, which differs from the value provided under the sectoral approach (639.60 TJ).
E.2	Feedstocks, reductants and other non-energy use of fuels (E.6, 2019) (E.3, 2017) (E.6, 2015) (37, 2014) (35, 2013) (39, 2012) Comparability	Revise the reporting of feedstocks and non-energy use of fuels in CRF table 1.A(d) in a consistent manner under the energy and industrial processes sectors.	Addressing. Monaco revised the reporting for lubricants in CRF table 1.A(d) and reported 0.04 kt CO_2 emissions as carbon excluded from the reference approach. However, in the reference approach (CRF table 1.A(b)), the emissions still seem to be included, as the carbon excluded is reported as "NO" (column P). According to the 2006 IPCC Guidelines, the carbon from lubricant used for non-energy purposes should be excluded from the reference approach. During the review, Monaco reported that there was an error in the reporting of lubricants for energy use in the reference approach (CRF table 1.A(b)), where the total amount of lubricant was reported. Monaco clarified that the mistake will be corrected in the next annual submission.
E.3	Feedstocks, reductants and other non-energy use of fuels (E.7, 2019) (E.3, 2017) (E.6, 2015) (37, 2014) (35, 2013) (39, 2012) Transparency	Explain in the NIR the use and disposal of lubricants in the country.	Addressing. The Party provided in the NIR more detailed information on how AD for lubricant were determined and how they were attributed to the energy and IPPU sectors. However, Monaco did not include in the NIR information on how lubricants are disposed of. During the review, the Party explained that there are no data on the amounts of lubricants used and sold in Monaco and that emissions were estimated using the COPERT model, assuming the consumption of lubricants in transport (non-combustion use in engine), as described in NIR section 4.2.4.2.1. The Party also clarified that the disposal and recycling of all waste oil is carried out in France. The ERT considers that this information should be reported transparently in the NIR.
E.4	1.A Fuel combustion – sectoral approach – liquid fuels – CO_2 (E.15, 2019) Transparency	Provide in the NIR a description of the biofuel authenticity assurance system to demonstrate the verifiability of biofuels delivered from France to Monaco, and consequently the accuracy of the assumptions made regarding the shares of biogenic and fossil carbon in liquid biofuels.	Not resolved. Monaco informed the ERT during the review that it was not possible to get precise information from the French customs service. The Party plans to carry out a fuel analysis in 2022 if budget is allocated.
E.5	1.A Fuel combustion – sectoral approach – other fossil fuels – CO_2 (E.16, 2019) Transparency	Include in the NIR a description of the methodology, assumptions and AD used to estimate the CO_2 emissions from the fossil fraction of biodiesel.	Addressing. Monaco reported AD for and emissions from the fossil part of biodiesel (from biodiesel produced with methanol) under other fossil fuels in the CRF tables for categories 1.A.2.g.vii (off-road vehicles and other machinery), 1.A.3.b.i (cars), 1.A.3.b.ii (light-duty trucks), 1.A.3.b.iii (heavy-duty trucks) and 1.A.3.d (domestic navigation). During the review the Party stated that it included an explanation on recalculations in the 2020 NIR, but the ERT could not find specific information on how the fossil part of biodiesel was calculated. In the 2021 NIR, the Party explained the methodologies applied to estimate emissions from these categories (NIR sections 3.3.4. 3.3.5, 3.3.6 and 3.3.7 and annex 3, sections 19.1, 19.2.2 and 19.3) but did not explain how the fossil part of biodiesel was estimated.
E.6	1.A Fuel combustion – sectoral approach – gaseous fuels – CO_2,	Describe in the NIR the method and assumption used to derive the AD for gaseous fuels under categories	Resolved. Monaco included in the NIR (section 3.3.4.2.1.3, p.11, and table 22, p.112) the method and assumption used to derive AD for natural gas for categories 1.A.2.g.viii (other), 1.A.4.a (commercial/institutional) and 1.A.4.b.i (residential-stationary combustion), including

ID#	Issue/problem classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
	CH_4 and N_2O (E.18, 2019) Accuracy	1.A.2.g.viii (other), 1.A.4.a (commercial/institutional) and 1.A.4.b.i (residential-stationary combustion), including the ratio used for 2015, 2016 and 2017 and for 1990–2014.	the ratio used for 2015–2019. The Party explained that the ratio calculated for 2015 was applied for 1990–2014. The Party also included explanations in NIR section 3.3.6.3.1.5 (p.164).
E.7	1.A Fuel combustion – sectoral approach – gaseous fuels – CH_4 and N_2O (E.18, 2019) Accuracy	Revise the CH_4 and N_2O emission estimates for categories 1.A.2.g.viii (other), 1.A.4.a (commercial/ institutional) and 1.A.4.b.i (residential-stationary combustion) to reflect the correct values resulting from the disaggregation of the AD for natural gas.	Resolved. Monaco revised the CH_4 and N_2O estimates for category 1.A.4.b.i (residential-stationary combustion), which, for 2017, fell from 0.21 to 0.041 t CH_4 and from 0.21 to 0.041 t N_2O (same values for CH_4 and N_2O). For categories 1.A.4.a.i and 1.A.2.g.viii, the estimates remained the same as in previous submissions for CH_4 (0.15 and 0.019 t, respectively) and N_2O (0.15 and 0.019 t, respectively). The sums of CH_4 and N_2O emissions for 2017 for the three categories are correct and correspond to a total of 0.21 t CH_4 and 0.21 t N_2O. The Party revised the CH_4 and N_2O emission estimates for the entire time series.
E.8	1.A.1.a Public electricity and heat production – other fossil fuels – CO_2 (E.19, 2019) Transparency	Include in the NIR an explanation of the drivers of the change in the CO_2 IEF from 2007 onward, including a description of the change in the relative energy contribution from waste components, for example, accompanied by a chart illustrating the trend.	Resolved. Monaco reported in its NIR (section 3.3.1.4) an explanation of the drivers of the change in the CO_2 IEF for 2007 onward. The fluctuation in the CO_2 IEF is directly related to changes in the composition of the solid waste mixture incinerated each year. For 2007 to 2016, the decrease from 77.11 to 67.62 t/TJ is mainly due to the increase in the share of unclassified fuels (which have a fossil carbon content of 0.03) and the associated decrease in the share of plastic waste (which has a fossil carbon content of 0.75). The ERT noted that the CO_2 IEF rose again to 70.81 t/TJ for 2019.
E.9	1.A.1.a Public electricity and heat production – other fossil fuels – CO_2 (E.19, 2019) Transparency	Include in the documentation box of CRF table 1.A(a)s information in accordance with footnote 4 to that table (i.e. "which fuels were included under other fossil fuels with a reference to the section of the NIR where further information is provided").	Not resolved. Monaco did not include in the documentation box of CRF table 1.A(a)s4 information in accordance with footnote 4 to clarify the types of fuel reported under other fossil fuels in this category.
E.10	1.A.2 Manufacturing industries and construction – liquid and gaseous fuels – CO_2, CH_4 and N_2O (E.10, 2019) (E.16, 2017) Comparability	Disaggregate emissions for categories 1.A.2, 1.A.4.a and 1.A.4.b.	Resolved. Under category 1.A.2, Monaco has reported AD only for categories 1.A.2.g.vii (off-road vehicles and other machinery) and 1.A.2.g.viii (other). For liquid fuels, Monaco disaggregated AD for categories 1.A.2, 1.A.4.a and 1.A.4.b (see ID#s E.11 and E.15 below). For natural gas, the Party, in response to the previous review, revised estimates by disaggregating AD using data from the annual reports of SMEG, the sole gas distribution company in Monaco. The Party also explained in the NIR (section 3.3.4.2, p.107) that, since the 2020 NIR, emissions from the use of natural gas in category 1.A.4.b have been reported under three categories: 1.A.2.g.viii, 1.A.4.a.i (stationary combustion, commercial/institutional) and 1.A.4.b.i (stationary combustion, residential). Further information on methodology was included in the NIR (section 3.3.4.2.1.3, p.111).
E.11	1.A.2 Manufacturing industries and	Conduct a survey on fuel consumption of manufacturing industries and	Resolved. Monaco conducted an in-depth study based on the data collected to establish its Climate Air Energy Plan for 2030, which enabled the Party to disaggregate liquid fuels

ID#	Issue/problem classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
	construction – all fuels – CO_2, CH_4 and N_2O (E.11, 2019) (E.16, 2017) Comparability	construction (category 1.A.2) and report in the NIR on the progress made in conducting such a survey.	consumption between categories 1.A.2.g.viii (previously reported as "IE") and 1.A.2.g.vii. No natural gas consumption occurs for category 1.A.2.g.vii (off-road vehicles and other machinery), and the AD reported for natural gas under category 1.A.2.g.viii were disaggregated using data from SMEG in response to the previous review (see ID# E.10 above). More detailed information on the results of the study was included in the NIR (section 3.3.4.2.1.3, p.113).
E.12	1.A.3.b Road transportation – liquid fuels – CO_2 (E.17, 2019) Transparency	Include in the NIR a description of the methodology, including the correct data and EF, used for diesel oil for category 1.A.3.b (road transport) in the inventory.	Resolved. The Party explained in the NIR (section 19.2.2.1, p.350) that for the 2021 submission the CO_2 IEF for diesel was updated to 74.52 t/TJ in accordance with the parameters provided by Citepa (3,243 g CO_2/g fuel). This value is explained by a change in the lower heating value.
E.13	1.A.3.b.i Cars – biomass – CO_2 (E.20, 2019) Accuracy	Check and correct the AD and CO_2 emission estimates reported for biomass under category 1.A.3.b.i, including the values reported in the memo items.	Resolved. Monaco revised the estimated CO_2 emissions from biomass under this category, and emissions for 2017 are now reported as 0.74 kt CO_2, as expected. The Party revised the entire time series, and the values were correctly reported in CRF table 1.A(a)s.3.
E.14	1.A.3.b.iii Heavy-duty trucks and buses – liquid fuels – CO_2, CH_4 and N_2O (E.21, 2019) Completeness	Obtain AD for the quantity of diester loaded into the fuel tanks of vehicles in Monaco and estimate emissions in line with the 2006 IPCC Guidelines (vol. 2, section 3.2.1.4).	Resolved. Monaco reported on recalculations carried out for this category in the 2020 NIR (section 3.3.5.4.6, p.140). The Party informed the ERT during the review that one of the reasons for the recalculations was the inclusion of data on diester that is stored and used in the country. The recalculation increased CO_2 emission estimates for diesel oil from 4.51 to 5.66 kt for 2017. Recalculations were performed again for the 2021 submission for this category, and CO_2 emission estimates decreased to 5.32 kt for 2017 and remained low for the later years in the time series.
E.15	1.A.4 Other sectors – all fuels – CO_2, CH_4 and N_2O (E.13, 2019) (E.6, 2017) (E.10, 2015) (42, 2014) (44, 2013) (44, 2012) (35, 2011) (37, 2010) (46, 2009) (34, 2008) Comparability	Make efforts to report emissions for categories 1.A.4.a (commercial/institutional) and 1.A.4.b.i (residential – stationary combustion) separately.	Resolved. Monaco disaggregated AD for liquid fuels and reported emissions separately for categories 1.A.4.a and 1.A.4.b.i (see ID#s E.10 and E.11 above).
E.16	1.A.4.a Commercial/institutional – liquid fuels – CO_2, CH_4 and N_2O (E.22, 2019) Completeness	Identify how the fuels used in the Grand Prix are marketed (whether they are imported by France, imported in bulk by the race companies to Monaco and/or accounted for in the country that produced and sold them to the race companies) and calculate the emissions to be accounted for in Monaco's inventory.	Not resolved. Monaco did not identify the fuels used in the Grand Prix. During the review, the Party explained that it has contacted the organization responsible for the Grand Prix but the data could not be obtained (see NIR section 3.3.6.2).

ID#	*Issue/problem classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
E.17	1.B.2.a Oil – liquid fuels – CO_2 and CH_4 (E.23, 2019) Comparability	Report the total quantity of distribution of oil products as AD in CRF table 1.B.2 for this category.	Resolved. Monaco reported the AD (distribution of oil products) for this category and "NE" for CO_2 and CH_4 emissions because there is no available method in the 2006 IPCC Guidelines for this activity.
E.18	1.B.2.a Oil – liquid fuels – CO_2 and CH_4 (E.23, 2019) Comparability	Report "NE" for CO_2 and CH_4 emissions with a justification in the documentation box that the activity occurs in Monaco but that no estimation method (EF) is provided in the 2006 IPCC Guidelines.	Resolved. Monaco reported "NE" for CO_2 and CH_4 emissions and explained in the documentation box of CRF table 1.B.2 that the activity occurs in Monaco but no estimation method (EF) is provided in the 2006 IPCC Guidelines.
IPPU			
I.1	2.D.1 Lubricant use – CO_2 (I.8, 2019) Transparency	Update the description of the methodology used in the NIR by explaining that the Party used parameters and default values according to equation 5.2 of the 2006 IPCC Guidelines and that the AD used are the amount of lubricant oxidized during use (total lubricant consumption multiplied by the fraction of lubricant oxidized during use).	Resolved. Monaco reported in the NIR (p.187) the methodology used to estimate emissions from lubricants. All the emissions from lubricants (non-energy use) were estimated using the COPERT model and EFs provided by Citepa. The Party clarified in the NIR that the COPERT model calculates the emissions from the amount of lubricant that goes directly in the combustion chamber to be burned, and this amount represents the fraction of lubricant oxidized during use (see ID#s I.2 and I.3 below).
I.2	2.D.1 Lubricant use – CO_2 (I.8, 2019) Transparency	Include in the NIR an explanation of how the AD are derived and a table showing the consumption of lubricant across the time series.	Resolved. Monaco explained in the NIR (section 4.2.4.2.2, p.187) that AD were derived from the COPERT model, and the results obtained represent the amount of lubricant burned in the combustion chamber, which represents the fraction of lubricant oxidized during use. The Party also included the consumption of lubricants in four-stroke engines for the whole time series (NIR figure 114).
I.3	2.D.1 Lubricant use – CO_2 (I.8, 2019) Transparency	Update the description of CRF table 2(I).A-Hs2 (cell B24) to reflect the fact that the AD used relate to the consumption of lubricant oxidized, and verify that the unit of the IEF is consistent with the AD used.	Resolved. Monaco continued to report in CRF table 2(I).A-Hs2 "lube consumption" in the description of the AD. The ERT considers that the update referred to in the previous recommendation is no longer relevant as the Party provided in the NIR (pp.187–188) the AD for the entire time series and explained that they represent the oxidized part of lubricant consumption (see ID# I.2 above).
I.4	2.F Product uses as substitutes for ozone-depleting substances – PFCs (I.4, 2019) (I.4, 2017) (I.4, 2015) (49, 2014)	Include information on the trend in the use of PFCs (under categories 2.F.1.a and 2.F.1.f) and ensure that the information collected on PFCs is complete and, even if no emissions from manufacturing are occurring, ensure that all emissions from stock and disposal	Addressing. Monaco did not include the required information in the NIR. The ERT checked CRF table 2(II)B-Hs2 and noted that the Party reported C_3F_8 from stocks under category 2.F.1.a (commercial refrigeration) as "IE" for the entire time series, with the explanation in CRF table 9 that emissions were included in category 2.F.1.f (stationary air conditioning). However, under category 2.F.1.f, emissions from stock for C_3F_8 were estimated only for 2001–2003, 2005–2011, 2013–2014 and 2019, and therefore CRF table 9 should be updated for the other years of the time series where "NO" was reported for C_3F_8 emissions under category 2.F.1.f. The ERT

ID#	Issue/problem classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
	(62, 2013) Transparency	are included or an explanation for the lack of emissions is provided.	noted that compared with the 2019 submission, where PFC emissions from stock were reported only for 2001–2009, the Party improved the AD in the time series for C_3F_8. However, the Party did not provide in the NIR information on the trend in the use of C_3F_8 under category 2.F.1.f, nor did it clarify whether all emissions from stock and disposal are included or provide any other explanation in case there is a lack of AD.
I.5	2.G.3 N_2O from product uses – N_2O (I.9, 2019) Transparency	Update the explanation provided in the NIR (section 4.2.7.1.4) to reflect that category 2.G.3.b (other) is not a key category and that the associated emissions are below the threshold of significance for the entire time series (0.03 per cent of Monaco's total GHG emissions without LULUCF) in accordance with paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines.	Resolved. The Party did not report emissions for category 2.G.3 as "NE" but instead reported emission estimates for the entire time series.
Agriculture			
		No agricultural practices occur in the country.	
LULUCF			
L.1	4. General (LULUCF) (L.1, 2019) (L.1, 2017) (L.1, 2015) (61, 2014) (74, 2013) Transparency	Provide more transparent information on the calculation of emissions from the burning of biomass of green waste to ensure the consistency of the information reported, and on the allocation of emissions and carbon stock changes between the LULUCF, waste and energy sectors.	Addressing. The Party reported in its NIR (pp.172–173) ongoing developments related to a study on GIS urban tree estimates affecting category 1.A.4 in the energy sector and the characterization of incinerated waste for energy production (category 1.A.1.a), which may provide clarification on storage volumes and LULUCF sector carbon incineration. During the review, the Party further noted that there have been delays to a study on urban trees, which is expected to be completed in 2022, and to a waste characterization study, which has just been launched for a 12-month period. According to the Party, these improvements are expected to be implemented for the next annual inventory submission.
L.2	4. General (LULUCF) (L.2, 2019) (L.2, 2017) (L.4, 2015) Comparability	Report fully completed CRF tables and resolve the inconsistent use of the notation keys (e.g. in CRF table 4(IV), for indirect N_2O emissions from managed soils, "NO" is reported instead of "NE").	Addressing. Emissions associated with N leaching and run-off (CRF table 4(IV)) were reported as "NE", and the Party noted in the NIR (section 6.1.2.1.2) that N inputs linked to run-off are difficult to estimate; moreover, in the climatic, territorial and green space management context of Monaco, N inputs are limited. However, the ERT did not find in CRF table 9 the required explanation for the use of "NE" to report N leaching and run-off, or the required cross reference to the NIR in the documentation box of CRF table 4(IV). During the review, the Party acknowledged that this was an oversight and that the required explanations for the reporting of "NE" for this category will be reported in CRF table 9 in the next annual submission.
L.3	4.E.1 Settlements remaining settlements – CO_2	Include aerial/satellite information to transparently demonstrate that any increase in biomass from growing	Addressing. An analysis is ongoing, and information on progress was provided in the NIR (section 6.6). During the review, the Party clarified that an analysis of the land use of the territory is in progress and aerial photography is being provided through a global GIS,

ID#	Issue/problem classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
	(L.4, 2019) (L.6, 2017) (L.7, 2015) Transparency	crown cover is not a land-use change to settlements; to demonstrate that any increase in crown cover does not meet the forest definition; and to improve the accuracy of the measurement of crown cover.	providing the ERT with an example of a GIS image showing a list of various layers related to land use in Monaco for several years since 1955.
L.4	4.E.1 Settlements remaining settlements – CO_2 (L.5, 2019) (L.7, 2017) (L.8, 2015) Transparency	Include the right uncertainty values for AD (an incorrect value of 50 per cent uncertainty was applied) and document the methodology by which expert judgment is used to determine uncertainty values for this category.	Addressing. The ERT noted that the uncertainty values have been corrected (NIR section 6.3, p.258) but considers that the explanations provided are not sufficiently clear to document the methodology by which expert judgment was used to determine uncertainty values for this category. During the review, the Party clarified that the uncertainty value of 490 per cent calculated for the EF is the sum of the uncertainties of the AD and the N_2O EF and provided the ERT with an extract of the calculation spreadsheet. The ERT determined that the uncertainty value of 490 per cent corresponds to the uncertainty of the annual estimate because it combines the uncertainties of AD, EFs and other parameters. The ERT noted that this combined uncertainty was calculated using equation 3.1 for error propagation from the 2006 IPCC Guidelines (vol. 1, chap. 3). The ERT considers that the Party needs to refer to the specific IPCC guidance used for this calculation.
L.5	4.E.1 Settlements remaining settlements – CO_2 (L.6, 2019) (L.10, 2017) Transparency	Include in the NIR information on the area of crown cover change, in particular the definition of the "tree crown cover" land-use category and the related threshold criteria for conversion from "tree crown cover" to "other settlements", together with a clear explanation of any fluctuations.	Addressing. The ERT was unable to find any additional information in NIR section 6.2.1 compared with the 2019 NIR. During the review, the Party clarified that a study aimed at consolidating inventory data for trees in the principality and for carbon storage according to the evolution and composition of wooded areas was carried out in 2021. The results of this study are still being validated and will be used and presented in a future submission. The Party also clarified that a study on urban trees has been delayed and is expected to be completed in 2022, and that this study is expected to consolidate the AD with an updated inventory of trees and provide an estimation of emissions for QA purposes.
L.6	4.E.1 Settlements remaining settlements – CO_2, CH_4 and N_2O (L.7, 2019) (L.11, 2017) Accuracy	Include information in the NIR on how losses are calculated using allometric equations.	Resolved. Notation keys have been modified as recommended in previous reviews. During the review, the Party clarified that the total wooded area in Monaco was estimated using the total area of green spaces, which is provided annually by the Department of Urban Planning of Monaco (garden maintenance services), and the estimated tree density and tree crown cover in 1990–2006 based on data in an inventory of trees in the Principality of Monaco conducted in 2006, and referred the ERT to the NIR (section 6.2.1) for more details. The Party also clarified that on-site biomass burning does not occur in Monaco; the only biomass burning that does occur in the country is the incineration of wood waste in solid waste disposal sites (see ID# L.11 in table 6). The ERT considers that the NIR (section 6.2.1) provides enough information on how carbon losses are calculated using allometric equations.
L.7	4.E.1 Settlements remaining settlements – CO_2	Describe the underlying assumptions regarding the definitions of other	Resolved. Additional information on the definition of other settlements and tree crown cover was provided in the NIR (section 6.1.2, p.243). The ERT considers that the NIR provides enough information to document the data and assumptions used.

ID#	Issue/problem classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
	(L.9, 2019) (L.12, 2017) Transparency	settlements and tree crown cover with respect to the shape of trees.	
L.8	4(IV).1 Atmospheric deposition – N_2O (L.13, 2019) (L.16, 2017) Accuracy	Report the values of AD in the correct cells of CRF tables 4(I) and 4(IV) to ensure comparability and consistency between the estimates of direct and indirect N_2O emissions from soils.	Not resolved. The Party has not yet corrected the inconsistency in the AD reported in CRF tables 4(I) and 4(IV) for direct and indirect N_2O emissions from soils. During the review, the Party clarified that the recommendation is being considered and it will investigate the cause of the discrepancy observed between CRF tables 4(I) and 4(IV).
L.9	4.G HWP – CO_2 (L.14, 2019) (L.13, 2017) Accuracy	Implement a tier 1 method to estimate whether the HWP contribution is significant. In case it is significant, report the HWP contribution and the volumes of imported wood products in CRF tables 4.Gs1 and 4.Gs2, respectively.	Addressing. The Party explained in the NIR (section 6.2.3) the national circumstances surrounding the lack of HWP production, storage and use for energy production, and also the volume of HWP treated as waste in the waste-to-energy plan of the country. During the review, the Party clarified that it has taken this request into account but that estimates remain very difficult to calculate. In addition, Monaco explained that it is launching a 12-month waste identification study and that it expects improvements to be made in time for the next annual submission.
Waste			
W.1	5.D.1 Domestic wastewater – CH_4 (W.1, 2019) (W.2, 2017) Transparency	Include explanations for any large inter-annual changes in the total organic product in the NIR.	Resolved. The Party reported in the NIR (figure 189, p.278) the changes in annual total organic product received by the wastewater treatment plant and provided information on the annual total organic product with degradable organic carbon removed as sludge. It also provided information on the percentage of wastewater treatment plant days of overload and shut down over the time series that cause the large inter-annual variations.
W.2	5.D.1 Domestic wastewater – CH_4 (W.7, 2019) Accuracy	Use the available plant-level volumes and water characteristics such as BOD or COD to apply a higher-tier method in accordance with the 2006 IPCC Guidelines.	Resolved. The Party reported in the NIR (section 7.5.3.1, p.269) on the use of monitoring data from the wastewater treatment plant for the estimation of CH_4 emissions. The data include wastewater volume and monitored parameters (BOD and COD), which allow emissions to be calculated using a higher-tier method. The procedures for the calculation of AD and the calculation of CH_4 emissions using plant-specific AD are described in the NIR (section 7.5.3.2, p.270, and section 7.5.4.2, p.276, respectively). The ERT considers that the methodology used is in accordance with the 2006 IPCC Guidelines.
W.3	5.D.1 Domestic wastewater – CH_4 (W.7, 2019) Transparency	When applying the higher-tier method as recommended in ID# W.2 above, report in the NIR the methods and data used, as well as the recalculation performed in accordance with paragraphs 43–45 of the UNFCCC Annex I inventory reporting guidelines	Addressing. The Party reported in its NIR (section 7.5.4, p.274) the methods and data used for the estimation of CH_4 emissions using the higher-tier method. The emissions were calculated on the basis of wastewater treatment plant monitoring data including volumes and wastewater characteristics (BOD and COD) to evaluate the total organic products and EFs under normal, overloading and shut-down conditions. The default values for B_o and methane conversion factor from the 2006 IPCC Guidelines were used. The recalculation was performed for the time series (1990–2017) and the emissions reported in the 2019 and 2020 submissions are compared in the NIR of the 2020 submission (section 7.5.10, p.285). However, the AD and EFs used to perform the recalculations were not reported. The ERT considers that the recommendation has not yet been fully addressed because the Party has not yet performed the recalculation in accordance with the UNFCCC Annex I inventory reporting guidelines (para. 44) as the

ID#	Issue/problem classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
			information on the amount of BOD removed as sludge used for performing the recalculations was not transparently reported.
W.4	5.D.1 Domestic wastewater – CH_4 (W.8, 2019) Transparency	Explain in the NIR (a) the improvements made in the collection of the AD (volume of treated and untreated wastewater) for the calculation of total organic load in wastewater and how the Party ensures the consistency of the time series for the years (i.e. 2008 and 2011) in which large amounts of data are missing from the daily database; (b) why estimated CH_4 and N_2O emissions decreased as a result of improved AD collection (on volume of wastewater treated); and (c) any recalculations performed for the next submission in accordance with paragraphs 43–45 of the UNFCCC Annex I inventory reporting guidelines.	Addressing. The Party reported in its NIR (section 7.5.7, p.283) the protocols used to ensure consistency of the time series for AD. In the absence of data, reconstructions of missing AD were carried out in correlation with other data (drinking water consumption and rainfall) or by using the latest homogeneous data available for the relevant period. Regarding the decrease in emissions as a result of improved AD, the Party reported in its NIR (section 7.5.3, pp.269–270) the use of available plant volume and wastewater characteristics (BOD) to calculate CH_4 and N_2O emissions. However, the ERT noted from the CRF table 5.D of the 2019 submission (before the recalculation) and the 2020 submission (after the recalculation) that the decrease in CH_4 emissions was due mainly to an increase in BOD removed as sludge. During the review, Monaco explained that information on the tonnage of sludge removed was obtained from plant operation data and is presented in the NIR (figure 178, p.266). The Party further explained that the quantity of BOD removed as sludge was determined on the basis of the carbon balance between the influent and treated wastewater; it was not determined from the amount of sludge reported in the NIR (p.266). The ERT considers that the Party did not explain in the NIR the impact of the use of updated AD (amount of sludge removed) on the decrease in estimated CH_4 emissions. Monaco performed recalculations of CH_4 emissions for the time series (1990–2017) and presented in the NIR of the 2020 submission (section 7.5.10, p.285) a comparison of the emissions reported in the 2019 and 2020 submissions. The Party explained that the recalculations were performed using higher-tier methodology (tier 3) for calculation of CH_4 emissions on a daily basis to reflect actual variation of wastewater volume, analysing BOD and BOD removed as sludge. However, the use of updated AD on the amount of BOD removed as sludge in the recalculation was not transparently explained in the NIR.
W.5	5.D.2 Industrial wastewater – CH_4 (W.5, 2019) (W.6, 2017) Comparability	Use the notation key "IE" instead of "NO" in CRF table 5.D for industrial wastewater and describe in CRF table 9 that these emissions are included together with domestic wastewater.	Addressing. The Party reported the IEF and emissions in CRF table 9 as "IE" and provided an explanation. However, the AD were still reported as "NO" in CRF table 5.D.
KP-LULUCF			
KL.1	General (KP-LULUCF) – CO_2 (KL.2, 2019) (KL.2, 2017) Accuracy	Include a comprehensive time-series analysis of land areas in the NIR.	Addressing. Monaco did not provide in the NIR a time-series analysis of land areas. During the review, the Party clarified that it will check the availability of additional information with a view to providing such an analysis. The Party added that a territorial analysis is being conducted on the basis of global GIS data and further work is required before a more precise analysis can be conducted, which would allow for a time-series reconstruction from aerial data. Some information on the progress of this analysis was provided in the NIR (section 11.2.3, p.303).

ID#	Issue/problem classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
KL.2	General (KP-LULUCF) – CO_2 (KL.3, 2019) (KL.3, 2017) Comparability	Report the FM cap in the CRF accounting table.	Not resolved. An updated value for the FM cap was reported in the CRF accounting table (3.596 kt CO_2 eq). However, the ERT noted that the value should be the same as that established in the report on the review of the report to facilitate the calculation of the assigned amount for the second commitment period (FCCC/IRR/2017/MCO), that is 27.809 kt CO_2 eq for the duration of the commitment period, which, in accordance with paragraph 13 of the annex to decision 2/CMP.7, was calculated as 3.5 per cent of the national total emissions excluding LULUCF in the base year times eight. During the review, the Party clarified that this is a mistake and that its understanding was that the FM cap needed to be updated each year on the basis of total emissions in 1990. The ERT considers that Monaco needs to report for each year of the second commitment period (2013–2020) the correct value of the FM cap (i.e. 27.809 kt CO_2 eq), which was established in the aforementioned report.

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

[b] The report on the review of the 2020 annual submission of Monaco was not available at the time of this review. Therefore, the recommendations reflected in this table are taken from the 2019 annual review report. For the same reason, 2020, 2018 and 2016 are excluded from the list of review years in which issues could have been identified.

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

9. In accordance with paragraph 83 of the UNFCCC review guidelines, the ERT noted that the issues and/or problems included in table 4 have been identified in three or more successive reviews, including the review of the 2021 annual submission of Monaco, and had not been addressed by the Party at the time of publication of this review report. In accordance with paragraph 83 of the UNFCCC review guidelines, and as documented in table 4, the ERT assessed that there were no issues identified in three or more successive reviews that had not been addressed by the Party.

Table 4
Issues and/or problems identified in three or more successive reviews and not addressed by Monaco

ID#	Previous recommendation for issue	Number of successive reviews issue not addressed[a]
General		
G.1	Improve QA/QC procedures to review the calculation of the inputs for determining the CPR, including the assigned amount and the relevant modalities in accordance with the annex to decision 18/CP.7, the annex to decision 11/CMP.1 and decision 1/CMP.8, paragraph 18.	3 (2017–2021)
G.5	Provide information concerning the implementation of the QA/QC plan, in particular regarding the prioritization of inventory improvements on the basis of the key category analysis and uncertainty assessment.	7 (2012-2021)
G.11	Provide in the NIR explanations of changes made in response to recommendations from previous reviews, including UNFCCC technical expert reviews.	3 (2017–2021)

ID#	*Previous recommendation for issue*	*Number of successive reviews issue not addressed*[a]
G.12	Report the recalculations under each category and include a clear explanation of the reasons for the recalculations made in the course of previous reviews, clearly distinguishing them from the recalculations made for the purpose of the current annual submission.	5 (2014–2021)
Energy		
E.1	Correct the error in total biomass consumption reported for the reference approach.	3 (2017–2021)
E.2	Revise the reporting of feedstocks and non-energy use of fuels in CRF table 1.A(d) in a consistent manner under the energy and industrial processes sectors.	7 (2012-2021)
E.3	Explain in the NIR the use and disposal of lubricants in the country.	7 (2012-2021)
IPPU		
I.4	Include information on the trend in the use of PFCs (under categories 2.F.1.a and 2.F.1.f) and ensure that the information collected on PFCs is complete and, even if no emissions from manufacturing are occurring, ensure that all emissions from stock and disposal are included or an explanation for the lack of emissions is provided.	6 (2013–2021)
Agriculture	No issues identified.	
LULUCF		
L.1	Provide more transparent information on the calculation of emissions from the burning of biomass of green waste to ensure the consistency of the information reported, and on the allocation of emissions and carbon stock changes between the LULUCF, waste and energy sectors.	6 (2013–2021)
L.2	Report fully completed CRF tables and resolve the inconsistent use of the notation keys (e.g. in CRF table 4(IV), for indirect N_2O emissions from managed soils, "NO" is reported instead of "NE").	4 (2015–2021)
L.3	Include aerial/satellite information to transparently demonstrate that any increase in biomass from growing crown cover is not a land-use change to settlements; to demonstrate that any increase in crown cover does not meet the forest definition; and to improve the accuracy of the measurement of crown cover.	4 (2015–2021)
L.4	Include the right uncertainty values for AD (an incorrect value of 50 per cent uncertainty was applied) and document the methodology by which expert judgment is used to determine uncertainty values for this category.	4 (2015–2021)
L.5	Include in the NIR information on the area of crown cover change, in particular the definition of the "tree crown cover" land-use category and the related threshold criteria for conversion from "tree crown cover" to "other settlements", together with a clear explanation of any fluctuations.	3 (2017–2021)
L.8	Report the values of AD in the correct cells of CRF tables 4(I) and 4(IV) to ensure comparability and consistency between the estimates of direct and indirect N_2O emissions from soils.	3 (2017–2021)
L.9	Implement a tier 1 method to estimate whether the HWP contribution is significant. In case it is significant, report the HWP contribution and the volumes of imported wood products in CRF tables 4.Gs1 and 4.Gs2, respectively.	3 (2017–2021)

ID#	*Previous recommendation for issue*	*Number of successive reviews issue not addressed*[a]
Waste		
W.5	Use the notation key "IE" instead of "NO" in CRF table 5.D for industrial wastewater and describe in CRF table 9 that these emissions are included together with domestic wastewater.	3 (2017–2021)
KP-LULUCF		
KL.1	Include a comprehensive time-series analysis of land areas in the NIR.	3 (2017–2021)
KL.2	Report the FM cap in the CRF accounting table.	3 (2017–2021)

[a] The reports on the reviews of the 2016, 2018 and 2020 annual submissions of Monaco have not yet been published. Therefore, 2016, 2018 and 2020 were not included when counting the number of successive years for this table.

V. Additional findings made during the individual review of the Party's 2021 annual submission

10. Tables 5–6 present findings made by the ERT during the individual review of the 2021 annual submission of Monaco that are additional to those identified in table 3. In accordance with paragraph 76(b) of the UNFCCC review guidelines, the ERT has prioritized in table 5 recalculations that changed the estimated total emissions or removals for a category by more than 2 per cent and/or national total emissions by more than 0.5 per cent for any of the recalculated years.

Table 5
Additional findings made during the individual review of the 2021 annual submission of Monaco related to recalculations

ID#	*Finding classification*	*Description of finding with recommendation or encouragement*	*Is finding an issue/problem?*[a]
Energy			
		Recalculations were made for the energy sector that changed the estimated emissions for a category by more than 2 per cent and/or national total emissions by more than 0.5 per cent; however, the ERT did not identify any issues or problems with these recalculations.	
IPPU			
I.6	2.D.1 Lubricant use – CO_2 and N_2O	Recalculations made for this category changed the estimated emissions of CO_2 by 3.29 per cent and of N_2O by 3.46 per cent for 2018. The Party reported in its NIR (p.189) the reason for the recalculations, which was the availability of more accurate AD on fuel consumption (sales) and the number of buses in the fleet used as input to the road vehicle tool (described in annex 3 to the NIR (pp.349–354)) used by Monaco. The ERT recommends that Monaco explain in the NIR the type of correction made to the number of buses used as input to the road vehicle tool and whether the data on buses operating in Monaco was updated or a correction was made to the tool.	Yes. Transparency

ID#	*Finding classification*	*Description of finding with recommendation or encouragement*	*Is finding an issue/problem?*[a]
I.7	2.D.2 Paraffin wax use – CO_2	Recalculations made for this category changed the estimated CO_2 emissions for 2018 by –12.68 per cent. The Party reported in its NIR (pp.189–190) an explanation regarding the recalculations. The Party used the carbon content of 20 kg C/GJ and the default NCV of 40.2 kJ/g from the 2006 IPCC Guidelines (vol. 2, table 1.2) for the whole time series, instead of using the NCV 46 kJ/g used for previous annual submissions, which is outside of the range permitted in the 2006 IPCC Guidelines. The ERT recommends that Monaco report in the NIR information on the reasoning behind the change in the NCV that led to the recalculations.	Yes. Transparency
I.8	2.F.1 Refrigeration and air conditioning – HFC-134a	Recalculations made for category 2.F.1.b (domestic refrigeration), which changed the estimated HFC-134a emissions by –21.32 per cent for 2018 and –17.50 per cent for 2017. The Party reported in its NIR (p.211) that recalculations for domestic and hotel refrigeration have been made for the whole times series on the basis of updates made by Citepa on the quantity of fluid in new equipment on the market; and a data correction on hotel refrigeration equipment as a result of a survey conducted. During the review, the ERT questioned the representativeness of the survey considering the low number of responses received. The Party explained that, to estimate equipment numbers, it relies solely on data from Monaco Statistics, which publishes annually the number of hotel rooms in Monaco, and that recalculations had been conducted for the 2021 submission to correct errors in Monaco Statistics data for 2003 and 2006. The Party also explained that the value of 0.05 kg, which is at the lower end of the range recommended in the 2006 IPCC Guidelines (vol. 3, table 7.9), was used because hotels in Monaco are considered to be at the forefront of modernity and residential hotels are included as hotels by Monaco Statistics. The ERT recommends that Monaco include in its NIR the information provided during the review on how hotels are considered in the inventory, as well as data on F-gases charged in new equipment, including references for such data from Citepa.	Yes. Transparency
I.9	2.F.4 Aerosols – HFC-132a and HFC-227ea	Recalculations made for category 2.F.4.a (metered dose inhalers) changed the estimated emissions of HFCs for 2018 by 7.42 per cent. The Party reported in its NIR (p.227) that recalculations were made following updates to the French AD for 2017–2019. Monaco uses a ratio that is based on metered dose inhaler consumption in France. Monaco reported in its NIR (section 4.2.6.5.5) that there are no QA/QC procedures for this category. The ERT recommends that Monaco provide information in the NIR on the source of data for estimating HFC emissions from metered dose inhalers and that Monaco develop and implement QA/QC procedures for reporting on emissions from metered dose inhalers (category 2.F.4.a).	Yes. Transparency
Agriculture			
		No agricultural practices occur in the country.	
LULUCF			
		Recalculations made for the LULUCF sector changed the estimated emissions or removals for a category by more than 2 per cent and/or national total emissions by more than 0.5 per cent; however, the ERT did not identify any issues or problems with these recalculations. All recalculations are clearly explained in the NIR (section 6.5, p.258).	

ID#	Finding classification	Description of finding with recommendation or encouragement	Is finding an issue/problem?[a]
Waste			
W.6	5.D Wastewater treatment and discharge – CH_4	Recalculations made for this category changed the estimated emissions by –62 per cent. Monaco reported in its 2020 NIR (section 7.5.10, p.285) that a recalculation was made following the ERT recommendation made during the 2019 review. This recalculation included the use of updated AD on plant-level generated volumes and wastewater characteristics (BOD) and updated CH_4 EFs derived from data on the daily operation of the wastewater treatment plants using higher-tier methodology in accordance with the 2006 IPCC Guidelines. Moreover, the value for BOD removed as sludge used in the calculation was estimated on the basis of the carbon balance between the wastewater treatment plant's influent and effluent stations, as described in the NIR (section 7.5.4.2, p.276). The ERT noted a significant increase in the amount of BOD removed as sludge reported in CRF table 5.D: the range increased from 0.37–0.90 kt DC in the 2019 submission to 0.74–1.51 kt DC in the 2020 submission. However, no explanation for this was provided in the NIR. During the review, the Party explained that the amount of sludge reported in the NIR (figure 178) was obtained from the wastewater treatment plant's annual report; but the value for BOD removed as sludge used in the calculation of emissions was obtained from daily operation data, which is different from the amount of sludge reported in the NIR. The ERT noted that this is not in accordance with the UNFCCC Annex I inventory reporting guidelines (para. 44), as the information on the AD used for performing the recalculation (i.e. BOD removed as sludge (kt DC)) was not transparently reported in the NIR as there was no explanation on the relationship between the amount of sludge reported (t) in the NIR and BOD removed as sludge (kt DC) reported in CRF table 5.D. The ERT recommends that Monaco provide information in the NIR on the relationship between the BOD removed as sludge (kt DC) reported in CRF table 5.D and the amount of sludge (t) reported in the NIR.	Yes. Transparency
KP-LULUCF			
		No recalculations made for KP-LULUCF changed the estimated emissions or removals for a category by more than 2 per cent and/or national total emissions by more than 0.5 per cent.	

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

11. Table 6 contains additional findings made by the ERT during the individual review of the 2021 annual submission that are not covered in table 3 or 5, but are within the scope of the desk review as specified in paragraph 76 of the UNFCCC review guidelines or paragraph 65 of the Article 8 review guidelines and are findings that the ERT wishes to convey to the Party.

Table 6
Additional findings made during the individual review of the 2021 annual submission of Monaco

ID#	Finding classification	Description of finding with recommendation or encouragement	Is finding an issue/problem?[a]
General			
		No general findings additional to those included in tables 3 and 5 were made by the ERT during the review.	

ID#	*Finding classification*	*Description of finding with recommendation or encouragement*	*Is finding an issue/problem?*[a]
Energy			
		No findings for the energy sector additional to those included in tables 3 and 5 were made by the ERT during the review.	
IPPU			
I.10	2. General (IPPU)	Monaco reported in its NIR that most of the categories in the IPPU sector are not subject to specific QA/QC procedures. QA/QC procedures only apply to lubricant use (2.D.1), urea consumption under other non-energy products from fuels and solvent use (2.D.3), domestic refrigeration (2.F.1.b) and stationary air-conditioning (2.F.1.f). The ERT recommends that Monaco develop and implement QA/QC procedures for more categories in the IPPU sector.	Yes. Convention reporting adherence
I.11	2. General (IPPU)	Monaco reported in its NIR (p.398) all references used for the IPPU sector. However, the ERT noted that not all of these references are cited in the text of the NIR and that the references that are cited are missing information on the year of publication, author, report type or editor. References should be reported using a standard format (author(s), report or paper title, editor, year of publication and place of publication). The ERT also noted that the Party, for the most part, did not include weblinks for references. The ERT encourages the Party to cite each reference in the appropriate section of the NIR, harmonize all references in a standard format and indicate, when applicable, the weblink for accessing the documentation.	Not an issue/problem
Agriculture			
		No agricultural practices occur in the country.	
LULUCF			
L.10	4. General (LULUCF)	The ERT noted that, when comparing the total national area reported in CRF table 4.1 and the total area reported in CRF table 4.E (settlements, unique land use that occurs in Monaco), small discrepancies were identified for 1990–2003. Specifically, while the area reported in CRF table 4.E is the same for all years (0.2027 kha) and is consistent with the national area of 202.7 ha reported in the NIR (p.242), the values reported for 1990–2003 in CRF table 4.1 are not the same. For example, for 1990–2000, the national area reported in CRF table 4.1 is 0.1995 kha whereas for 2001–2003 the value reported for each year is 0.2 kha. During the review, the Party clarified that the increase in the surface area of the territory corresponds to the construction of an extension of Port Hercule, which required the creation of a platform reclaimed from the sea, a semi-floating dyke and a lee breakwater. Thus, the surface was increased from 199.50 to 202.70 ha. The values reported in CRF table 4.1 are correct. The error in CRF table 4.E will be corrected for the next annual submission. The ERT recommends that Monaco correct the inconsistency in land areas reported in CRF tables 4.1 and 4.E in view of the recent increase in the total national land area and include in the NIR a clear explanation of the change in the land area of the territory.	Yes. Accuracy
L.11	4(V) Biomass burning – CO_2, CH_4 and N_2O	The Party used the notation key "NE" instead of "NO" in CRF table 4(V) for CO_2 emissions from green waste collection and used the notation key "IE" instead of "NO" for CH_4 and N_2O emissions (see ID# L.6 in table 3). During the review, the Party clarified that on-site biomass burning (i.e. due to wildfires or controlled burning) does not occur in the country and that the only burning of woody biomass is the incineration of wood waste in solid waste disposal sites. The ERT considers that the emissions that should be reported in CRF table 4(V) are those due to biomass burned on site and not	Yes. Accuracy

ID#	Finding classification	Description of finding with recommendation or encouragement	Is finding an issue/problem?[a]
		due to combustion of biomass transferred to other locations for energy production or wood incinerated in solid waste disposal sites, the CO_2 emissions of which should be reported under HWP in CRF table 4.G and the non-CO_2 emissions of which should be reported under either the energy or the waste sector (2006 IPCC Guidelines, vol. 4, chap. 12, p.12.6).	
		The ERT recommends that the Party report CO_2, CH_4 and N_2O emissions in CRF table 4(V) using the notation key "NO" with a clear justification in the NIR that no on-site biomass burning activities occur in Monaco.	
L.12	4(IV).1 Atmospheric deposition – N_2O	The Party reported the N_2O IEF as 1.00 kg N_2O–N/kg N in CRF table 4.(IV) for atmospheric deposition. However, the default EF for N volatilization and re-deposition is 0.01 kg N_2O–N/kg N with uncertainty ranges from 0.002 to 0.05 kg N_2O–N/kg N, in accordance with the 2006 IPCC Guidelines (vol. 4, chap. 11, table 11.3). During the review, the Party clarified that this is an error in CRF table 4(IV) of the reported unit of N volatized from managed soils from inputs of N values, noting that the values were reported in t N instead of in kg N/year. The Party noted that the EF used for estimation is 0.01 kg N–N_2O/kg N, in accordance with the 2006 IPCC Guidelines, and that the unit will be correct in the 2022 submission.	Yes. Comparability
		The ERT recommends that the Party correct the reporting of the IEF in CRF table 4(IV) for atmospheric deposition by using the default EF for N volatilization and re-deposition of 0.01 kg N_2O-N/kg N in accordance with the 2006 IPCC Guidelines (vol. 4, chap. 11, table 11.3).	
Waste			
		No findings for the waste sector additional to those included in tables 3 and 5 were made by the ERT during the review.	
KP-LULUCF			
KL.3	General (KP-LULUCF)	The Party reported in CRF table NIR 2 (land-transition matrix) the notation key "NO" for "Other" and "Total area at the end of the current inventory year". The ERT noted that this is not in accordance with the reporting guidelines under Article 7, paragraph 1, of the Kyoto Protocol. Those guidelines require the area of the country that has never been subject to any land management activities under Article 3, paragraphs 3–4, of the Kyoto Protocol (see footnotes 6–7 to CRF table NIR 2) to be reported under "Other", which, in the case of Monaco where there are no areas subject to such land management activities, is the total area of the country.	Yes. KP reporting adherence
		The ERT recommends that the Party report the total area of the country under "Other" in CRF table NIR 2 for each year of the second commitment period so that the value in the cell of row "Total area at the end of the current inventory year" corresponds to the total land area of the country, as required by the relevant Kyoto Protocol guidelines.	

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

VI. Application of adjustments

11. The ERT did not identify the need to apply any adjustments for the 2021 annual submission of Monaco.

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

12. Monaco has elected commitment period accounting and therefore the issuance and cancellation of units for KP-LULUCF activities is not applicable to the 2019 review.

VIII. Questions of implementation

13. No questions of implementation were identified by the ERT during the individual review of the Party's 2021 annual submission.

Annex I

Overview of greenhouse gas emissions and removals and data and information on activities under Article 3, paragraphs 3–4, of the Kyoto Protocol, as submitted by Monaco in its 2021 annual submission

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

Table I.1

Total greenhouse gas emissions and removals for Monaco, base year–2019

(kt CO_2 eq)

	Total GHG emissions excluding indirect CO_2 emissions		*Total GHG emissions and removals including indirect CO_2 emissions*[a]		*Land-use change (Article 3.7 bis as contained in the Doha Amendment)*[b]	*KP-LULUCF (Article 3.3 of the Kyoto Protocol)*[c]	*KP-LULUCF (Article 3.4 of the Kyoto Protocol)*	
	Total including LULUCF	*Total excluding LULUCF*	*Total including LULUCF*	*Total excluding LULUCF*			*CM, GM, RV, WDR*	*FM*
FMRL								NA
Base year[d]	102.98	102.98	NA	NA	NA		NO	
1990	102.74	102.73	NA	NA				
1995	105.50	105.53	NA	NA				
2000	108.96	109.00	NA	NA				
2010	87.87	87.92	NA	NA				
2011	85.47	85.52	NA	NA				
2012	87.50	87.53	NA	NA				
2013	90.49	90.53	NA	NA		NO	NO	NO
2014	84.86	84.89	NA	NA		NO	NO	NO
2015	87.77	87.70	NA	NA		NO	NO	NO
2016	86.70	86.71	NA	NA		NO	NO	NO
2017	85.76	85.76	NA	NA		NO	NO	NO
2018	87.11	87.13	NA	NA		NO	NO	NO
2019	82.61	82.54	NA	NA		NO	NO	NO

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

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

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

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

[d] "Base year" refers to the base year under the Kyoto Protocol, which is 1990 for CO_2, CH_4, N_2O and NF_3 and 1995 for HFCs, PFCs and SF_6. Monaco has not elected any activities under Article 3, para. 4, of the Kyoto Protocol. For activities under Article 3, para. 3, of the Kyoto Protocol and FM under Article 3, para. 4, only the inventory years of the commitment period must be reported.

Table I.2
Greenhouse gas emissions and removals by gas for Monaco, excluding land use, land-use change and forestry, 1990–2019
(kt CO_2 eq)

	CO_2[a]	CH_4	N_2O	HFCs	PFCs	Unspecified mix of HFCs and PFCs	SF_6	NF_3
1990	98.22	2.20	2.23	NO, IE	NO, IE	NO	0.08	NO
1995	101.19	1.21	2.80	0.24	NO, IE	NO	0.09	NO
2000	100.29	1.43	3.16	4.03	NO, IE	NO	0.09	NO
2010	77.74	1.25	4.13	4.68	0.03	NO	0.09	NO
2011	74.97	1.16	3.97	5.30	0.03	NO	0.09	NO
2012	78.02	1.30	3.95	4.18	NO, IE	NO	0.09	NO
2013	78.79	1.27	4.07	6.28	0.03	NO	0.09	NO
2014	73.86	1.31	3.70	5.92	0.01	NO	0.09	NO
2015	76.12	1.36	3.67	6.46	NO, IE	NO	0.09	NO
2016	74.63	1.33	3.42	7.21	0.01	NO	0.11	NO
2017	73.01	1.36	2.89	8.39	0.01	NO	0.11	NO
2018	74.72	1.33	3.10	7.85	NO, IE	NO	0.12	NO
2019	71.34	1.08	2.87	7.13	NO, IE	NO	0.12	NO
Percentage change 1990–2019	**–27.4**	**–51.0**	**28.5**	**NA**	**NA**	**NA**	**50.6**	**NA**

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

Table I.3
Greenhouse gas emissions and removals by sector for Monaco, 1990–2019
(kt CO_2 eq)

	Energy	IPPU	Agriculture	LULUCF	Waste	Other
1990	101.65	0.38	NO, NA	0.00	0.71	NO
1995	104.22	0.64	NO, NA	–0.02	0.67	NO
2000	103.37	4.56	NO, NA	–0.04	1.06	NO
2010	80.11	6.79	NO, NA	–0.05	1.01	NO
2011	77.24	7.40	NO, NA	–0.04	0.88	NO
2012	80.30	6.20	NO, NA	–0.04	1.03	NO
2013	81.22	8.25	NO, NA	–0.03	1.06	NO
2014	76.24	7.51	NO, NA	–0.03	1.14	NO
2015	78.77	7.79	NO, NA	0.07	1.14	NO

	Energy	*IPPU*	*Agriculture*	*LULUCF*	*Waste*	*Other*
2016	77.28	8.33	NO, NA	–0.01	1.10	NO
2017	75.50	9.13	NO, NA	0.00	1.13	NO
2018	77.46	8.52	NO, NA	–0.02	1.15	NO
2019	73.86	7.78	NO, NA	0.08	0.90	NO
Percentage change average for 1990–2019	**–27.34**	**NA**	**NA**	**NA**	**26.68**	**NA**

Notes: (1) Monaco did not report emissions or removals in the sector other (sector 6); (2) Monaco did not report indirect CO_2 emissions in CRF table 6.

Table I.4

Greenhouse gas emissions and removals from activities under Article 3, paragraphs 3–4, of the Kyoto Protocol by activity, base year–2019, for Monaco

($kt\ CO_2\ eq$)

	Article 3.7 bis as contained in the Doha Amendment[a]	*Activities under Article 3.3 of the Kyoto Protocol*		*FM and elected activities under Article 3.4 of the Kyoto Protocol*				
	Land-use change	*AR*	*Deforestation*	*FM*	*CM*	*GM*	*RV*	*WDR*
FMRL				NA				
Technical correction				NA				
Base year	NA				NO	NO	NO	NO
2013		NO	NO	NO	NO	NO	NO	NO
2014		NO	NO	NO	NO	NO	NO	NO
2015		NO	NO	NO	NO	NO	NO	NO
2016		NO	NO	NO	NO	NO	NO	NO
2017		NO	NO	NO	NO	NO	NO	NO
2018		NO	NO	NO	NO	NO	NO	NO
2019		NO	NO	NO	NO	NO	NO	NO
Percentage change base year–2019					**NA**	**NA**	**NA**	**NA**

Notes: (1) Monaco did not report information in the CRF tables on accounting and the base year for emissions and removals from KP-LULUCF activities; (2) Monaco has not elected to report on any activities under Article 3, para. 4, of the Kyoto Protocol. For activities under Article 3, para. 3, of the Kyoto Protocol and FM under Article 3, para. 4, only the inventory years of the commitment period must be reported; (3) values in this table include emissions from land subject to natural disturbances, if applicable.

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

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

Table I.5
Key relevant data for Monaco under Article 3, paragraphs 3–4, of the Kyoto Protocol from its 2021 annual submission

Parameter	*Data values*
Periodicity of accounting	(a) AR: commitment period accounting (b) Deforestation: commitment period accounting (c) FM: commitment period accounting (d) CM: not elected (e) GM: not elected (f) RV: not elected (g) WDR: not elected
Elected activities under Article 3, paragraph 4, of the Kyoto Protocol	None
Election of application of provisions for natural disturbances	No
3.5% of total base-year GHG emissions, excluding LULUCF	3.476 kt CO_2 eq (27.809 kt CO_2 eq for the duration of the commitment period)
Cancellation of AAUs, CERs and ERUs and/or issuance of RMUs in the national registry for:	
1. AR	NA
2. Deforestation	NA
3. FM	NA

Annex II

Information to be included in the compilation and accounting database

Tables II.1–II.7 include the information to be included in the compilation and accounting database for Monaco. Data shown are from the Party's annual submission, including the latest revised estimates submitted, adjustments (if applicable) and the final data to be included in the compilation and accounting database.

Table II.1
Information to be included in the compilation and accounting database for 2019, including on the commitment period reserve, for Monaco
(t CO_2 eq)

	Original submission	*Revised submission*	*Adjustment*	*Final value*
CPR	–	–	–	–
Annex A emissions				
CO_2	71 342	–	–	71 342
CH_4	1 077	–	–	1 077
N_2O	2 866	–	–	2 866
HFCs	7 131	–	–	7 131
PFCs	NO, IE	–	–	NO, IE
Unspecified mix of HFCs and PFCs	NO	–	–	NO
SF_6	124	–	–	124
NF_3	NO	–	–	NO
Total Annex A sources	**82 539**	–	–	**82 539**
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	NO	–	–	NO
Deforestation	NO	–	–	NO
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	NO	–	–	NO

Table II.2
Information to be included in the compilation and accounting database for 2018 for Monaco
(t CO_2 eq)

	Original submission	*Revised submission*	*Adjustment*	*Final value*
Annex A emissions				
CO_2	74 724	–	–	74 724
CH_4	1 335	–	–	1 335
N_2O	3 096	–	–	3 096
HFCs	7 854	–	–	7 854
PFCs	NO, IE	–	–	NO, IE
Unspecified mix of HFCs and PFCs	NO	–	–	NO
SF_6	124	–	–	124
NF_3	NO	–	–	NO
Total Annex A sources	**87 133**	–	–	**87 133**
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	NO	–	–	NO
Deforestation	NO	–	–	NO
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	NO	–	–	NO

Table II.3
Information to be included in the compilation and accounting database for 2017 for Monaco
(t CO_2 eq)

	Original submission	*Revised submission*	*Adjustment*	*Final value*
Annex A emissions				
CO_2	73 014	–	–	73 014
CH_4	1 356	–	–	1 356
N_2O	2 886	–	–	2 886
HFCs	8 386	–	–	8 386
PFCs	8	–	–	8
Unspecified mix of HFCs and PFCs	NO	–	–	NO
SF_6	113	–	–	113
NF_3	NO	–	–	NO
Total Annex A sources	**85 764**	–	–	**85 764**
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	NO	–	–	NO
Deforestation	NO	–	–	NO
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	NO	–	–	NO

Table II.4
Information to be included in the compilation and accounting database for 2016 for Monaco
(t CO_2 eq)

	Original submission	*Revised submission*	*Adjustment*	*Final value*
Annex A emissions				
CO_2	74 628	–	–	74 628
CH_4	1 333	–	–	1 333
N_2O	3 417	–	–	3 417
HFCs	7 207	–	–	7 207
PFCs	8	–	–	8
Unspecified mix of HFCs and PFCs	NO	–	–	NO
SF_6	113	–	–	113
NF_3	NO	–	–	NO
Total Annex A sources	**86 707**	–	–	**86 707**
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	NO	–	–	NO
Deforestation	NO	–	–	NO
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	NO	–	–	NO

Table II.5
Information to be included in the compilation and accounting database for 2015 for Monaco
(t CO_2 eq)

	Original submission	*Revised submission*	*Adjustment*	*Final value*
Annex A emissions				
CO_2	76 119	–	–	76 119
CH_4	1 355	–	–	1 355
N_2O	3 672	–	–	3 672
HFCs	6 463	–	–	6 463
PFCs	NO, IE	–	–	NO, IE
Unspecified mix of HFCs and PFCs	NO	–	–	NO

	Original submission	*Revised submission*	*Adjustment*	*Final value*
SF_6	88	–	–	88
NF_3	NO	–	–	NO
Total Annex A sources	**87 698**	–	–	**87 698**
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	NO	–	–	NO
Deforestation	NO	–	–	NO
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	NO	–	–	NO

Table II.6
Information to be included in the compilation and accounting database for 2014 for Monaco
(t CO_2 eq)

	Original submission	*Revised submission*	*Adjustment*	*Final value*
Annex A emissions				
CO_2	73 857	–	–	73 857
CH_4	1 309	–	–	1 309
N_2O	3 704	–	–	3 704
HFCs	5 922	–	–	5 922
PFCs	10	–	–	10
Unspecified mix of HFCs and PFCs	NO	–	–	NO
SF_6	87	–	–	87
NF_3	NO	–	–	NO
Total Annex A sources	**84 889**	–	–	**84 889**
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	NO	–	–	NO
Deforestation	NO	–	–	NO
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	NO	–	–	NO

Table II.7
Information to be included in the compilation and accounting database for 2013 for Monaco
(t CO_2 eq)

	Original submission	*Revised submission*	*Adjustment*	*Final value*
Annex A emissions				
CO_2	78 787	–	–	78 787
CH_4	1 270	–	–	1 270
N_2O	4 074	–	–	4 074
HFCs	6 283	–	–	6 283
PFCs	28	–	–	28
Unspecified mix of HFCs and PFCs	NO	–	–	NO
SF_6	86	–	–	86
NF_3	NO	–	–	NO
Total Annex A sources	**90 528**	–	–	**90 528**
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	NO	–	–	NO
Deforestation	NO	–	–	NO
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	NO	–	–	NO

Annex III

Additional information to support findings in table 2

Missing categories that may affect completeness

The only category for which an estimation method is included in the 2006 IPCC Guidelines that was reported as "NE" or for which the ERT otherwise determined that there may be an issue with the completeness of the reporting in the Party's inventory is category 1.A.4.a commercial/institutional – liquid fuels (CO_2, CH_4 and N_2O) (see ID# E.16 in table 3).

Annex IV

Reference documents

A. Reports of the Intergovernmental Panel on Climate Change

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

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

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

B. UNFCCC documents

Annual review reports

Reports on the individual reviews of the 2013, 2014, 2015, 2017 and 2019 annual submissions of Monaco, contained in documents FCCC/ARR/2013/MCO, FCCC/ARR/2014/MCO, FCCC/ARR/2015/MCO, FCCC/ARR/2017/MCO and FCCC/ARR/2019/MCO, respectively.

Other

Aggregate information on greenhouse gas emissions by sources and removals by sinks for Parties included in Annex I to the Convention. Note by the secretariat. Available at https://unfccc.int/sites/default/files/resource/AGI%202020_final.pdf.

Annual status report for Monaco for 2021. Available at https://unfccc.int/sites/default/files/resource/asr2021_MCO.pdf.

C. Other documents used during the review

Responses to questions during the review were received from Jérémie Carles (Department of the Environment of Monaco), including additional material on the methodology and assumptions used.